Annamalai University

Accredited with 'A" grade by NAAC

Faculty of Science

DEPARTMENT OF CHEMISTRY

(DST- FIST & UGC-SAP Sponsored)

M.Sc.CHEMISTRY (5 YEAR)

Programme Code: SCHE51

Regulations, Curricula and Syllabi
2019-2020

M.Sc. CHEMISTRY (FIVE YEAR)

Programme Code: SCHE51

These regulations are common to all the students admitted to the **Five year Master Programme** in the **Faculty of Science** from the academic year 2019 – 2020 onwards.

1. Definitions and Nomenclature

1.1 **University** refers to Annamalai University.

1.2 **Department** means any of the academic departments and academic centers at the University.

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Botany is a discipline in the Natural Sciences, while Economics is a discipline in Social Sciences.

1.4 **Programme** encompasses the combination of courses and/or requirements leading to a Degree. For example, M.A., M.Sc.

1.5 **Course** is an individual subject in a programme. Each course may consist of Lectures/Laboratory /Seminar/Project work/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 **Curriculum** encompasses the totality of student experiences that occur during the educational process.

1.7 **Syllabus** is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 **Academic Year** refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 **Semester** is a half-year term that lasts for a minimum duration of 90 days.

1.10 **Choice Based Credit System**: A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.

1.11 **Core Course** is mandatory and an essential requirement to qualify for the Degree.

1.12 **Elective Course** is a course that a student can choose from a range of alternatives.

1.13 **Value-added Courses** are optional courses that complement the students' knowledge and skills and enhance their employability.

1.14 **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.

1.15 **Credit Hour** refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular course.

1.16 **Programme Outcomes** (POs) are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.

1.17 **Programme Specific Outcomes** (PSOs) are statements that list what the graduate of a specific programme should be able to do at the end of the programme.

1.18 **Learning Objectives** are statements that define the expected goal of a course in **Course Objectives** in terms of demonstrable skills or knowledge that will be acquired by a student.

1.19 **Course Outcomes** (COs) are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

1.2 **Grade Point Average** (GPA) is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3

1.21 **Cumulative Grade Point Average** (CGPA) is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters to the sum of total credits of all courses in all semesters. Calculation of CGPA is given in section11.4.

1.22 **Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2 Programme Offered and Eligibility Criteria:

The Department of Chemistry offers a M.Sc. Chemistry (Five Year) programme. A pass in H.S.E. (10+2 level) Examination OR Equivalent thereto with a minimum aggregate of 40% marks in any one of the following combinations:

1. Mathematics, Physics & Chemistry 2. Biology, Physics & Chemistry
3. Botany, Physics & Chemistry 4. Zoology, Physics & Chemistry.

2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for all the above Programmes.

3 Reservation Policy:

Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4 Programme Duration

4.1 The Five Year Master's Programme consist of five academic years.

4.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

4.3 Each semester will have 90 working days (18 weeks).

5 Programme Structure

5.1 The Five Year Integrated Programme consists of Language Courses, Core Courses, Allied Courses, Elective Courses, Soft skills, value Education, Experiential Learning, Project and Value Added Course. Students shall also participate in Extension Activities as part of their curriculum.

5.2 Language Courses

5.2.1 Each student shall take two languages of four courses each, one in each semester for the first two years of the programme.

5.2.2 Language-I shall be Tamil or another language such as Hindi or French.

5.2.3 Language-II shall be English.

5.3 Core courses

5.3.1 These are a set of compulsory courses essential for each programme.

5.3.2 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

5.4 Allied Courses

5.4.1 Each student shall take two allied courses and practicals in the first and second year of the programmes.

5.4.2 Each student shall take Botany in both first and second semesters along with practical in the second semester.

5.4.3 Student shall take Maths theory papers in both first and second semesters.

5.4.4 Student shall take Physics theory papers in both third and fourth semesters along with practical in the fourth semester.

5.5 Elective courses

5.5.1 **Departmental Electives** (DEs) are the Electives that students can choose from a range of Electives offered within the Department.

Interdepartmental Electives (IDEs) are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties. IDEs are listed in the Handbook which is available in the University website.

5.6 Soft Skills

5.6.1 Soft skills are intended to enable students to aquire attributes that enhance their performance and achiev their goals with complementing hard skills.

5.6.2 Soft skills include communication skills,computer skills among others.

5.7 Value Education

5.7.1 All students shall take a course on Value Education that includes human values, sustainable development, gender equity, ethics and human rights.

5.7.2 **Value Eduation** is categorized as **Non-Credit Compulsory Course**.

5.8 Experiential Learning

5.8.1 Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations.

5.8.2 In-plant training/ field trips/ internships/ industrial visits (if applicable) fall under this category.

5.8.3 **Experiential learning** is categorized as **Non-Credit Compulsory Course**.

5.9 Extention Activities

5.9.1 It is mandatory for every student to participate in extention activities.

5.9.2 All the students shall enrol under NCC/ NSS/ YRC/ RRC or any other Service Organization in the University.

5.9.3 Students shall put in a minimum attendance of 40 hours in a year duly certified by the Programme Co-ordinator.

5.9.4 These activities shall be conducted outside the class hours.

5.9.5 **Extention Activities** is categorized as Non-Credit Compulsory Course.

5.10 Project

5.10.1 Each student shall undertake a Project and submit a dissertation as per guidelines in the final semester.

5.10.2 The Head of the Department shall assign a Research Supervisor to the student.

5.10.3 The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

5.10.4 Students who wish to undertake project work in recognized institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute.

5.11 Value added Courses (VACs)

5.11.1 Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

5.11.2 These courses impart employable and life skills. VAC are listed in the Handbook available in the University website.

5.11.3 Each VAC carries 2 credits with 30 hours of instruction. Classes for a VAC are conducted beyond the regular class hours and preferably in the VIII and IX Semesters.

5.12 Online Courses

5.12.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.12.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

5.13 Credit Distribution: The credit distribution is organized as follows:

List of courses	Credits
SEMESTER I to VI	
Language-I (Tamil or any other language)	12
Language-II (English)	12
Core Courses	81
Allied courses -I (1st Year-SEM I & II)	10
Allied courses -II (2nd Year-SEM III & IV)	10
Electives (DE)	09
Environmental studies (UGC mandated)	03
Soft Skills-Computer Applications	03
Value Education	02*
Experiential Learning	02*
Extention Activities	01*
Total Credits (Semester I to VI)	140
SEMESTER VII to X	
Core Courses	72
Electives (DE & IDE)	15
Project	06
Constitution of India	02*
Total Credits (Semester VII to X)	93
Total Credits (Semester I to X)	**233**

Note: * ⟹ Non- Credit Compulsory Course

5.14 Credit Assignment

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one hour duration per week over a semester

1 Practical/Project period of two hours duration per week over a semester.

6 Attendance

6.1 Each faculty handling a course shall be responsible for the maintenance of Attendance and Assessment Record for candidates who have registered for the course.

6.2 The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course teacher.

6.3 The record shall be submitted to the Head of the Department and Dean once a month for monitoring the attendance and syllabus coverage.

6.4 At the end of the semester, the record shall be placed in safe custody for any future verification.

6.5 The Course teacher shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

6.6 Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End Semester Examination. The student has to redo the semester in the next year.

6.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

7 Mentor-Mentee System

7.1 To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.

7.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.

7.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

8 Examinations

8.1 The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

8.2 There will be two CIA Tests and one ESE in each semester.

8.3 The Question Papers will be framed to test different levels of learning based on Bloom's taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

8.4 Continuous Internal Assessment Tests

8.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments and seminars. This requires an element of openness.

8.4.2 The students will be informed in advance about the assessment procedures.

8.4.3 The question paper will be set by the respective course teacher using Bloom's Taxonomy.

8.4.4 CIA Test-I will cover the syllabus of the first two units while CIA Test-II will cover the last three units.

8.4.5 CIA Tests will be for one- or two-hours duration depending on the quantum of syllabus.

8.4.6 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the course teacher in consultation with the Head of the Department.

8.4.7 For the CIA Tests, the assessment will be done by the Course teacher.

8.5 End Semester Examinations (ESE)

8.5.1 The ESE for the first and third semester will be conducted in November and for the second and fourth semester in May.

8.5.2 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.

8.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course.

9 Evaluation

9.1 Marks Distribution

9.1.1 For each course, the Theory, Practical and project shall be evaluated for a maximum of 100 marks.

9.1.2 For the theory courses and project, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will carry 40% and the ESE 60% of the marks.

9.2 Assessment of CIA Tests

9.2.1 For CIA tests, the assessment will be done by the Course Teacher.

9.2.2 For the Theory Courses the break-up of marks shall be as follows:

	Marks
Test-I & Test-II	15
Seminar	5
Assignment	5
Total	25

9.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

	Marks
Test-I	15
Test-II	15
Record	10
Total	40

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by Internal examiners.

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

9.4.4 The Project Report evaluation and viva-voce will be conducted by a committee constituted by the Head of the Department.

9.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

9.4.6 The marks shall be distributed as follows:

Continuous Internal Assessment (25 Marks)		End Semester Examination (75 Marks)	
Review-I - 10	**Review-II -15**	**Project / Dissertation Evaluation**	**Viva-voce**
		50	**25**

9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal. Two CIA Tests shall be conducted by the Department(s) offering VAC.

9.5.2 The grades obtained in VACs will not be included for calculating the GPA/CGPA.

9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than 50% marks in the ESE and **not less than 50% marks** in aggregate taking CIA and ESE marks together.

9.6.2 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

10 Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

11 Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed.

11.3 **The GPA** is calculated by the formula

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

where, C_i is the Credit earned for the Course i in any semester;

G_i is the Grade Point obtained by the student for the Course i and

n is the number of Courses passed in that semester.

11.4 **CGPA** is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

$$CGPA = \frac{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i}$$

Where, C_i is the Credit earned for the Course i in any semester;

G_i is the Grade Point obtained by the student for the Course i

n is the number of Courses passed in that semester.

m is the number of semester.

11.5 Evaluation :

11.5.1 Performance of the student for each course will be rated as shown in the Table.

Range of Marks	Grade Points	Letter Grade
90 and above	10	S
80-89	9	A
70-79	8	B
60-69	7	C
55-59	6	D
50-54	5	E
Less than 50	0	RA
Withdrawn from the examination	0	W

11.5.2 A ten-point rating scale is used to evaluate the performance of a student to provide overall grade for the Master's Programme.

CGPA	CLASSIFICATION OF FINAL RESULT
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0 and above but below 5.0	Re-appear

11.6 Classification of Results. The successful candidates are classified as follows:

11.6.1 For First Class with Distinction: Candidates who have passed all the courses prescribed in the Programme in the first attempt with a CGPA of 8.25 and above within the programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (See Section 12 for details).

11.6.2 For First Class: Candidates who have passed all the courses with a CGPA of 6.5 and above.

11.6.3 For Second Class: Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.

11.6.4 Candidates who obtain overall highest CGPA in all examinations in the first appearance itself are eligible for University Rank.

11.7 Course-Wise Letter Grades

11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.

11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade sheet of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/ Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

12 Provision for Withdrawal from the End Semester Examination

12.1 The letter grade W indicates that a candidate has withdrawn from the examination.

12.2 A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.

12.3 Permission for withdrawal from the examination shall be granted only once during the entire duration of the programme.

12.4 Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.

12.5 The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations.Notwithstanding the mandatory prerequisite of ten days notice, due consideration will be given under extraordinary circumstances.

12.6 Withdrawal will not be granted for arrear examinations of courses in previous semesters and for the final semester examinations.

12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.

12.8 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.

13 **Academic misconduct**: Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitized on issues of academic integrity and ethics.

14 **Transitory Regulations**: Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.

15 Notwithstanding anything contained in the above pages as Rules and Regulations governing the Five Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.

M.Sc. Chemistry(Five Year) Programme

Programme Code: SCHE 51

Curricula and Scheme of Examination

(For students admitted from the academic year 2019-2020)

Course Code	Course Title	Hours/ week		C	Marks		
		L	P		CIA	ESE	Total
FIRST SEMESTER							
19IXXXC11	Language – I: Course 1	3		3	25	75	100
19IENGC12	Language – II: Course 1	3		3	25	75	100
19IENSC13	Environmental Studies	3		3	25	75	100
19ICHEC14	Inorganic, Organic and Physical Chemistry - I	5		5	25	75	100
19IMATA01/ 19IBOTA01	Allied - I: Mathematics - I / Botany - I	5/4		5/4	25	75	100
19ICHEE1X	Elective 1: Department Elective	3		3	25	75	100
				22/ 21			
SECOND SEMESTER							
19IXXXC21	Language – I: Course 2	3		3	25	75	100
19IENGC22	Language - II: Course 2	3		3	25	75	100
19ICISC23	Soft Skills - Computer Applications – I	3		3	25	75	100
19ICHEC24	Inorganic, Organic and Physical Chemistry - II	5		5	25	75	100
19ICHEP25	Practical – I: Volumetric Analysis		8	4	40	60	100
19IMATA02/ 19IBOTA02	Allied I: Mathematics - II / Botany – II	5/4		5/4	25	75	100
19IBOTP01	Allied: Botany Practical – I		4	2	40	60	100
				23/24			
THIRD SEMESTER							
19IXXXC31	Language – I: Course 3(Tamil/French/Hindi)	3		3	25	75	100
19IENGC32	Language – II: Course 3	3		3	25	75	100
19ICHEC33	Inorganic, Organic and Physical Chemistry - III	5		5	25	75	100
19ICHEP34	Practical – II: Inorganic Qualitative Analysis		8	4	40	60	100
19IPHYA01	Allied - II: Physics – I	4		4	25	75	100
19ICHEE3X	Elective 2: Department Elective	3		3	25	75	100
				22			

FOURTH SEMESTER							
19IXXXC41	Language – I: Course 4	3		3	25	75	100
19IENGC42	Language – II: Course 4	3		3	25	75	100
19ICHEC43	Inorganic, Organic and Physical Chemistry – IV	5		5	25	75	100
19ICHEC44	Analytical Chemistry	5		5	25	75	100
19ICHEP45	Practical – III: Preparation and Analysis of Organic Compounds		8	4	40	60	100
19IPHYA02	Allied- II: Physics – II	4		4	25	75	100
19IPHYP01	Allied: Physics Practical		4	2	40	60	100
19ICHEF40*	Extension Activities		2	1*	40	60	100
				26			
FIFTH SEMESTER							
19ICHEC51	Organic Chemistry – I	5		5	25	75	100
19ICHEC52	Inorganic Chemistry – I	5		5	25	75	100
19ICHEC53	Physical Chemistry – I	5		5	25	75	100
19ICHEP54	Practical – IV: Gravimetric Analysis		10	5	40	60	100
19ICHEE5X	Elective 3: Department Elective	3		3	25	75	100
19ICHEV50*	Value Education	2		2*	25	75	100
				23			
SIXTH SEMESTER							
19ICHEC61	Organic Chemistry – II	5		5	25	75	100
19ICHEC62	Inorganic Chemistry – II	5		5	25	75	100
19ICHEC63	Physical Chemistry – II	5		5	25	75	100
19ICHEC64	Pharmaceutical Chemistry	5		5	25	75	100
19ICHEP65	Practical – V: Basic Physical Chemistry Practical		8	4	40	60	100
19ICHEF60*	Experiential Learning		4	2*	40	60	100
				24			

SEVENTH SEMESTER							
19ICHEC71	Organic Reaction Mechanisms	4		4	25	75	100
19ICHEC72	Coordination Chemistry and Inorganic Reaction Mechanisms	4		4	25	75	100
19ICHEC73	Chemical Thermodynamics, Photochemistry and Group Theory	4		4	25	75	100
19ICHEP74	Organic Chemistry Practical- I		6	3	40	60	100
19ICHEP75	Physical Chemistry Practical- I		6	3	40	60	100
	Elective 4: Inter Department Elective	3		3	25	75	100
				21			
EIGHTH SEMESTER							
19ICHEC81	Organic Photochemistry and Molecular Rearrangements	4		4	25	75	100
19ICHEC82	Solid-State and Organometallic Chemistry	4		4	25	75	100
19ICHEC83	Chemical Kinetics and Quantum Mechanics	4		4	25	75	100
19ICHEP84	Organic Chemistry Practical–II		6	3	40	60	100
19ICHEP85	Inorganic Chemistry Practical–I		6	3	40	60	100
19ICHEE8X	Elective 5: Department Elective	3		3	25	75	100
	Elective 6: Inter Department Elective	3		3	25	75	100
				24			
NINTH SEMESTER							
19ICHEC91	Synthetic Organic Chemistry	4		4	25	75	100
19ICHEC92	Green Chemistry, Computational Chemistry, Drug Design and Spectroscopy	4		4	25	75	100
19ICHEC93	Spectral and Analytical Techniques	4		4	25	75	100
19ICHEC94	Electrochemistry and Spectroscopy	4		4	25	75	100
19ICHEP95	Inorganic Chemistry Practical – II		6	3	40	60	100
19ICHEP96	Physical Chemistry Practical – II		6	3	40	60	100
19IPSC090*	Constitution of India	2		2*	25	75	100
19ICHEE9X	Elective 7: Department Elective	3		3	25	75	100
	Elective 8: Inter Department Elective	3		3	25	75	100
				28			

TENTH SEMESTER							
19ICHECX1	Nuclear, Bioinorganic and Materials Chemistry	4		4	25	75	100
19ICHECX2	Nano Materials, Macromolecular and Surface Chemistry	4		4	25	75	100
19ICHEPX3	Organic Chemistry Practical–III		4	2	40	60	100
19ICHEPX4	Inorganic Chemistry Practical–III		4	2	40	60	100
19ICHEPX5	Physical Chemistry Practical–III		4	2	40	60	100
19ICHEDX6	**Project Work**		12	6	25	75	100
		32		**20**			
	TOTAL CREDITS			**233**			
	Value-Added Courses						

L- Lectures; P- Practical; C- Credits; CIA- Continuous Internal Assessment;

ESE- End- Semester Examination.

Note: * ⟹ **NON-CREDIT CONPULSORY COURSES**

Note:

1. Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available. The details of interdepartmental electives are given in the "**Handbook of Interdepartmental Electives- PG Programmes**" and listed in the University website.
2. Students may opt for any Value-Added Courses listed in the University website. The details of Value-Added Courses are given in the "**Handbook of Value-Added Courses**" and listed in the University website.

DEPARTMENT ELECTIVE COURSES (DE)

S. No	Course Code	Course Title	Hours/ week		C	Marks		
			L	P		CIA	ESE	Total
1.	19ICHEE15	Applied chemistry	3	-	3	25	75	100
2.	19ICHEE16	Industrial chemistry	3	-	3	25	75	100
3.	19ICHEE35	Chemistry for mankind	3	-	3	25	75	100
4.	19ICHEE36	Food chemistry	3	-	3	25	75	100
5.	19ICHEE55	Clinical Chemistry	3	-	3	25	75	100
6.	19ICHEE56	Agricultural Chemistry	3	-	3	25	75	100
7.	19ICHEE86	Selective materials, techniques and environmental chemistry	3	-	3	25	75	100
8.	19ICHEE87	Applied chemistry	3	-	3	25	75	100
9.	19ICHEE97	Scientific Research Methodology	3	-	3	25	75	100
10.	19ICHEE98	Organic chemical technology	3	-	3	25	75	100

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

S. No.	Course Code	Course Title	Hours/ week		C	Marks		
			L	P		CIA	ESE	Total
1.	19ICHEA01	CHEMISTRY I	4	-	4	25	75	100
2.	19ICHEA02	CHEMISTRY II	4	-	4	25	75	100
3.	19ICHE**P**01	CHEMISTRY PRACTICAL I	-	4	4	40	60	100

ANNAMALAI UNIVERSITY

Department of Chemistry

[Question Paper Pattern - INTERNAL TESTS I & II (CIA)]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc.: Five Year Integrated **Semester: All**

Time: 2 Hrs **Max.Marks:50**

Part-A (Level-K1) **Marks: (6x2=12)**

(Answer ALL of the questions)

1. Define /Choose/ Relate……
2. What / Why / How?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Match the following i - a ii - b iii - c iv - d v - …..
6. Match the following i - a ii - b iii - c iv - d v - …..

Part-B (Level-K2) **Marks: (3x5=15)**

(Answer any THREE of the questions)

7. Explain…..
8. Describe…..
9. Select……
10. Compare

Part-C (Level-K3/ Level-K4) **Marks: (2x7=14)**

(Answer any TWO of the questions)

11. Apply….
12. Calculate….
13. Categorize…

Part-D (Level-K5/ Level-K6) **Marks: (1x9=9)**

(Answer any ONE of the questions)

14. Discuss….
15. Summarize….

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: I/II Year

Time: 3 Hrs Max.Marks:100

Part-A (Level-K1) **Marks: (15x2=30)**

(Answer ALL of the questions)

1. Define……
2. What …….?
3. Choose/ Relate……
4. How ……?
5. Why ……?
6. Find……
7. Spell out……
8. Multiple Choices a. b. c. d.
9. Multiple Choices a. b. c. d.
10. Multiple Choices a. b. c. d.
11. Multiple Choices a. b. c. d.
12. Match the following i - a ii - b iii - c iv - d v - …..
13. Match the following i - a ii - b iii - c iv - d v - …..
14. Match the following i - a ii - b iii - c iv - d v - …..
15. Match the following i - a ii - b iii - c iv - d v - …..

Part-B (Level-K2) **Marks: (5x5=25)**

(Answer any FIVE of the questions)

16. Explain…..
17. Describe…..
18. Select……
19. Classify….
20. Compare….
21. Interpret…

Part-C (Level-K3/ Level-K4) **Marks: (5x7=35)**

(Answer any FIVE of the questions)

22. Apply….
23. Show…..
24. Solve….
25. Calculate….
26. Categorize…
27. Distinguish….
28. Test for…..

Part-D (Level-K5) **Marks: (1x10=10)**

(Answer any ONE of the questions)

29.Discuss….

30.Summarize….

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: III Year

Time: 3 Hrs Max.Marks:100

Part-A (Level-K1) **Marks: (10x2=20)**

***(Answer ALL of the questions*)**

1. Define……
2. What …….?
3. Multiple Choices a. b. c. d.
4. Multiple Choices a. b. c. d.
5. Multiple Choices a. b. c. d.
6. Multiple Choices a. b. c. d.
7. Match the following i - a ii - b iii - c iv - d v - …..
8. Match the following i - a ii - b iii - c iv - d v - …..
9. Match the following i - a ii - b iii - c iv - d v - …..
10. Match the following i - a ii - b iii - c iv - d v - …..

Part-B (Level-K2) **Marks: (5x3=15)**

(Answer any FIVE of the questions)

11. Explain…..
12. Describe…..
13. Select……
14. Classify….
15. Compare….
16. Outline ….

Part-C (Level-K3/Level-K4) **Marks: (9x5=45)**

(Answer any NINE of the questions)

17. Apply….
18. Prepare….
19. Show…..
20. Solve….
21. Illustrate…..
22. Sketch….
23. Infer….
24. Categorize…
25. Analyze…
26. Distinguish….
27. Take part in…

Part-D (Level-K5/ Level-K6) **Marks: (2x10=20)**

(Answer any TWO of the questions)

28. Discuss….
29. Summarize….
30. Design….

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc.,: Five Year Integrated PG Year: IV Year

Time: 3 Hrs Max.Marks:100

Part-A (Level-K1/ Level-K2) **Marks: (10x2=20)**

(Answer ALL of the questions)

1. Define……
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii - b iii - c iv –d v - …..
5. Match the following i - a ii - b iii - c iv –d v - …..
6. Explain…….
7. Select…..
8. Describe……
9. Classify….
10. Elucidate….

Part-B (Level-K3/ Level-K4) **Marks: (8x5=40)**

(Answer any EIGHT of the questions)

11. Prepare…..
12. Solve…..
13. Apply……
14. Show…..
15. Categorize…
16. Analyze…
17. Distinguish….
18. Infer….
19. Compare….
20. Compute

Part-C (Level-K5) **Marks: (3x10=30)**

(Answer any THREE of the questions)

21. Discuss…
22. Summarize….
23. Evaluate…..
24. Disprove….

Part-D (Level-K6) **Marks: (1x10=10)**

(Answer any ONE of the questions)

25. Design….
26. Develop…

ANNAMALAI UNIVERSITY

[End Semester Examinations]

(Based on Revised Bloom's Taxonomy)

Programme: M.Sc., : Five Year Integrated PG Year: V Year

Time: 3 Hrs Max.Marks:100

Part-A (Level-K1/ Level-K2) **Marks: (10x2=20)**

(Answer ALL of the questions)

1. Define……
2. Multiple Choices a. b. c. d.
3. Multiple Choices a. b. c. d.
4. Match the following i - a ii - b iii - c iv –d v - …..
5. Match the following i - a ii - b iii - c iv –d v - …..
6. Explain…….
7. Select…..
8. Describe…..
9. Classify….
10. Elucidate….

Part-B (Level-K3/ Level-K4) **Marks: (6x5=30)**

(Answer any SIX of the questions)

11. Apply……
12. Show…..
13. Prepare
14. Make use of….
15. Categorize…
16. Analyze…
17. Distinguish….
18. Simplify…..

Part-C (Level-K5) **Marks: (3x10=30)**

(Answer any THREE of the questions)

19. Discuss…
20. Recommend with
21. Evaluate…..
22. Justify….
23. Optimize…

Part-D (Level-K6) **Marks: (2x10=20)**

(Answer any TWO of the questions)

24. Design….
25. Formulate …
26. Modify …..

M.Sc. Mathematics (FIVE YEAR) PROGRAMME														
[End Semester Examinations] **Bloom's Taxonomy - Questions Conforming to Levels K1 to K6**														
	I Year(Five Year PG)					II Year (Five Year PG)					III Year(Five Year PG)			
	Level	Part	Questions & Marks	Total Marks		Level	Part	Questions & Marks	Total Marks		Level	Part	Questions & Marks	Total Marks
	K1	A	15 x 2	30		K1	A	15 x 2	30		K1	A	10 x 2	20
	K2	B	5 x 5	25		K2	B	5 x 5	25		K2	B	5 x 3	15
	K3	C	3 x 7	21		K3	C	3 x 7	21		K3	C	5 x 5	25
	K4		2 x 7	14		K4		2 x 7	14		K4		4 x 5	20
	K5	D	1 x 10	10		K5	D	1 x 10	10		K5	D	1 x 10	10
				100					100		K6		1 x 10	10
														100

IV Year (Five Year PG)					V Year (Five Year PG)			
	Level	Part	Questions & Marks	Total Marks	Level	Part	Questions & Marks	Total Marks
	K1	A	5 x 2	10	K1	A	5 x 2	10
	K2		5 x 2	10	K2		5 x 2	10
	K3	B	4 x5	20	K3	B	2 x 5	10
	K4		4 x5	20	K4		4 x 5	20
	K5	C	3 x 10	30	K5	C	3 x10	30
	K6	D	1 x 10	10	K6	D	2x 10	20
				100				100

PROGRAMME OUTCOMES (POs)

After the successful completion of the M.Sc CHEMISTRY (5 year) Degree Programme, the graduates will be able to learn about:

PO1	Domain knowledge: Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline.
PO2	Resource Utilisation: Cultivate the skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge-base and stay abreast of recent developments.
PO3	Analytical and Technical Skills: Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.
PO4	Critical thinking and Problem solving: Identify and critically analyse pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions.
PO5	Project Management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational skills and the ability to manage time and resources.
PO6	Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.
PO7	Effective Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.
PO8	Environment and Society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.
PO9	Ethics: Commitment to professional ethics and responsibilities.
PO10	Life-long learning: Ability to engage in life-long learning in the context of the rapid developments in the discipline.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the programme, the student will be able to

PSO1	Gain complete knowledge about all fundamental aspects of all branches of chemistry.
PSO2	Understand the basic concepts of organic chemistry like reagents in organic syntheses, stereochemistry, instrumental method of chemical analysis and natural products etc.
PSO3	Identify the importance inorganic chemistry includes coordination chemistry, role of metal ions in biological processes and organometallic chemistry.
PSO4	Gather attention about the physical aspects of molecules like molecular spectroscopy, role of catalysts, polymer chemistry, materials chemistry and bio-physical chemistry.
PSO5	Learn about the potential uses of analytical industrial chemistry, medicinal chemistry, and environment oriented chemistry. Apply the various analytical techniques like IR, mass, NMR, NQR, EPR, XRD to structural characterization of unknowncompounds.
PSO6	Carry out experiments in the area of organic analysis, estimation, separation derivative process, inorganic semi-micro analysis, preparation, conductometric and potentiometric analysis.
PSO7	Obtain knowledge in Spectral, Analytical, Qualitative & Quantitative techniques and contribute new scientific insights or innovative applications of chemical research to the next generation.

Semester I	19ITAMC11: Part-I Language நவீன இலக்கியமும் நாடகமும்	L	P	C
		3	0	3

கற்பித்தலின் நோக்கம்:

LO1	தமிழில் தோன்றிய நவீன இலக்கியங்களின் வளர்ச்சியைக் கூறல்.
LO2	சிறுகதை, புதினங்கள் காட்டும் சமூசச் சிக்கல்களையும் கதை உத்திகளையும் விளக்குதல்.
LO3	தமிழின் நீட்சியாக வளர்ந்துள்ள புதுக்கவிதை வகைகளை எடுத்துரைத்தல்.
LO4	நவீன நாடகங்களை இலக்கிய நாடகங்களோடு ஒப்பிடல்.
LO5	ஐரோப்பியர் வருகையால் தமிழில் ஏற்பட்ட மாற்றங்களையும் மறுமலர்ச்சியை விளக்குதல்.

கற்றல் வெளிப்பாடு:

இந்தப் பாடமுடிவில் மாணவர்கள்

CO1	மொழிப் பாடம் வழியே தமிழின் சிறப்புக்களை மாணவர்கள் அறிந்து கொள்வர்.
CO2	உலக இலக்கியங்களுக்குத் தமிழ் இணையானது என்னும் மனநிலையை அடைவர்
CO3	மாணவர்களுக்கு நாவல்கள், சிறுகதை வாசிப்புத் திறன் மேன்படும்
CO4	புதுக்கவிதைப் படைப்புத் திறன் தோன்றும்
CO5	பாடப்பகுதிக்குரிய நாடகங்களை விழாக்களில் நிகழ்த்தும் ஆர்வம் ஏற்படும்.

அலகு–1 சிறுகதை

1.புதுமைப்பித்தன் - பால்வண்ணம்பிள்ளை
2.கி.ராஜநாராயணன் - கதவு
3.கு.அழகிரிசாமி - ராஜாவந்திருக்கிறார்
4.கண்மணிகுணசேகரன் - உயிர்த்தண்ணீர்
5.மேலாண்மைபொன்னுச்சாமி - தேசியமயில்

அலகு-2 புதுக்கவிதை

1.பாரதியார் - புதுமைப்பெண்
2.பாரதிதாசன் - தமிழ்உணவு
3.உவமைக்கவிஞர்சுரதா - தமிழில் பெயரிடுங்கள் (துறைமுகம்)
4.தேவதேவன் - புகட்டல் (அமுதம் மாத்திரமே வெளிப்பட்டது)

5. அறிவுமதி -நட்புக்காலம்
(முதல்20- கவிதைகள்மட்டும்)
6.மித்ரா - ஹைகூஎன்தோழி
(முதல் 20- கவிதைகள்மட்டும்)

அலகு - 3 புதினம்

1. டி.செல்வராசு - பொய்க்கால் குதிரை

அலகு – 4 நாடகம்

1. இன்குலாப் - ஔவை

அலகு - 5 இக்கால இலக்கிய வரலாறு

ஐரோப்பியர் வருகை – நவீன இலக்கியங்கள் அறிமுகம் - புதுக்கவிதை - சிறுகதை – புதினம் ஆகியவற்றின் தோற்றமும் வளர்ச்சியும் – இலக்கிய முன்னோடிகள் – செய்தித்தாள் வருகை - நாடகம் – தோற்றமும் வளர்ச்சியும்.

மாணவர்கள் அறிந்து கொள்வதற்கு மட்டும் – தேர்வுக்கான பகுதிஅல்ல.

இலக்கியங்களையும் அவை தொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப்படித்தல்.நவீன இலக்கியங்கள் சமூகத்தைப் படம் பிடித்துக்காட்டுவதை சமூகக்கண்ணோட்டத்தோடு அறிதல். நவீன இலக்கிய வடிவங்களின் வளர்ச்சி வாழ்வியலுக்குப் பயன்படும் முறையை விளக்குதல்.

பாடநூல்கள்

1. புதுமைப்பித்தன், (2015), பால்வண்ணம் பிள்ளை, (ஐந்தாம் பதிப்பு), நியூ செஞ்சரி புக் ஹவுஸ், சென்னை.
2. கி.ராஜநாராயணன், (2015), கதவு, (ஏழாம் பதிப்பு), அன்னம்வெளியீடு, தஞ்சாவூர்.
3. கு.அழகிரிசாமி, (2012), ராஜா வந்திருக்கிறார், முதற் பதிப்பு), காலச்சுவடு பதிப்பகம், நாகர்கோயில்.
4. கண்மணி குணசேகரன், (1997), உயிர்த் தண்ணீர், (முதற் பதிப்பு) தாமரைச்செல்வி பதிப்பகம், சென்னை.
5. மேலாண்மை பொன்னுச்சாமி, (1997), தேசியமயில், (முதற் பதிப்பு), வானதிபதிப்பகம், சென்னை.
6. பாரதியார், (2017), பாரதியார் கவிதைகள், (இரண்டாம் பதிப்பு), நியூ செஞ்சரிபுக் ஹவுஸ், சென்னை.
7. பாரதிதாசன், (2016), பாரதிதாசன் கவிதைகள், (ஏழாம் பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
8. உவமைக் கவிஞர் சுரதா, (2010), துறைமுகம் (முதற்பதிப்பு), சுவாதிபதிப்பகம், அம்பத்தூர், சென்னை.
9. தேவதேவன், (2016), அமுதம் மாத்திரமே வெளிப்பட்டது, (முதற் பதிப்பு), நியூ செஞ்சரி புக் ஹவுஸ், சென்னை.
10. அறிவுமதி, (2005), நட்புக்காலம், (எட்டாம்பதிப்பு), கவிதாபதிப்பகம், சென்னை.
11. மித்ரா, (1990), மித்ராகவிதைகள், (முதற்பதிப்பு), சாரல் வெளியீடு, சென்னை.
12. டி.செல்வராசு, (2014), பொய்க்கால் குதிரை, (முதற்பதிப்பு), நியூ செஞ்சரி புக் ஹவுஸ், சென்னை

13. இன்குலாப், (2015), ஔவை, (ஐந்தாம்பதிப்பு), அகரம் பதிப்பகம், தஞ்சாவூர்.
14. ச.வே.சுப்பிரமணியன், (2015), தமிழ் இலக்கிய வரலாறு, (ஏழாம்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
15. சோ.நா. கந்தசாமி, (2004), தமிழ் இலக்கிய வரலாறு, (முதற்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.

பார்வைநூல்கள்

1. வல்லி கண்ணன், (2008), புதுக் கவிதையின் தோற்றமும் வளர்ச்சியும், (முதற் பதிப்பு), பாரி நிலையம், சென்னை.
2. க. கைலாசபதி (2010), தமிழ் நாவல் இலக்கியம், (மறுபதிப்பு) குமரன் பதிப்பகம், வடபழனி சென்னை.
3. கார்த்திகேசு சிவதம்பி (2013), தமிழில் சிறுகதை தோற்றமும் வளர்ச்சியும், (முதற் பதிப்பு), நியூ செஞ்சரி, புத்தக நிலையம், சென்னை.
4. ஆறு. அழகப்பன், (2011), தமிழ் நாடகத் தோற்றமும் வளர்ச்சியும், (முதற்பதிப்பு), பாரி நிலையம், சென்னை.
5. சு. சக்திவேல், (2010), இருபதாம் நூற்றாண்டுத் தமிழ் உரை நடை மணிவாசகர் பதிப்பகம், சிதம்பரம்.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3				2	2			2	2	2	3	3	3	2
CO2	3	3				2			3			2	2		
CO3		2	3		3	2					3			2	3
CO4	3		3			2				2	2	2	2		
CO5	3	2			2				2	2	2			3	2

*1-Low *2-Medium *3-Strong

Semester I	19IHINC11: Part-I LANGUAGE HINDI- I	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To know the Hindi terms for various professions.
LO2	To gain knowledge of poem and prose.
LO3	To to learn the importance of the moral, spiritual and human values.
LO4	To study short stories and imbibe morals.
LO5	To know about national leaders.

Course Outcomes (CO):

At the end of the course, the student will be able to

LO1	Understand the basic structure of poems.
LO2	Knowledge on common hindi words.
LO3	Describe the basic concepts of moral stories.
LO4	Apply the concepts of in life.
LO5	Analyze the difference between prose and poem.

Unit - I: Introduction Mathru vandana(poem) ,peshwar,chalo bazaar chalo, ahimsa ki vijay.

Unit - II: Poem ,Prose

Balwan bano, , Gandhiji ke asheram me chor,

Unit - III: Vani ka theer , Bharth, daku se mahatma.

Unit - IV: Chandhini,samay ki pabandhi, vitamin.

Unit - V: Rajiv Gandhi, titiali(poem),Bangalore.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. Adharsha hindi reader I-DBHPsabha-Chennai.17.
2. Parichya DBHPS , Trichi 17.

Supplementary Reading

1. Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2. Hindi prachar vahini.1,DHBS,sabha Chennai 17.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	3	2	2	3	2	3	3	3	3	3			
CO2	3		2		3		2	2		3					
CO3	3	2			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester I	19IFREC11: Language- I: Course -1 FRENCH-I	L	T	C
		3	0	3

Learning Objective (LO):

LO1	To greet People.
LO2	To introduce oneself (Basic 1).
LO3	To identify the things and the persons; spell a word.
LO4	To ask about the day, the time and the date.
LO5	To ask excuse.

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	Greet people appropriately, ask how they are, tell them how I am and ask how others are.
CO2	Obtain another different culture, the sound of the French language, certain words in French, some famous French symbols/landmarks.
CO3	Understand basic classroom instructions.
CO4	Can use different forms of address to speak to friends, teachers and people I do not know, using formal and informal modes of address and language.
CO5	Understand when the teacher is speaking to one or more persons in class and understand simple commands (mostly passive, receptive language with some active, productive language) and polite language. I can recognise 'tu' and 'vous' forms and help phrases such as ***'Pardon', 's'il vous plaît', 'excusez-moi', 'merci'.***

Unit I

Aborder quelqu'un; Dire son nom

Identifier une langue, la nationalité et le nombre.

Identifier les choses et les personnes

Unit II

Remplir une fiche de renseignements.

Découvrir la carte postale, un message sur internet et le blog très simples.

Les pays francophones ; Les lieux de la ville

Dire si on comprend ; Saluer ; Prendre congé

Dire s'excuser ; Affirmer et nier ; Epeler son nom

Unit III

L'espace francophone ; Découvrir la France et les pays francophones

Exprimer ses gouts ; Identifier les professions

Demander quelque chose à quelqu'un

Unit IV

Comprendre un article de presse sur un portrait d'une personne.

Première approche de la société française (noms, âges, origines, lieux d'habitation)

Parler des loisirs ; Faire un projet

Unit V

Proposer-accepter ou refuser une proposition

Demander une explication

Ecrire les cartes et messages d'invitation, d'acceptation ou de refus.

Découvrir la carte de France et les connaissances.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. J. Girardet et J. Pecheur, (2012), Echo A1 - méthode de français, Langers, Paris.

Supplementary Reading

1. Marie-Noelle Cocton et Emilie Pommier, (2015), Saison A1 - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), FORUM – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), Le Cours de langue et de la civilisation française, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), Grammmaire Prograssive du Français avec 400 exerices, CLE International, Paris.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1				2			2	3	3	3	3	3			
CO2	3		2		3		2	2		3					
CO3	3	2			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester I	19IENGC12: Part-II Language English-I ENGLISH THROUGH LITERATURE I: PROSE	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To develop the Language ability of the students.
LO2	To enable students to understand the passage, to read fluently, to enrich their vocabulary, and to enjoy reading and writing.
LO3	To make the students proficient in the four language skills.
LO4	To make the students read with correct pronunciation, stress, intonation, pause, and articulation of voice.
LO5	To develop their inquiry skill.

Course Outcomes (CO):

At the end of the course, the student will be able to gain

CO1	Competency in communication both in written and oral skills.
CO2	Fluency in the English language.
CO3	Knowledge about construction of sentence structures.
CO4	English Vocabulary to use the English language effectively.
CO5	Proficiency in the four communication skills.

Unit-I: Stephen Leacock "With the Photographer" Winston S. Churchill "Examinations" Grammar: Introduce the Parts of speech Nouns, Verbs, Adjectives, and Adverbs.

Unit-II: G.B. Shaw "Spoken English and Broken English" M.K. Gandhi "Voluntary Poverty" Grammar: Articles.

Unit-III: Robert Lynd "On Forgetting "Virginia Woolf " Professions for Woman" Grammar: Pronouns.

Unit-IV: A. G. Gardiner « "On Umbrella Morals"R.K. Narayan "A Snake in the Grass" Grammar: Prepositions.

Unit-V: Martin Luther King (Jr.) "I Have a Dream" George Orwell "The Sporting Spirit" Grammar:Conjunctions& Interjections.

The faculty will impart Contemporary Contours at the end of each course.This Contemporary Contours will not be credited in the examinations.

Text books

1. Ayyappa Raja. S., Deivasigamani. T., Saravana Prabhakar. N., Karthikeyan. B. *English through Literature*: Prose.
2. David Green: Contemporary English Grammar: *Structures and Composition*, Macmillan. Publishers, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1				3			3	3		3	3	3			3
CO2				3			3	3		3	3	3			3
CO3	3			2			2	2		2	2	2			3
CO4	3			3			3	3		3	3	3			3
CO5	2			2			2	2		2	2	2			2

***1-Low *2-Medium *3-Strong**

Semester I	19IENSC13-ENVIRONMENTAL STUDIES	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To make the student aware of World Environmental System.
LO2	To make the student aware of the fundamental Concepts and Principles of Eco- system and energy-flow.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Evaluate the present condition of environmental pollution.
CO2	Understand the nature of the atmosphere.
CO3	Be aware of causes of pollution and precautionary measure.

Unit I: The Environmental System

1.1 The services provided by the environmental system 1.2 Ecosystems: Food Chains, Food Webs, Ecological pyramids 1.3 Biochemical Cycles: Hydrological Cycle,Carbon Cycle

Unit II: Environmental Damage – Pollution

2.1 Sources and impact of Air Pollution 2.2 Water Pollution 2.3 Land Pollution – 2.4 Muncipal Solid Waste – Noise Pollution

Unit III: Resource Depletion

3.1 Importance of Forests : Causes and consequences of Deforestation 3.2 Bio Diversity Meaning and Importance- Reasons 3.3 Consequences of Biodiversity Decline

Unit IV : Global Climate Change

4.1 The Science of Climaye Change 4.2 Green House Effect-Sources and Impact of Climate Change. 4.3 Coping with Climate change.

Unit V : Sustainable Development

5.1 Concepts and Definition of Sustainable Development – (Brundtland Commission Definition) 5.2 Poverty,Population Growth and Environmental Damage 5.3 Policies for Sustainable Development.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in Environmental Studies to the students and these components will not cover in the examination.

Text Books

1. Erach Bharucha (2004),*Environmental Studies*, New Delhi.
2. Rajamannar (2004), *Environmental Studies,* EVR Publications,Trichy.
3. Kalavathy S.,(2004*), Environmental Studies*, Bishop Heber College Publication,Trichy.

Supplementary Reading

1. Richard Wright and Darathy F Boorse (2010),*Environmental Science Towards a Sustainable future*, Prentice Hall India, Publications,New Delhi.
2. Kumerasan K.A Alagappa Moses and M.Vasanthi *Environmental Studies*,Bharathidasan University Publications,Trichy.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3					3	2	2	3					3	2	3
CO2		3					2	2	2	3					3	2	3
CO4		3					2	2	2	3					3	2	3

***1-Low *2-Medium *3-Strong**

Semester I	19ICHEC14 - INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY– I	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic principles of atomic structure, bonding etc.
LO2	To learn about concepts of gaseous and liquid states.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Students will know the importance of chemistry.
CO2	Students will start the basic building of chemistry.
CO3	Learn principles in inorganic, organic and physical chemistry.

Unit–I: Atomic Structure and Periodic Properties

Atomic orbitals, quantum numbers, shapes of s, p and d orbitals. Aufbau principle, Pauli exclusion principle. Hund's rule.Electronic configuration of atoms.Screening effect.Effective nuclear charge. Calculation of effective nuclear charge using Slater rules. Periodic classification of elements based on electronic configuration. Atomic and ionic radii.Ionization energy, Electron affinity and electronegativity.Trends in periodic table.

Unit–II: Study of s block elements I – Hydrogen and alkali metals

Hydrogen – preparation, properties and uses - hydrogen as a fuel - Isotopes of hydrogen.

Alkali metals – Electronic structure, sizes of atoms and ions. Chemical properties: Oxides, hydroxides, peroxides and superoxides, hydrides and halides of alkali metals.

Compounds of Li, Na and K - preparation, properties and uses of LiCl, Li_2CO_3, washing soda, baking soda, sodium nitrite, sodamide, KI and KCN.

Unit–III: Formation and Characters of Covalent Bond Involving Carbon

Types of hybridization of carbon.Structures of methane, ethane, ethylene and acetylene.C-C bond lengths in ethane, ethylene and acetylene.Inductive effect, resonance, hyperconjugation, aromaticity, classification of organic compounds.Types of organic reactions. Types of intermediates like carbocations, carbanions and radicals. Factors influencing the stabilities of intermediates.

Unit–IV: Alkanes, Alkenes and Alkynes

Nomenclature.Methods of preparation of alkanes – physical properties and chemical reactions of alkanes.Mechanism of free radical halogenation of alkanes – reactivity and regioselectivity.

Methods of preparation of alkenes.Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides.Saytzeff rule.Hofmann's rule.Physical properties and chemical reactions of alkenes. Markovnikov's rule – Hydroboration – epoxidation – ozonolysis – hydroxylation.

Oxidation, reduction and polymerization.Uses of ethylene and propene. Cumulative, conjugated and isolated double bonds. 1,3 Butadiene, 1,4-addition. Diels – Alder reaction, polymerization reactions of butadiene.

Unit–V: Gaseous and Liquid States

Kinetic theory of gases. Deviation from ideal behaviour van der Waals equation of state. PV isotherm of real gases. Continuity of state. Critical phenomena – critical constants for a van der Waals gas. Law of corresponding states – reduced equation of state. Qualitative idea of structure of liquids.Structure of nematic and cholesteric phases. Applications of liquid crystals.

Unit–VI: (Not for Final Examination)

IUPAC Nomenclature: Nomenclature of alcohols, alkyl halides, ether, carbonyl compounds and amines.

Periodic table – long form of periodic table, placement of s, p, d, f-block elements, study of periodicity.

Lennard-Jones (6-12) potential. Second Virial Coefficient, Liquefaction of gases.

Text Books

1) Lee J.D., (2012) *Concise Inorganic Chemistry*, 5th Ed. Blackwell Science Ltd, London.
2) Puri B.R., Sharma L.R., Kalia K.K., (2016) *Principles of Inorganic Chemistry*, Milestone Publishers, New Delhi.
3) Finar I.L., *Organic Chemistry*, (2012) Volume 1, 6th Ed., Dorling Kindersley (India) Pvt. Ltd., New Delhi.
4) Puri B.R, SharmaL.R.,.PathaniaS (2017), *Principles of Physical Chemistry*, Vishal Publishing Co. New Delhi.
5) Bahl B.S, Arun Bahl, (2012) *Advanced Organic Chemistry*, S. Chand & Co. Ltd., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						1			3	2	2	2			
CO2	3		3	3						3	3	2	2	2			

***1-Low *2-Medium *3-Strong**

Semester I	19IMATA01: ALLIED – I: MATHEMATICS – I	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic knowledge on series and matrices .
LO2	To learn about concepts of differentiation.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Study the series of number system.
CO2	Understand the various the matrix operations and differentiations methods.
CO3	Study the trigonometric and hyperbolic functions.

Unit-1:

Series, Comparison test, Integral test, Comparison of ratios, D'Alembert's ratio test, Cauchy's root test, Alternating series, Convergence of exponential series, Uniform convergence.

Unit-2:

Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

Unit-3:

Expansion of sin $n\theta$, cos $n\theta$, tan $n\theta$ in powers of sin θ, cos θ and tan θ, Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

Unit-4:

Differentiation, Successive differentiation, Meaning of derivative.

Unit-5:

Maxima and minima, Rolle's theorem and Mean value theorem, Expansions of functions, Partial differentiation.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. Grewal B.S, (2008), "*Higher Engineering Mathematics*" by Khanna Publishers,New Dehi.
2. Narayanan S.and Manicavachogam T.K. (2009), "*Calculus"* Vol. I Pillay, S. Viswanathan Printers, Chennai.

Supplementary Reading

1. Thomas G.B.and.FinneyR.L. (1998),*Calculus and Analytic Geometry*, Addison Wesley (9 th Edn), Mass. (Indian Print).
2. Venkataraman M.K..(1992),*Engineering Mathematics*-Part B. National Publishing Company, Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	3	2	2	3				3	2	2	3	2			
CO2	3	2	3	2	2	3				3	2	2	3	2			
CO3	3	2	3	2	2	3				3	2	2	3	2			
CO4	3	2	3	2	2	3				3	2	2	3	2			

***1-Low *2-Medium *3-Strong**

Semester I	19IBOTA01: ALLIED –I: BOTANY I: PLANT DIVERSITY, ANATOMY AND EMBRYOLOGY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To acquire basic knowledge in plant science.
LO2	To learn about structure of bacteria, Bryophytes,Pteridophytes etc.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Appreciate the diverse Algae & Fungi groups and their characteristics.
CO2	Understand the anatomy of vascular plants.
CO3	Understand the structure and types of embryo of seed plants.

Unit – 1

General account of bacteria – ultrastructure, nutrition and nutritional types, reproduction- asexual and parasexual. Economic importance Viruses: Structure-ultrastructure of TMV, bacteriophage, reproduction of viruses.

Unit – 2

Structure, Reproduction and Life history of *Nostoc, Oedogonium, Ectocarpus* and *Polysiphonia, Albugo, Pencillium* and *Agaricus.*

Unit – 3

Structure, reproduction and life history of *Funaria* ,*Lycopodium* and *Cycas*.

Unit – 4

Anatomy – simple and complex tissues, Internal structure of dicot root, stem and leaf - monocot stem and leaf. Normal secondary thickenings of dicot stem.

Unit – 5

Embryology – Microsporogenesis – male gametophyte, Megasporogenesis (*Polygonum* Type) – types of ovule, double fertilization, Types of endosperms.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. Bhojwani,S.S and Bhatnagar,S.P. (2015). *Embryology of Angiosperms*. Vikas Publications PVT Ltd., New Delhi.
2. Pandey, S.N. (2009). *Plant Anatomy*. S.Chand & Company, New Delhi.
3. Sambamoorthy, A.V.S.S(.2005(. *A Textbook of Algae*. I.K.International Pvt Ltd., New Delhi.
4. Sharma,O.P.(2007). *Textbook of Algae*. Tata McGraw Hill Publications Pvt Ltd, New Delhi.
5. Vashista, B.R. (2014). *Textbook of Fungi*. S.Chand & Company, New Delhi
6. Vashista, B.R., A.K.Sinha and Adarsh Kumar. (2011). *Botany for Degree students*- Bryophyta. S.Chand & Company, New Delhi.
7. Vashista, B.R. (2015). *Textbook of Pteridophyta*. S.Chand & Company, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**								**3**	**3**	**3**	**3**				
CO2	**3**	**3**								**3**	**3**	**3**	**3**				
CO3	**3**	**3**								**3**	**3**	**3**	**3**				
CO4	**3**	**3**								**3**	**3**	**3**	**3**				
CO5	**3**	**3**								**3**	**3**	**3**	**3**				

***1-Low** ***2-Medium** ***3-Strong**

Semester II	19ITAMC21- பகுதி – 1 (Part I) பக்தி இலக்கியமும் சிற்றிலக்கியமும்	L	P	C
		3	0	3

கற்பித்தலின் நோக்கம்:

LO1	தமிழ்ப்பக்தி இலக்கியங்களையும் சிற்றிலக்கியங்களையும் அறிமுகம் செய்தல்.
LO2	தமிழின் தனித்துவமான பக்தி இலக்கிய வகைமையை ஒப்பிட்டுக்காட்டல்.
LO3	சைவ வைணவ இலக்கியங்களின் தனித்துவத்தை எடுத்துரைத்தல்.
LO4	கிறித்துவ, இசுலாமிய இலக்கியங்களையும் பாடு பொருட்களையும் விளக்குதல்.
LO5	சிற்றிலக்கியத் தோற்ற பின்னணிகளின் வழி அவ்விலக்கியங்களை அறிய வைத்தல்.

கற்றல் வெளிப்பாடு:

இந்தப் பாடமுடிவில் மாணவர்கள்

CO1	பக்தி இலக்கியம் சிற்றிலக்கியம் வகைமைகளையும் உத்திகளையும் அறியும் திறன்.
CO2	திருஞானசம்பந்தரின் பக்தித் திறத்தை உணர்தல்.
CO3	ஆண்டாளின் பக்தி மார்க்கதையும் பாவை நோன்பையும் குறித்துத் தெளிதல்.
CO4	வள்ளலாரின் உயிர் நேயக் கோட்பாட்டை அவசியம் அறிவர்
CO5	இந்தியத் தத்துவ ஞான வரலாற்றுடனும் இதிகாசங்களுடன் தொடர்பு ஏற்பட்டிருக்கும்.

அலகு- 1 பக்தி இலக்கியம்

1.திருஞானசம்பந்தர் - திருநள்ளாறு -பச்சைப்பதிகம் (முதல் 5 பாடல்கள்)

2.திருமூலர் - திருமந்திரம் (உடம்பினைமுன்னை,யாவர்க்குமாம், ஒன்றேகுலமும், உள்ளம்பெருங்கோயில், ஆர்க்கும் எனத்தொடங்கும் பாடல்கள்)

3.சிவவாக்கியர் - அறிவுநிலை (5 பாடல்கள்)

அலகு–2 பக்தி இலக்கியம்

1.ஆண்டாள்	-	திருப்பாவை (முதல் 5 பாடல்கள்)
2.வள்ளலார்	-	திருவருட்பா – பிள்ளைச்சிறுவிண்ணப்பம்

அலகு–3 பக்தி இலக்கியம்

1.தேம்பாவணி	-	குழவிகள்வதைப்படலம்
2.சீறாப்புராணம்	-	மானுக்குப்பிணை நின்ற படலம்

அலகு–4 சிற்றிலக்கியம்

1.குற்றாலக்குறவஞ்சி	-	மலைவளம் (வானரங்கள்... பாடல்முதல்)
2.முக்கூடற்பள்ளு	-	நாட்டுவளம்

அலகு – 5 இலக்கிய வரலாறு பக்தி சிற்றிலக்கிய வரலாறு – இடைக்காலத் தமிழகச்சூழல்–சைவ வைண சமயங்களின் செல்வாக்கு – சமண பௌத்த சமய இலக்கியங்கள் – கிறித்துவ இசுலாம் இலக்கியங்கள்–நாயக்கர்காலச் சிற்றிலக்கியங்கள் தோற்ற பின்னணி–சிற்றிலக்கிய வகை.

(மாணவர்கள் அறிந்து கொள்வதற்கு மட்டும் – தேர்வுக்கான பகுதிஅல்ல)

இலக்கியங்களையும் அவை தொடர்பான இலக்கிய வரலாற்றையும் இணைத்துப்படித்தல். பக்தி இலக்கிய வளர்ச்சியில் தமிழ்ப்பனுவல்களில் ஏற்பட்ட வளர்ச்சியைச் சுட்டிக்காட்டுதல். மனித மனத்தை பண்படுத்தவும், சமூக அமைதியை நிலை நாட்டவும், உலக நல்லிணக்கம் காணவும் பக்தி இலக்கியம் பயன்படுமாற்றை விளக்குதல்.

பாடநூல்கள்

1. ச.வே.சுப்பிரமணியன் (ப.ஆ), (2010), பன்னிரு திருமுறைகள் மூன்றாம் பதிப்பு, மணிவாசகர் பதிப்பகம், சென்னை.
2. ச.வே.சுப்பிரமணியன் (ப.ஆ), (2000), நாலாயிரத் திவ்ய பிரபந்தங்கள் (இரண்டாம் பதிப்பு), முல்லை நிலையம், சென்னை-17.
3. சி.எஸ். முருகேசன் (ப.ஆ) (1996) சித்தர்பாடல்கள், இரண்டாம் பதிப்பு, மணிவாசகர் பதிப்பகம், சென்னை.
4. வள்ளலார் திருவருட்பா,, அண்ணாமலைப் பல்கலைக்கழகப்பதிப்பு, அண்ணாமலைநகர்.
5. வீரமாமுனிவர், (2010), தேம்பாவணி, (முதற்பதிப்பு) பாரி நிலையம்,சென்னை – 8.
6. உமறுப்புலவர், (2004), சீறாப்புராணம்,(முதற்பதிப்பு), நேஷ்னல் பதிப்பகம், சென்னை.
7. திரிகூடராசப்பக்கவிராயர் (2014), குற்றாலக் குறவஞ்சி, (இரண்டாம்பதிப்பு) பாவை பதிப்பகம், சென்னை.
8. முனைவர் கதிர்முருக(ப.ஆ) (2015), முக்கூடற்பள்ளு, (மறுபதிப்பு), பாரி நிலையம், சென்னை -108.

பார்வைநூல்கள்

1. ந.வீ.செயராமன், (1968), சிற்றிலக்கியச் செல்வம், (முதற்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
2. ந.வீ. செயராமன், (1980), பள்ளு இலக்கியம், (முதற்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
3. கோ.கேசவன், (1981), பள்ளுஇலக்கியம் ஒரு சமூகவியல்பார்வை, (முதற்பதிப்பு), அன்னம் வெளியீடு, தஞ்சாவூர். -.
4. ச.வே.சுப்பிரமணியன், (2010), தமிழ் இலக்கிய வரலாறு, (ஏழாம்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
5. சோ.நா.கந்தசாமி, தமிழ் இலக்கிய வரலாறு, மணிவாசகர் பதிப்பகம், சென்னை.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2								3	2	3	3	3
CO2	3	2	2								2	2	2	3	3
CO3	3	2	2									2			3

*1-Low *2-Medium *3-Strong

Semester II	19IHINC21: Part-I LANGUAGE HINDI-II	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To know the life of National leaders.
LO2	To introduce the Gandhiji's thought.
LO3	To understand the concepts of teaching and learning from Dr.Sarvapalli Radhakrishnan's life.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the basic structure of poem and prose.
CO2	Classify and compare various poems.
CO3	Describe the basic concepts of moral stories.
CO4	Apply the teachings of various national leaders.
CO5	Understand the spirit of spirituality.

Unit - I: Introduction

man ki shakti dena ,prathighna palan, hamara Rajchinga,adhbhud maya..

Unit - II: Poem ,Prose

sarvapalli radhakrishnan,amedkar, mahaveer, sadak ke niyam,sanghi ka phal(poem).

Unit - III: Stories.

Tyog ka such,bhavan sabka ek hai,chirjivan ka jharna, lob ka parinam.

Unit - IV: dadha ki moorkatha, kuthe ki poonch ande barabar dhana.

Unit - V: bakri do ghav kha gayi, Dhan ki magima.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. *Naveen Hindi Patamala*: Part - II D.B.H.P. Sabha, Chennai - 600 017.
2. *Manohar Kahaniyam* , Part – II D.B.H.P. Sabha, Chennai - 600 017.

Supplementary Reading

1.Naveen Hindi Patamala: Part - I , D.B.H.P. Sabha, Chennai - 600 017.
2.Hindi prachar bodhini-DHBS, Chennai 600 017.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3	3	2	2	3	2	3	3	3	3	3			
CO2	3		3		3		2	2		3					
CO3	3	3			2	3		2	3	3			2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester II	19IFREC21: Language- I: Course -2 FRENCH-II	L	P	C
		3	0	3

Learning Objective (LO):

LO1	By introducing the course, it is intended to:
LO2	Talk about their family members
LO3	Engage a simple conversation about family members.
LO4	Talk about your likes and dislikes
LO5	Fill in a simple form

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	Understand simple texts providing personal details of others.
CO2	State how many people are in my family and who they are, using vocabulary including family members, possessive adjectives and negatives such as 'je n'ai pas de frères/sœurs'.
CO3	Write a short text to inform others of my likes and dislikes and provide reasons. Ask others about their likes and dislikes, showing that I appreciate diverse viewpoints and personalities e.g. 'Quel est ton … favori/préféré?'
CO4	Understand in filling up a simple form.
CO5	Write a short introduction about myself, providing personal details and use simple connectors, such as *'et' , 'mais' and 'aussi'.*

Unit I

Demander /donner des précisions sur le temps

Demander / indiquer l'heure et la date

Demander / dire ce qu'on a fait

Féliciter

Unit II

Comprendre et écrire un journal personnel en français.

Comprendre l'agenda de quelqu'un

Les rythmes de vie en France

Evaluez-vous

Unit III

Evasion en français par l'Internet, la télévision, la radio et la presse.

Découvrir la France dans votre pays

Unit IV

Les voyages et les transports

Comparer les choses ; Montrer ; Indiquer une appartenance

Demander / donner une explication

Unit V

Voyager en France ; Situations pratiques relatives au voyage.

Parler d'un repas.

Situations pratiques à l'hôtel et au restaurant

Les habitudes des Français sur un repas.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français***,*** Langers, Paris

Supplementary Reading

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - *méthode de français*, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), ***FORUM*** – *Méthode de français*, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), ***Grammmaire Prograssive du Français avec 400 exerices***, CLE International, Paris.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	3	2	2	3	2	3	3	3	3	3			
CO2	3		2		3		2	2		3					
CO3	3	2			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester II	19IENGC22: ENGLISH THROUGH LITERATURE II: POETRY	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To develop the ability of the learner to comprehend and appreciate poems in English.
LO2	To learn the basic theorems of vector calculus.
LO3	To enhance the competence of the learner in using the English language.
LO4	To improve the interest of the learner in human values and perceptions.
LO5	To provide learners with the theoretical and practical understanding of grammar

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Become competent in communication, both in written and oral skills.
CO2	Gain fluency in English language.
CO3	Attain knowledge about construction of sentence structures.
CO4	Acquire the vocabulary to use the English language effectively.
CO5	Acquire the aesthetic sense for appreciating poetry.

UNIT I

William Shakespeare	"Sonnet 116"
William Blake	"Lamb"
Robert Burns	"A Red, Red Rose"
Grammar	Finite & Non-finite verbs

UNIT II

PB Shelley	"To Wordsworth"
John Keats	"Sonnet to Sleep"
Thomas Hardy	"Neutral Tones"
Grammar	Strong and Weak Verbs, Auxiliaries and Modals

UNIT III

Robert Frost	"Stopping By Woods on a Snowy Evening"
Wilfred Owen	"Anthem for Doomed Youth"
Emily Dickinson	"A Narrow Fellow in the Grass"
Grammar	Transitive, Intransitive Verbs, Active and Passive voice

UNIT IV

Sri Aurobindo	"The Tiger and the Deer"
AK Ramanujan	"Obituary"
Sarojini Naidu	"Queen's Rival"
Grammar	"Concord"

UNIT V

Roger Mc Gough	"My Bus Conductor"
Maya Angelou	"Still I Rise"
Langston Hughes	"The Negro Speaks of Rivers"
Grammar	Tenses and their forms

The faculty will impart Contemporary Contours at the end of each course. This Contemporary Contours will not be credited in the examinations.

Text Books

1. Hydes, Jack. (1985), *Touched With Fire*.: Cambridge UP, London.
2. Narasimhaiah, C. D (2006), *An Anthology of Common Wealth Literature*. Macmillan, New Delhi.
3. Thomas, C. T. , (2006), *Twentieth Century Verse: An Anglo-American Anthology*. Macmillan, New Delhi.
4. Gates, Henry Louis, and Nellie Y. McKay. (2004), *The Norton Anthology of African American Literature*.: W.W. Norton & Co, New York.
5. Ramachandran C. N. and Radha Achar. (1998), *Five Centuries of Poetry*. New Delhi: Laxmi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3			3			3	3		3		3	3		
CO2	2			3			3	3		3	3	3	3		
CO3	3			2			2	2		2		2	2		
CO4	3			3			3	3		3	2	3	3		
CO5	2			2			2	2		2	3	2	2		

***1-Low *2-Medium *3-Strong**

Semester II	19ICISC23:SOFT SKILLS- COMPUTER APPLICATIONS - I	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To Study the Fundamentals Concepts of Computers and Operating Systems.
LO2	To get familiar with basics of the Internet Programming.
LO3	To acquire knowledge and skills for creation of web site considering both client and server side programming.
LO4	To explore different web extensions and web services standards and ability to develop responsive web applications.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Describe the usage of computers and why computers are essential components in business and society.
CO2	Solve common business problems using appropriate Information Technology applications and systems.
CO3	Identify categories of programs, system software and applications. Organize and work with files and folders and utilize the Internet Web resources and evaluate on-line e-business system.
CO4	Design a responsive web site using HTML5 and demonstrate Rich Internet Application.

Unit – 1: Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers. Input, output devices, data storage devices, software, the definition, the role of software, House keeping.

Unit – 2: The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software. Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – 3: Introduction to internet, client sever basics, E-mail, Telnet and Archie, FTR – Gopher, Jug head and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – 4: Issues involved in web site management, addressing, designing web sites with front page.

Unit – 5: Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies fundamental and use of hypertext, hypermedia, sound, images, animation, video. Using multimedia, multimedia interface, planning and development of multimedia projects.

Current stream of thought
Faculty member will impart the knowledge on recent trends in Computer Applications to the students and these components will not cover in the examination.

Text Books

1. Sanjay Saxena, (2015), "*A first course in computers*", Vikas Publishing House, New Delhi.
2. Alexies Leon and Mathews Leon (2003), "*Internet in a nutshell*" Leon Press, Chennai. and Vikas Publishing House, New Delhi.
3. Tay Vaughan (1999), *"Multimedia Making it work",* Osborne, Tata McGraw Hill. New Delhi.

Supplementary Reading

1. Ron Mansfield, (1997), "Windows 95 for Busy People", Obsorne, McGraw Hill.
2. Krishnan, (2014),"Computer fundamentals and Windows with Internet Technology", Scitech Publications Pvt Ltd, Chennai, India.
3. Krishnan, "Windows and MS-Office 2000 with database concepts", Scitech Publications Pvt Ltd, Chennai, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3		1	3	2		2		2	3			3	1		3		2
CO2	3	2	3					3		2						3	1	
CO3			3		3		1						2	3				1
CO4	3	2		3	2	1		3					3			3	3	

***1-Low *2-Medium *3-Strong**

Semester II	19ICHEC24 - INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – II	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic principles of atomic structure, bonding etc.
LO2	To learn about concepts of gaseous and liquid states.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Learn the basic principles of periodic classification.
CO2	Learn about organic functional groups and their reactions.
CO3	Learn the basic principles of thermodynamics.

Unit – I: Study of s block elements II - Alkaline Earth Metals

Electronic structure – sizes of atoms and ions. Chemical properties – Oxides, hydroxides, peroxides, nitrides, carbides, hydrides and halides of alkaline earth metals comparison of Be and Mg with other alkaline earth metals – Comparison of alkaline earth metals with alkali metals - Plaster of Paris, Portland cement – Hardness of water.

Unit – II: Arene, Alkyl Halides and Aryl Halides

Nomenclature of benzene derivatives.Isolation of benzene from coal tar.Mechanism of electrophilic substitution. Activating and deactivating substituents. Orientation, effect of substituents.

Preparation, physical properties and chemical reactions of alkyl halides.S_N1 and S_N2 mechanisms. Manufacture, properties, reactions and uses of $CHCl_3$ and CCl_4, vinyl chloride, allyl chloride and chlorobenzene. Relative reactivities of alkyl, aryl, vinyl and allyl halides.

Unit – III: Alcohols and Phenols

Alcohols: Classification: Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature.Reactions of alcohols.

Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal diols, oxidative cleavage by $Pb(OAc)_4$ and HIO_4 and pinacol-pinacolone rearrangement. Glycerol – manufacture, properties, reactions and uses.

Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Gattermann synthesis, Houben – Hoesch reaction and Reimer – Tiemann reaction.

Unit – IV: Chemical Kinetics and Catalysis

Rate of a chemical reaction.Factors influencing rates of chemical reactions.Order and molecularity.Rate equations for zero-, first- and second-order reactions.(For second-order reaction with equal and unequal concentrations of reactants).Half-life period.Determination of order of reaction- differential method, method of integration, half-life period method, isolation method.Method of following kinetics by titrimetric procedures. Acid- and base- catalysed hydrolysis of ester and iodination of acetone as examples. Arrhenius equation, concept of activation energy.Simple collision theory.Catalysis, characteristics of catalysed reactions, classification of catalysts.

Unit – V: Thermodynamics - I

Definition of system and surroundings.Types of systems, thermodynamic properties - intensive and extensive properties.State and path functions - Concept of heat and work – thermodynamic equilibrium – reversible and irreversible processes.

First law of thermodynamics: statement - heat capacities at constant volume and constant pressure, relationship between Cp and Cv.

Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: standard state, standard heat of formation – Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume.Heat of neutralization - temperature dependence of heat of chemical reaction – Kirchoff's equation.

Unit – VI: **(Not for Final Examination)**

Name reactions: Friedal craft's reaction, Kolbe reaction, Hofmann rule, zaitseff rule, Reimer-Tiemann reaction, Grignard reaction.

Properties of alkali metals – Li, Na, K, Rb, Cs.

Zeroth Law of Thermodynamics , Absolute temperature scale, Autocatalysis and Oscillatory reactions.

Text Books

1) Lee J. D., *Concise Inorganic Chemistry*, (2012)5th Ed. Blackwell Science Ltd, London.

2) Puri B.R, Sharma L.R, Kalia K.K, (2016),*Principles of Inorganic Chemistry*, Milestone Publishers, New Delhi.

3) Finar I.L., *Organic Chemistry*, Volume 1,(2012), 6th Ed., Dorling Kindersley (India) Pvt. Ltd., New Delhi.

4) Bahl B.S., Arun Bahl, (2012),*Advanced Organic Chemistry*, S. Chand & Co. Ltd., New Delhi.

5) Jerry March, (2016),*Advanced Organic Chemistry*, 7th Ed. John Wiley.NJ.

6) Puri B.R, Sharma L.R., Pathania S., (2017), *Principles of Physical Chemistry*, Vishal Publishing Co. New Delhi.

7) Laidler K.J., (2008), *Chemical Kinetics*, 3rd Ed. Dorling Kindersley (India) Pvt. Ltd., New Delhi.

8) Agarwal G.L, (1990), *Basic Chemical Kinetics*, Tata Mc Graw Hill, New Delhi.

9) Rajaram J., KuricoseJ.C., (1999), *Thermodynamics for Students of Chemistry*, Shoban Lal Nagin Chand & Co., New Delhi.

10) Glasstone S,(2008), *Thermodynamics for Chemists*; Affiliated East West Press, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						1			3	3	3	3			1
CO2	3		3								3	3	3	3			2

***1-Low *2-Medium *3-Strong**

Semester II	19ICHEP25: Practical – I: VOLUMETRIC ANALYSIS	L	P	C
		0	8	4

Learning Objective (LO):

LO1	To learn the basic principles of acid base titrations.
LO2	To learn the important concepts of redox and precipitation titrations.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	To learn the basics of practical chemistry
CO2	To learn about oxidation and reduction reactions.
CO3	To understand the principles involved in practical chemistry.

1. Acid-base Titrations:

a) Determination of NaOH and Na_2CO_3 in a mixture by double titration.

b) Estimation of barium chloride

c) Determination of ammonium ion

2. Redox Titrations:

a) Permanganometry – Estimation of ferrous and ferric ions in a mixture

b) Estimation of oxalic acid and oxalate ion.

c) Dichrometry – Estimation of Fe^{2+} and Fe^{3+} ions

d) Iodometry – Estimation of copper

3. Precipitation Titration: Determination of chloride

Text Books

1. Vogel A. I., (2002), *Textbook of Quantitative Inorganic Analysis*, Pearson India Publishers. New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	2	2	1	1				2		1	2	3			2	2	2

***1-Low *2-Medium *3-Strong**

Semester II	19IMATA02: ALLIED I -MATHEMATICS – II	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the idea of integration.
LO2	To learn the basic theorems of vector calculus.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	To learn the basic mathematical concepts related to the science field.
CO2	To learn about notion of vector and its derivative.
CO3	To understand the Green's theorem, Gauss divergence theorem and Stoke's theorem.

Unit-1: Integration

Introduction, Definite integral, Methods of integration, Integrals of the form

$\int \frac{f'(x)}{f(x)} dx$

$\int F\{f(x)\}f'(x)dx$

$\int \frac{dx}{ax^2+bx+c} dx$

$\int \frac{lx+m}{ax^2+bx+c} dx$

$\int \frac{1}{\sqrt{a}x^2+bx+c}$

$\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$

Unit-2: Integration

Properties of definite integrals, Integration by parts, Reduction formula for the following types

$I_n = \int x^n e^{ax}$ S n→+ve integer

$I_n = \int \cos^n x\, dx$ n, positive integer

$I_n = \int sin^n x\, dx$

$I_{m,n} = \int sin^m x cos^n x dx$ Bernoulli's formula.

Unit-3:

Area under plane curves, Area of a closed curves, Area between two intersecting curves, Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of revolution.

Unit-4:

Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector, Differentaitions formulas, Differentation of dot and cross products, The Vector differential operator Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector, Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

Unit-5:

Vector integration, The line integral, Green's theorem in two dimesions-verification, Gauss divergence theorem (without proof)-verification and evaluation of integrals, Stoke's theorem (without proof)-verification and evaluation of integrals.

Current stream of thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. Narayanan S. and. Manicavachogam PillayT.K, (2003), "*Calculus (Major)"* Vol. II by S. Viswanathan Printers,.Chennai.
2. Venkataraman M.K and Manorama Sridhar (2002), *"Vector Calculus and Fourier Series*" by The National Publishing Company, Chennai.

Supplementary Reading

1. Thomas G.B.and Finney R.L., (1998) *Calculus and Analytic Geometry*, Addison Wesley (9th Edn), Mass. (Indian Print).
2. Venkataraman M.K. (1992) *Engineering Mathematics*-Part B. National Publishing Company, Chennai.
3. Vittal P.R. (2004) *Vector Calculus*, Fourier series and Fourier Transform. Margham Publications, Chennai.
4. Grewal (2008) *Higher Engineering Mathematics*, Khanna Publishers, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	3	2	2	3				3	2	2	3	2			
CO2	3	2	3	2	2	3				3	2	2	3	2			
CO3	3	2	3	2	2	3				3	2	2	3	2			
CO4	3	2	3	2	2	3				3	2	3	2	2			

*1-Low *2-Medium *3-Strong

Semester II	19IBOTA02: ALLIED I- BOTANY II: TAXONOMY, PHYSIOLOGY, ECOLOGY AND BIOTECHNOLOGY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To understand the principles, classification and salient features of Angiosperm families.
LO2	To understand the physiology and ecology of plants .

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the Bentham and Hooker's Classification.
CO2	Understand the characteristic features various angiosperm families.
CO3	Comprehend the photosynthesis and respiration of plants
CO4	Appreciate the knowledge on ecological principles .
CO5	Analyze various tissue culture methods and its applications

Unit – 1

Outline the classification of natural system- Bentham and Hooker, A detailed study of following families and their economic importance: Annonaceae, Zygophyllaceae, Caesalpiniae and Cucurbitaceae

Unit – 2

A detailed study of following families and their economic importance: Rubiaceae, Apocynaceae, Lamiaceae, Nyctaginaceae, Cannaceae and Poaceae

Unit – 3 Physiology

Absorption of water, absorption of minerals, photosynthesis- photo system I and Photo system II, C3 C4 and CAM pathways. Respiration- Glycolysis, TCA cycle and electron transport system, Pentose phosphate pathway. Growth hormones- physiological effects of growth substance – Auxins, Gibberellins and Cytokinins.

Unit – 4 Ecosystem

Biotic and abiotic components – food chain – food web – energy flow. Plant Ecology: Factors affecting vegetation- abiotic and biotic. Morphological and anatomical adaptations in hydrophytes and Xerophytes.

Unit – 5 Plant Biotechnology

Enzymes (restriction enzymes, DNA Ligase)- cloning vectors (Plasmid, Cosmid, Tiplasmid). Production of rDNA. Production of transgenic plants. Tissue culture techniques (Aseptic conditions, MS media and callus induction).

Current stream of thought
Faculty member will impart the knowledge on recent trends in subject to the students and these components will not cover in the examination.

Text Books

1. Devlin, R.M.(1996.), *Plant Physiology*. PWS Publishers, Boston.
2. Dubey, R.C.(2009), *A Textbook of Biotechnology*. S.Chand & Company, New Delhi.
3. Dutta, S.C.(2003*) ,Systematic Botany*. New Age International pvt Ltd., New Delhi.
4. Jain, V.K.(2009*), Fundamentals of Plant Physiology*. S.Chand & Company, New Delhi.
5. Pandey, B.P. (2009), *Taxonomy of Angiosperms*, S.Chand & Company, New Delhi .
6. Sambamoorthy, A.V.S.S(.2005), *Molecular Biology*, Narosa Publishers, New Delhi.
7. Shukla R.S and R.S. Chandel. (1998)*Plant Ecology*, S.Chand &Co. Pvt.Ltd, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3								3	3	3	3		
CO2	3	3								3	3	3	3		2
CO3	3	3								3	3	3	3		
CO4	3	3	2					2		3	3	3	3	2	
CO5	3	3	2					2		3	3	3	3		

***1-Low *2-Medium *3-Strong**

Semester II	19IBOTP01: ALLIED PRACTICAL I: BOTANY	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To know about the Microbes, Algae, Bryophytes, Pteridophytes and Gymnosperms
LO2	To gain knowledge on the anatomy of leaf, stem and roots.
LO3	To gain knowledge on the physiology of plants.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Analyze the microbes, Algae, Bryophytes, Pteridophytes and Gymnosperms.
CO2	Analyze the anatomy of leaf, stem and roots
CO3	Analyze the physiological aspects of plants.

Practicals:

1. To make suitable micro preparations, describe and identify the specimens of Algae, Fungi, Bacteria, Viruses, Bryophytes, Pteridophytes and Gymnosperms prescribed in theory syllabus.
2. Study of Anatomical features of leaf, stem and root of dicots and monocots
3. Study of different types of anther, LS of ovule.
4. Detailed study of families mentioned in the theory with one representative specimen from the local Flora
5. Simple experiments and experimental set up in Plant Physiology section of the syllabus.
6. Study of anatomical structure of Hydrophytes and Xerophytes.

Semester III	19ITAMC31-பகுதி–1 (Part I) அற இலக்கியமும் காப்பியமும்	L	P	C
		3	0	3

கற்பித்தலின் நோக்கம்:

LO1	தமிழ் அற இலக்கிய வரலாற்றை அறிமுகம் செய்து விளக்கப்படும்.
LO2	அற இலக்கியங்களின் வழித் தனி மனித ஒழுக்கம் வலியுறுத்தப்படும்.
LO3	காப்பிய இலக்கிய இலக்கணத்துடன் அதன் வரலாறும் புகட்டப்படும்.
LO4	தமிழில் தோன்றியுள்ள காப்பியங்களின் தனித்துவம் உணர்த்தப்படும்.
LO5	தமிழில் அற இலக்கியங்களின் தேவையைப் புரிய வைத்தல்.

கற்றல் வெளிப்பாடு:

இந்தப் பாடமுடிவில் மாணவர்கள்

CO1	திருக்குறள் வழி மனித மாண்புகளையும் ஒழுக்கங்களையும் அறியும் திறன்.
CO2	பெரியவர்களை மதிக்கும் மனப்பான்மையும் பிழைக் கூறாமையும் வளரும்.
CO3	இந்திர விழா கொண்டாடிய தமிழர்கள் பண்பாட்டை உணர்ந்திருப்பர்.
CO4	நாயன்மார்கள் வரலாற்றையும் பக்தி நெறியையும் பெற்றிருப்பர்.
CO5	வாலி வதைப் படலம் வழி விவாத திறன் ஏற்படும்.

அலகு- 1அறஇலக்கியம்

1. திருக்குறள் - உழவு,ஒழுக்கமுடைமை, காலமறிதல், நட்பு, பிரிவாற்றாமை

அலகு- 2 அறஇலக்கியம்

1. நாலடியார் - பெரியாரைப்பிழையாமை
2. பழமொழிநானூறு - கல்வி

அலகு – 3 காப்பியம்

1. சிலப்பதிகாரம் - இந்திரவிழவு ஊரெடுத்தகாதை
2. மணிமேகலை - ஆபுத்திரன் திறன் அறிவித்த காதை

அலகு - 4 காப்பியம்

1. பெரியபுராணம் - அப்பூதி அடிகள் புராணம்
2. கம்பராமாயணம் - வாலி வதைப்படலம்

அலகு - 5 இலக்கியவரலாறு

சங்க மருவிய கால அற இலக்கியங்கள் – திருக்குறளின் பெருமை – அற இலக்கியங்களின் வளர்ச்சி – காப்பிய இலக்கணம் - பகுப்புகள் – காலந்தோற்றம் தோன்றிய காப்பியங்கள் - வரலாறு.

(மாணவர்கள் அறிந்து கொள்வதற்கு மட்டும் – தேர்வுக்கான பகுதி அல்ல)

அறஇலக்கியங்கள் மனதை நெறிப்படுத்துவதோடு சமூக நடத்தைகளையும் கற்றுத்தருகின்றன. அற இலக்கியங்களின் தொடர்பால் மாணவர்கள் நல்லக்கருத்துகளைக் கற்றுக் கொள்வதோடு வாழ்விலும் கடைபிடிக்க எண்ணுதல் நல்ல சமூகம் உருவாகும். சமூகத்திற்கு அறநெறிகளில் தேவையானவைளை எடுத்துரைத்தல்.

பாடநூல்கள்

1. பதிப்பாசிரியர் ச. மெய்யப்பன், (2017), திருக்குறள், (இரண்டாம்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை- 08.
2. ச.வே.சுப்பிரமணியன், (2012), நாலடியார் பழமொழி நானூறு, (இரண்டாம்பதிப்பு) மணிவாசகர் பதிப்பகம், சென்னை- 08.
3. இளங்கோவடிகள், (2008), சிலப்பதிகாரம், (பதினொன்றாம் பதிப்பு), டாக்டர் உ.வே.சா. பதிப்பு சென்னை.
4. சீத்தலைச்சாத்தனார், (2008), மணிமேகலை, (எட்டாம் பதிப்பு), டாக்டர் உ. வே.சா. பதிப்பு, சென்னை.
5. சேக்கிழார், (2010), பெரியபுராணம், (முதற்பதிப்பு), முல்லை நிலையம், சென்னை.
6. கம்பர், கம்பராமாயணம்,அண்ணாமலைப் பல்கலைக் கழகம், வெளியீடு,
7. ச.வே.சுப்பிரமணியன், (1999) தமிழ் இலக்கிய வரலாறு, (முதற்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
8. சோ.ந.கந்தசாமி, (2004), தமிழ் இலக்கிய வரலாறு, (முதற்பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2								3	2	3	3	3
CO2	3	2	2								2	2	2	3	3
CO3	3	2	2									2			3

*1-Low *2-Medium *3-Strong

Semester III	19IHINC31: Part-I Language HINDI-III	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To study various comedy stories.
LO2	To introduce Indian epics.
LO3	To understand the concepts of drama.

Course Outcomes (CO):

At the end of the course, the student will be able to

LO1	Understand the basic structure of short stories.
LO2	Gain knowledge on Mahabharath.
LO3	Describe the basic concepts of human feelings.
LO4	Apply the concepts of comedy in stories.
LO5	Describe the effects of western culture.

Unit - I: Introduction, ekanki.

. Andher Nagari - Bharathendhoo Harishchandra

Unit - II: Mahabharath Ki Ek Sanj - Bharath Bhoosahn Agrwal [Full]

Unit - III: Drama.

3. Ladai - Sarveswar Dayal Saxeena [Full]

Unit - IV: stories, Tatava-vyanghya

Unit - V: Upstick Ki Muskhan - Vishnu Prabakar [Full]

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1 Andher Nagari - *Bharathendhoo Harishchandra*, Vinodh Pustak Mandir, Agra-2.

2. Dr. Dashrath Oojaa, *Prathinidhi Ekanaki* , Jawahar Pustakalya, Mathura.

3 Dr.V.P. Abhithap, *Ekanaki Manach* , Jawahar Pustakalya, Mathura.

4. Sarveswar Dayal Saxeena, *Ladai* , Rajkamal Prakashan, New Delhi.

Supplementary Reading

1.Hindi natak uthbhav aur vikas-dashrath ojha-rajpal and saons, New Delhi 7.

2.Hindi natak aur rangmanch-pahachan aur parak-Dr. Indranath madan, New Delhi 7.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3	3	2	2	3	2	3	3	3	3	3			
CO2	3		3		3		2	2		3					
CO3	3	3			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester III	19IFREC31: Language- I: Course -3 FRENCH-III	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To buy some products in a shop.
LO2	To ask the news of someone .
LO3	To talk about the climate .
LO4	To introduce their family.
LO5	To talk about their accommodation.

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	Ask the price of the product, pay for the product.
CO2	Ask about their daily activities .
CO3	To give and ask information about the climate.
CO4	Describe their family .
CO5	Describe their accommodation where they live.

Unit I

Demander des nouvelles de quelqu'un(les activités de la journée)

Choisir, acheter, payer un objet

Unit II

S'informer sur la présence ou l'existence d'une personne ou d'un objet (Parler d'un logement ; s'orienter, Décrire un trajet, Exprimer un besoin)

S'informer sur l'état physique de quelqu'un

Le temps en France et parler du temps

Unit III

Evaluez-vous

Evasion dans la Poésie

Unit IV

Souvenez-vous (Les moments de la vie)

Demander /donner des informations sur la biographie d'une personne (enchainer les idées).

Unit V

Demander /donner des informations sur ses relations amicales ou familiales.

Présenter sa famille.

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Book

1. J. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français***,*** Langers, Paris.

Supplementary Reading

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), ***FORUM*** – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris
4. Michele Boulares et Jean-Louis Frerot, (1997), ***Grammmaire Prograssive du Français avec 400 exerices***, CLE International, Paris.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	3	2	2	3	2	3	3	3	3	3			
CO2	3		2		3		2	2		3					
CO3	3	2			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester III	19IENGC32: ENGLISH THROUGH LITERATURE III: DRAMA	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To enhance the conversational competence of the learners by introducing drama in English.
LO2	To make the students the understand characteristics of the Elizabethan Age.
LO3	To make them appreciate Shakespearean drama.
LO4	To make them learn the key elements of sentence structures.
LO5	To make the students master the mechanics of writing.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Obtain a literary acumen to answer MCQs of NET/SET examinations and othercompetitive examination.
CO2	Appreciate conversational English.
CO3	Recognize the dramatic elements of Shakespearean dramas.
CO4	Use punctuations and capitals effectively in their composition.
CO5	Recognize the elements of the spoken discourses.

Unit I

William Shakespeare	The Tempest (Act I)
Grammar	"Phrases and Clauses"

Unit II

William Shakespeare	The Tempest (Act II)
Grammar	"Simple, Compound, and Complex Sentences"

Unit III

William Shakespeare	The Tempest (Act III)
Grammar	"Transformation of Sentences"

Unit IV

William Shakespeare	The Tempest (Act IV)
Grammar	"Sequence of Tenses and Reported Speech"

Unit V

William Shakespeare	The Tempest (Act V)
Grammar	"Punctuation and Capitals"

The faculty will impart Contemporary Contours at the end of each course. This Contemporary Contours will not be credited in the examinations.

Text Books

1. Shakespeare, William (2008), *The Tempest*. Ed. W. Turner: S. Chand & Co. New Delhi.
2. Green, David. (2010),*Contemporary English Grammar, Structures, and Composition*. MacMillan, Chennai.

Supplementary Reading

1. Cahn, L Victor. (1996.)*Shakespeare the Playwright*: *A Companion to the Complete Tragedies Histories, Comedies, and Romances.* Praeger, London.
2. Crystal, David. Shakespeare's Words(2009).: *A Glossary and Language Companion*. Penguin, London.
3. Greenbaum , Sidney(2005). *Oxford English Grammar*.: Oxford UP, London.
4. McCarthy (2018), *Cambridge Grammar of English*, Cambridge UP, London.
5. Quirk, Randolph, (2010). *A Comprehensive Grammar of the English Language*.: Pearson London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3			3			3	3		3	3	3			3
CO2	2			3			3	3		3	3	3			3
CO3	3			2			2	2		2	2	2			2
CO4	3			3			3	3		3	3	3			3
CO5	2			2			2	2		2	2	2			2

***1-Low *2-Medium *3-Strong**

Semester III	19ICHEC33 - INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY III	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic principles of chemical bonding.
LO2	To learn the classifications of organic compounds.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	To understand the important basics of chemical bonding.
CO2	To gain knowledge in various organic functional groups.
CO3	To appreciate the fundamentals of electrochemistry.

Unit – I: Chemical Bonding

Ionic bonding: Formation and general properties. Radius ratio rule and its limitations.

Hydration energy and lattice energy and their applications. Born-Haber cycle. Fajan's rules.

Covalent bond: Valence bond theory. Formation and general properties. Orbital overlap. Hybridization, sigma and pi bonds, VSEPR theory and geometries of H_2O, NH_3. CH_4, PCl_5, SF_6, IF_7, BF_3 molecules.

Partial ionic character of covalent bond and percentage of ionic character. Molecular Orbital Theory: Bonding and anti-bonding molecular orbitals, bond order. MO diagrams of H_2, Ne_2, O_2, O_2^+, O_2^- and CO.

Unit – II: Acids, Bases and Non Aqueous Solvents

Bronsted definition, Lewis definition, Lux-Flood definition – Usanovich's generalized definition – K_a K_b, pK_a and pK_b for Bronsted acids and bases. Relative strengths of Bronsted acids and bases- pH of Buffer solution- Henderson's equation. Theory of acid base indicators.

Non-aqueous solvents, liquid NH_3, liq.SO_2 and HF.

Unit – III: Ethers, Epoxides, Aldehydes and Ketones

Preparation, properties and chemical reactions of ethers with special reference to diethyl ether. Uses of diethyl ether. General methods of preparation of epoxides. Preparation, properties and chemical reactions of ethylene oxide. Polar nature of carbonyl group. Nomenclature of aldehydes and ketones. Important methods of preparation of aldehydes and ketones. Reactions and Industrial applications of aldehydes and ketones with special reference to formaldehyde, acetaldehyde, benzaldehyde, acetone, acetophenone and benzophenone.

Unit – IV: Carboxylic Acids and their Derivatives

Nomenclature. Important methods of preparing carboxylic acids. Reactions of carboxylic acids with special reference to formic acid, acetic acid and benzoic acid. Halogenated acids: chloroacetic acid, α-chloro and β-chloro propionic acid. Hydroxyacids: glycollic acid, lactic acid, tartaric acid, malic acid and citric acid. Preparation, properties and reactions of carboxylic acid derivatives with special reference to acetyl chloride, acetic anhydride, acetamide, ethyl acetate, benzoyl chloride and benzamide. Unsaturated acids: Acrylic acid and Crotonic acid. Dicarboxylic acids: oxalic acid, succinic acid and phthalic acid.

Unit – V: Electrochemistry - I

Electrical transport. Conduction in metals and in electrolyte solutions. Specific conductance and equivalent conductance. Measurement of equivalent conductance. Variation of equivalent and specific conductances with dilution.

Migrations of ions. Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations. Weak and strong electrolytes. Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes. (elementary treatment only). Transport number: definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of the degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt and conductometric titrations.

Unit – VI: (Not for Final Examination)

Preparation, Properties and synthesis application of acetoacetic ester, Diethyl malonate and Diazo methane.

Chemical bond – octet rule – Arrhenius acid and base concept, weak chemical forces – van der Waals forces, dipole-dipole interactions, induced dipole interactions, Hydrogen bonding.

Fick's Law of Diffusion, Half-wave potential, Applications of polarography.

Text Books

1) Puri B.R., Sharma L.R,. Kalia K.K, (2017),*Principles of Inorganic Chemistry*, Shoban Lal Nagin, Chand & Co. New Delhi.

2) Lee J. D.,(2012), *Concise Inorganic Chemistry*, 5th Ed. Blackwell Science Ltd, London.

3) Cotton F.A., Wilkinson G, GausP.L,(2013), *Basic Inorganic Chemistry*, 6th Edition, John Wiley, UK.

4) Finar I.L., (2012), *Organic Chemistry*, Volume 1, 6th Ed., Dorling Kindersley (India) Pvt. Ltd., New Delhi.

5) Morrison R. T., Boyd R.N., (1992),.*Introduction to Organic Chemistry*, Prentice Hall of India,

6) Puri B.R., Sharma L.R, Pathania, (2017), *Principles of Physical Chemistry*, Vishal Publishing Co. New Delhi.

7) Glasstone S., (2005), *An Introduction to Electrochemistry*, East West Press. New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**									**3**	**2**					
CO2	**3**		**3**								**3**	**2**					
CO3	**3**			**3**						**3**	**3**			**3**			**3**

***1-Low *2-Medium *3-Strong**

Semester III	19ICHEP34: Practical II - Inorganic Qualitative Analysis	L	P	C
		0	8	4

Learning Objective (LO):

LO1	To analyze the inorganic mixture containing two cations and two anions.
LO2	Analysis of mixture containing an interfering ion.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	To perform inorganic analysis systematically.
CO2	To analyse inorganic mixture containing an interfering ion
CO3	To perform inorganic analysis independently.

Analysis of mixture containing two cations and two anions.

One will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be studied: Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be studied: Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate.

Text Book

1. Ramanujam. V. V,(2004), *Inorganic semi micro Qualitative analysis*, The National Publishing Company, Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3		3	3		3			3	
CO2	3		3								3	2					

***1-Low *2-Medium *3-Strong**

Semester III	Allied - II: 19IPHYA01 - APPLIED PHYSICS I	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To educate and motivate the interdisciplinary students to understand the elementary concepts of various topics of physics.
LO2	To understand the centre of gravity and behavior of fluid motion.
LO3	To understand how the principle of relativity leads to time dilation and length contraction.
LO4	To understand the principle,theory, operations and applications of laser.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the behaviour of fluids and practical applications of the same in real life.
CO2	Understand relativity and its consequences.
CO3	A cquire in depth knowledge of various lasers and diodes used for different applications.
CO4	Knowledge about the different types of nuclear models and detectors.

UNIT - I: MECHANICS

Centre of gravity – Definition - Determination of centre of gravity of a hollow hemisphere, solid hemisphere and solid cone.

Streamline and Turbulent flow - Equation of continuity of flow – Energy of a liquid flow- Bernoulli's theorem – Velocity of efflux of a liquid - Torricelli's theorem – Venturimeter.

UNIT - II: RELATIVITY

Introduction - Definition of Relativity - Special theory and general theory of relativity - Postulates- Newtonian relativity - Frame of reference - Galilean transformation equations - The Michelson - Morley experiment - Lorentz transformation equations - Derivation - Length contraction -Time dilation - Addition of velocity - Variation of mass with velocity - Mass - Energy equivalence.

UNIT-III: LASER PHYSICS

Introduction - absorption – spontaneous emission – Stimulated emission – Einstein's A and B coefficients – Population inversion – Meta stable state – Pumping– Methods of pumping – Components of laser – Ruby laser – Helium – Neon laser – Applications.

UNIT- IV: NUCLEAR PHYSICS

Properties of nucleus (size, mass, binding energy, spin and parity) – Particle detectors - G.M.counter – Wilson cloud chamber - Bubble chamber- Nuclear models – Liquid drop model - Shell model– Nuclear Energy – Nuclear fission - Fusion - Self sustained chain reaction - Nuclear fusion in stars – Carbon - Nitrogen cycle - Proton - Proton cycle - Thermonuclear reaction - Nuclear reactor.

UNIT- V: BASIC ELECTRONICS

Junction diode- Zener diode- Photodiode- Transistor -CE and CB characteristics- LED and LCD – Applications.

CURRENT STREAMS OF THOUGHT (Not for Final Examinations)

Experimental determination of viscosity of a liquid – Black hole- Holography and their applications – semiconductor detectors – Fabrication of integrated circuits .

Text books

1. Murugesan, R, (2005) , *Allied Physics*, S .Chand & Co, Ltd. ,New Delhi.
2. Murugesen & Kiruthiga Sivaprasath, (2016), *Modern Physics*, S.Chand& Co Ltd. New Delhi.
3. Pandya , M. L. and Yadav ,P.R.S, (1993), *Elements of Nuclear Physics,* Kedarnath Ramnath publications, New Delhi..

Supplementary Reading

1. Mathur , D.S. & Hemne, P.S (2006), *Mechanics* , S.Chand & Co Ltd., New Delhi.
2. Beiser, A. (1997), *Concepts of Modern Physics*, Tata McGraw Hill Publication.New Delhi.
3. Avadhanulu, M.N. and Hemne, M.N,(2011), *An introduction to Lasers theory and applications,* S. Chand & Co. Ltd. New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	3	3	3	3	3	3	2	3	3	3	3	1	3	3	3
CO2	3	3	2	2	1	1	3	1	1	2	3	3	3	3	1	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3

*1-Low *2-Medium *3-Strong

Semester IV	19ITAMC41 பகுதி – 1 (Part 1) சங்க இலக்கியமும் செம்மொழி வரலாறும்	L	P	C
		3	0	3

கற்பித்தலின் நோக்கம்:

LO1	தமிழ்ச் செம்மொழி இலக்கியங்கள் குறித்து அறிமுகம் செய்தல்..
LO2	செம்மொழி வரலாற்றுடன் அதன் தகுதிபாடுகளுக்கான வரையறைகள் சுட்டப்படும்.
LO3	சங்க அக, புற இலக்கியங்களின் தனித்தன்மைகளை உணர்துதல்.
LO4	பத்துப்பாட்டு இலக்கியங்களில் நெடுநல்வாடை வழிப் பண்பாட்டைச் சுட்டிக் காட்டல்.
LO5	தமிழின் பயன்பாடும் தேவையும் எடுத்துக்காட்டுகளுடன் விளக்குதல்.

கற்றல் வெளிப்பாடு:

இந்தப் பாடமுடிவில் மாணவர்கள்

CO1	சங்க அக இலக்கியங்களைத் திணை அடிப்படையில் ஆராய்ந்து கற்கும் திறன் பெற்றிருப்பர்.
CO2	புற இலக்கியங்களில் பெண்பாற் புலவர்களின் புலமையை அறியும் ஆற்றல் பெற்றிருப்பர்
CO3	நெடுநல்வாடை வழி இலக்கியங்களில் இயற்கைப் பெறுமிடத்தைச் சுட்டுவர்
CO4	சங்க இலக்கியங்களின் வகைமை, வடிவம், உள்ளடக்கம் குறித்த அறிவைப் பெற்றிருப்பர்.
CO5	தொல்காப்பியம் என்னும் தனித்துவமான இலக்கணத்தை விவரிக்கும் திறன் பெற்றிருப்பர்.

அலகு – 1 அக இலக்கியங்கள்

1. குறுந்தொகை - 125, 129, 177, 302, 397 (நெய்தல்)
2. நற்றிணை - 206, 217, 304, 334, 382 (குறிஞ்சி)
3. ஐங்குறுநூறு - 17, 18, 71, 75, 96,(மருதம்)
4. அகநானூறு - 147, 303, 370 (பாலை)
5. கலித்தொகை - 104, 10 (முல்லை)

அலகு - 2 புறஇலக்கியங்கள்

1. புறநானூறு - பெண்பாற்புலவர்கள்

76, 83, 133, 146, 178,

188, 227, 261, 264, 278

அலகு - 3 பத்துப்பாட்டு 1. நெடுநெல்வாடை

அலகு - 4 சங்கஇலக்கியவரலாறு

தொல்காப்பியம் - சங்ககாலம் - முற்சங்கங்கள் – பாட்டும் தொகையும் - தொகுப்புமுறை - தனித்தன்மைகள்.

அலகு - 5 பயன்பாட்டுத் தமிழும் செம்மொழி வரலாறும்

மொழி விளக்கம் – மொழிக் குடும்பங்கள் – உலகச் செம்மொழிகள் – இந்தியச் செம்மொழிகள் – செம்மொழித் தகுதிகள் - வரையறைகள் – வாழும் செம்மொழித் தமிழ் – தமிழின் தொன்மை – தமிழின் சிறப்புக்கள் – தமிழ்ச் செம்மொழி நூல்கள் – தமிழ் செம்மொழி அறிந்தேற்பு – பரிதிமாற்கலைஞர் முதல் தற்கால அறிஞர்கள் வரை (அறிஞர்கள் - அமைப்புகள் - நிறுவனங்கள் – இயக்கங்கள் தொடர் முயற்சிகள் - அறப்பேராட்டங்கள் – உலகத்தமிழ்ச் செம்மொழி மாநாடு, கோவை-2010)

(மாணவர்கள் அறிந்து கொள்வதற்கு மட்டும் – தேர்வுக்கானபகுதிஅல்ல)

பண்டைய தமிழ் மரபுகளையும் சமூக அமைப்புகளையும் விளக்குதல், தமிழ் மொழியில் தனித்துவத்தையும் செம்மொழி இயல்புகளையும் சங்க இலக்கியங்களின் துணைக் கொண்டு விளக்குதல். சங்கப்பனுவல்களில் பொதுமைத்தன்மையையும் அவற்றின் சிறப்பியல்புகளையும் விளக்குதல்.

பாடநூல்கள்

1. ச.வே.சுப்பிரமணியன் (ப.ஆ), (2011), குறுந்தொகை, நற்றினை, ஐங்குறுநூறு, அகநானூறு, கலித்தொகை, (இரண்டாம் பதிப்பு) மணிவாசகர் பதிப்பகம், சென்னை.
2. ச.வே.சுப்பிரமணியன் (ப.ஆ)- (2011), புறநானூறு, (இரண்டாம் பதிப்பு) மணிவாசகர் பதிப்பகம், சென்னை.
3. ச.வே.சுப்பிரமணியன்(ப.ஆ), (2011), பத்துப்பாட்டு (நெடுநல் வாடை) (இரண்டாம் பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.
4. தெ.பொ.மீனாட்சி சுந்தரம், (2018), சங்க மொழி வரலாறு, (முதற் பதிப்பு), நியூசெஞ்சரி, புத்தக நிலையம்.
5. மணவை முஸ்தபா, (2010), செம்மொழி உள்ளும் புறமும், (முதற் பதிப்பு), சீதை பதிப்பகம், சென்னை.
6. ச.வே.சுப்பிரமணியன், (2011), சங்க இலக்கியம், (இரண்டாம் பதிப்பு), மணிவாசகர் பதிப்பகம், சென்னை.

7. மு.வரதராசன், (2015), தமிழ் இலக்கிய வரலாறு, (மூன்றாம் பதிப்பு), சாகித்திய அகாதெமி வெளியீடு, புதுதில்லி.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2								3	2	3	3	3
CO2	3	2	2								2	2	2	3	3
CO3	3	2	2									2			3

***1-Low *2-Medium *3-Strong**

Semester IV	19IHINC41: Part-I Language HINDI - IV	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To learn the important poems of famous Hindi poets.
LO2	To imbibe the knowledge of writing in Premchand stories.
LO3	To understand the relation between poems and stories.
LO4	To gain knowledge on stories of Beeshma Sahini.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the concepts of Hindi poems.
CO2	Knowledge on stories of Premchand.
CO3	Describe the basic concepts of hindi stories.
CO4	Apply the concepts of writings of Jai sankar Prasad.
CO5	Understand the writing style of Beeshma Sahini.

Unit - I: Introduction, Poem

Kabeer - 1 To 10 Dohas Tulasi - 1 To 10 Dohas.

Unit - II: Rahim - 1 To 10 Dohas

Unit – III: Edgaah - Premchand. Madhuva - Jayashankar Prasad.

Unit - IV: stories,

Chief Ki Daavat - Beeshma SahinI

Unit - V: 7. HANUMAN JI ADHALATH ME - HARISHAKNA PARSAYE

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. PADHYA MANJARI - DR. T.NIRMALA & DR.S.MOHAN Rajkamal Prakashan, New Delhi

2..premchand ki pradhini kahaniya,rajkamal prakshan,new Delhi.7.

3..kahani:nayi kahani: namvirsingh, Rajkamal Prakashan, New Delhi.

4..bihari-ompraksh.vani prakshan, New Delhi, 110002.

Supplementary Reading

1..Nayi kahani:prakruti aur paat:surendra chowdari.

2..Naveen ekanki , D.B.H.P. SABHA, Chennai 17.

3..Bihari ki kavya sruti:jaya praksh.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3	3	2	2	3	2	3	3	3	3	3			
CO2	3		3		3		2	2		3					
CO3	3	3			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

*1-Low *2-Medium *3-Strong

Semester IV	19IFREC41: Language- I: Course -2 FRENCH- IV	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To draw a France map and name its regions and cites.
LO2	To fix an appointment .
LO3	To draw a person physically and name its parts.
LO4	To talk about the qualities and defects of the person.
LO5	To talk about their health problems.

Course Outcomes (CO):

At the end of the course, the student will be able to:

CO1	Describe a country.
CO2	Take an appointment with a doctor or with friends, etc.
CO3	Express in which part of the body they have pain.
CO4	Describe a person physically and mentally.
CO5	Ask others about how they are feeling using expressions such as ‘Qu’est-ce que tu as? Où est-ce que tu as mal?’

Unit I

Faire un bilan du sondage

Aborder quelqu’un (Parler de moyens de communication)

Unit II

Faire valoir son droit

Exprimer une opinion sur la vérité d’un fait.

Savoir-vivre en France

Unit III

Donner un conseil

Téléphoner /Prendre rendez-vous

Unit IV

Exposer un problème/ réagir

Parler du corps et des problèmes de santé

Unit V

Parler des qualités et des défauts des personnes

Demander / donner une explication

décrire une personne

Evaluez-vous

Current streams of Thought
Faculty member will impart the knowledge on recent trends in the subject to the students and these components will not cover in the examination.

Text Books

1. Girardet et J. Pecheur, (2012), ***Echo A1*** - méthode de français**,** Langers, Paris

Supplementary Reading

1. Marie-Noelle Cocton et Emilie Pommier, (2015), ***Saison A1*** - méthode de français, Les Editions Didier, Paris.
2. Angels Campa, Claude Mestreit, Julio Murillo et Manuel Tost, (2001), ***FORUM*** – Méthode de français, HACHETTE LIVRE, Paris.
3. Mauger Bleu, (2014), ***Le Cours de langue et de la civilisation française***, - Méthode de français, Hachette, Paris.
4. Michele Boulares et Jean-Louis Frerot, (1997), ***Grammmaire Prograssive du Français avec 400 exerices***, CLE International, Paris.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		2	3	2	2	3	2	3	3	3	3	3			
CO2	3		2		3		2	2		3					
CO3	3	2			2	3		2	3				2		
CO4	3	3	3	3	3		3		2	2	2			2	
CO5			3	3	3	3	3	2	2	2	2				3

***1-Low *2-Medium *3-Strong**

Semester IV	19IENGC42: ENGLISH THROUGH LITERATURE IV: SHORT STORY	L	P	C
		3	0	3

Learning Objective (LO):

LO1	Develop the communicative competence of learners in the English Language through training them in the skills of listening, speaking, reading, and writing.
LO2	Enable the students to know about the origin and development of short story
LO3	Enable the students to know about the origin and development of short story
LO4	Enable the learner to function through the written mode of English language in all situations including classroom, library, laboratory etc.
LO5	Disover an author's purpose and draw conclusions about certain vents, evaluating cause and effect andunderstanding point of view.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Use more vocabularies while writing.
CO2	Ensure about the history and development
CO3	Develop a flow in writing
CO4	Come up with new ideas while reading stories from different perspectives
CO5	Write in a style appropriate for communicative purposes

Unit I

1. O' Henry — "The Gift of The Magi"
2. Ken Liu — "The Paper Menagerie"

Grammar — Synonyms and Antonyms

Unit II

1. Flora Annie Steel — "Valiant Vicky"
2. Oscar Wilde — "Happy Prince"

Grammar — Words often confused

Unit III

1. R. K. Narayan — "The Martyr's Corner"
2. Mahasweta Devi — "Draupati"

Grammar — Paragraph-Writing

Unit IV

1. Leo Tolstoy — "How much Land Does a Man Need?"
2. Somerset Maugham — "The Verger"

Grammar — Letter-Writing

Unit V

1. Langston Hughes — "On the Road"
2. Premchand — "Bakthi Marg"

Grammar — Precis-Writing

The faculty will impart Contemporary Contours at the end of each course. This Contemporary Contours will not be credited in the examinations.

Text Books

1. Srinivasa Iyengar, K.R. 1(996), *Indian Writing in English*. Sterling Publ., New Delhi.
2. Swan, Michael. (2016), *Practical English Usage:* Oxford University Press,India.
3. Palmer, Frank Robert(1975.), *Grammar: (by) Frank Palmer*. Penguin Books.
4. Browns, Julie, ed.,(1997),*Ethnicity and the American Short Story*. Garland.
5. *Patea, Viorica, (*2012) *Short Story Theories: A Twenty-First-Century Perspective.* Rodopi. New York.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3			3			3	3		3	3	3			3
CO2	2			3			3	3		3	3	3			3
CO3	3			2			2	2		2	2	2			2
CO4	3			3			3	3		3	3	3			3
CO5	2			2			2	2		2	2	2			2

***1-Low *2-Medium *3-Strong**

Semester IV	19ICHEC43 - INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – IV	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic principles of metallurgy.
LO2	To learn important classifications of organic compounds and stereochemistry.

Course Outcomes (CO:)

At the end of the course, the student will be able to

CO1	Know the important basics of metallurgy.
CO2	Understand various organic compounds and stereochemistry.
CO3	Study the fundamentals of thermodynamics.

Unit – I: Metallurgy

Occurrence of metals. Extraction and concentration of ore. Various methods of concentration of ore. Various processes involved in metallurgy such as calcination, roasting, smelting, zone refining and froth flotation. Various types of reductions of metallic oxides into metals. Types of furnaces used in metallurgy. Reverberatory furnaces and blast furnace. Extraction of titanium, vanadium, chromium, iron and copper from their ores. Refining of metals- Electrolytic refining, Zone refining. Important physical and chemical properties of Ti, Th, U, Pb, Zn, Al, Fe and Cu. Important alloys of Ti, V, Cr, Pb, Zn, Al, Fe and Cu with special reference to steel and alloy steels.

Unit – II: Organic Compounds of Nitrogen

Preparation and reactions of nitroalkanes with special reference to nitromethane. Preparation and reactions of nitrobenzene. Preparation and reactions of aliphatic and aromatic nitriles with special reference to CH_3CN and C_6H_5CN. Primary, secondary and tertiary amines. Methods of preparation of amines. Separation of a mixture of primary, secondary and tertiary amines. Reactions of amines with special reference to methylamine, ethylamine, dimethylamine, diethylamine, triethylamine, aniline, N-methylaniline and N,N- dimethylaniline. Preparation and reactions of benzene diazonium chloride.

Unit – III: Stereochemistry of Organic Compounds

Asymmetric carbon. Optical activity and optical isomerism. Enantiomers and their representation by Fischer projection and flying wedge formula. R-S notation. Isomerism in compounds with two asymmetric carbons. Meso and dl-forms of tartaric acid and their representation by Fischer projection formula and flying wedge formula. Geometrical isomerism about C=C bond. Reason for high energy barrier to rotation about C=C bond. Geometrical isomerism of fumaric and maleic acids. E – Z notation. Use of dipole moment in differentiating E and Z 1,2-dihaloethenes.

Unit – IV: Thermodynamics - II

Second law of thermodynamics: Need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change during physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities. A and G as criteria for the thermodynamic equilibrium and spontaneity Variation of G and A with P, V and T.

Unit – V: Colloidal State and Adsorption

Definition and classification of colloids.

Sols: Kinetic, optical, electrical properties and stability of sols. Protective action. Hardy- Schulze law. Gold number.

Emulsions: Types of emulsions. Preparation. Emulsifier. Gels: classification, preparation and properties. Applications of colloids.

Difference between adsorption and absorption. Physical and chemical adsorptions. Freundlich adsorption isotherm and its experimental verification. Adsorption indicators.

Unit – VI: (Not for Final Examination)

Nomenclature of Nitro compound, (aliphatic) nitrites and amide. Test of Nitro and Amino compound functional groups.Important physical and chemical properties of III row transition elements.Fugacity and activity, determination of fugacity of a gas and liquid.

Text Books

1. Puri B.R., Sharma L.R., Kalia K.K.,(2016), *Principles of Inorganic Chemistry*, 32nd Ed. Milestone Publishers, New Delhi.
2. Jerry March, (2016), *Advanced Organic Chemistry*, 7th Ed. John Wiley, London.
3. Eliel E.C., (2011), *Stereochemistry of Carbon Compounds*, 42nd Ed. Tata Mc- Graw Hill. New Delhi.

4. Morrison R., Boyd R.N, (2014),*Introduction to Organic Chemistry*, 7th Ed. Prentice Hall of India.

5. Puri B.R., Sharma L.R., S. Pathania (2017)., *Principles of Physical Chemistry*, Vishal Publishing Co., New Delhi.

6. Rajaram J., Kuricose J.C., (1999), *Thermodynamics for Students of Chemistry,* Shoban Lal Nagin Chand & Co., New Delhi.

7. Kundu N., Jain S.K., (2003) *Physical Chemistry*, S.Chand and Co. Ltd., New Delhi.

8. Moore W.J., (1998) ,*Physical Chemistry*, 4th Ed. Longmann Press, London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**						**3**					**3**				
CO2	**3**		**3**								**3**				**3**	**3**	
CO3	**3**									**3**	**3**			**3**			**2**

***1-Low** ***2-Medium** ***3-Strong**

Semester IV	19ICHEC44 - ANALYTICAL CHEMISTRY	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic concepts of analytical chemistry.
LO2	To learn important concept of separation methods.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the advanced basics of analytical chemistry
CO2	Learn the basic principles error analysis
CO3	Learn the basic principles separation techniques

Unit – I: Basic concepts of analytical chemistry

Role of Analytical Chemistry. Classification of analytical methods – classical and instrumental. Types of instrumental analysis. Selecting an analytical method - Neatness and cleanliness - Laboratory operations and practicals - Analytical balance - Techniques of weighing, Errors, Volumetric glassware-cleaning and calibration of glassware. Sample preparations – dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. Safety in the analytical laboratory.

Unit – II: Errors and their Evaluation

Definition of terms mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of errors in experimental data- determinate (systematic), indeterminate (or random) and gross. Sources of errors and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.

Unit – III: Titrimetric Analysis

Theoretical considerations of titrimetric analysis – classification of reactions in titrimetric analysis – standard solutions – concentration units – primary and secondary standards – Neutralisation indicators – apparent indicator constant – universal or multiple – Range indicators. Neutralisation curves – Neutralisation of strong acid with strong base, weak acid with strong base, weak base with strong acid, weak acid with weak base and polyprotic acid with strong base. precipitation titrations, redox titrations, self indicators, external indicators, starch, EMF as an indicator of End Point.

Complexometric titration, EDTA titrations, EBT and murexide indicator. Titrations in non-aqueous solvents – solvents for non-aqueous titrations - Indicators for non-aqueous titrations.

Unit– IV: Gravimetric Analysis

Principles of gravimetric analysis – characteristics of precipitating agents – choice of precipitants and conditions of precipitation – specific and selective precipitants – DMG, cupferron, salicyladehyde, ethylene diamine – use of sequestering agents – co precipitation – post precipitation – peptisation – differences reduction of error – precipitation from homogeneous solutions – calculations in gravimetric methods – use of gravimetric factor.

Thermal analytical methods – Principle involved in thermogravimetric analysis and differential thermal analysis.

Unit – V : Separation Methods

Solvent extraction: Principles and process of solvent extraction – Distribution law and the partition coefficient – Batch extraction – Continuous extraction.

Classification of chromatographic methods, Principles of differential migration and adsorption phenomenon – Nature of the adsorbent solvent systems – Rf values – Paper chromatography – various modes of development: ascending, descending and horizontal, Detection of spots – Two dimensional - reversed phase and preparative paper chromatography, Thin layer chromatography – Coating materials – Preparation of plates – Solvents for development and detection – Preparative TLC – Application. Column chromatography: Adsorption and partition methods: Nature of the column materials, preparation of the column, solvent system and detection methods.

Unit VI: (Not for Final Examination)

Centrifugation methods: Introduction – sedimentation and centrifugal force – Types of Centrifugation techniques. Electrophoretic techniques: principle – apparatus – support media (paper, cellulose acetate membranes, gels). Stereoisomeric separation and analysis: measurement of optical rotation - chiral solvents and chiral shift reagents – chiral chromatographic techniques using chiral columns.

Text Books

1. Christian G.D,(1994), *Analytical Chemistry*, 5th Ed., John Wiley, NJ.
2. Skoog D.A,.West D.M,.Holler F.J, W.B. Saunders,(1988)*Fundamentals of Analytical Chemistry.W.B. Saunders* Co., Holt, Rinehart and Winston; New York, NY (USA).
3. Kennedy J.H., W.B.Saunders, *Analytical Chemistry*: *Principles*. Prentice Hall,NJ.
4. Day R.A, Jr. and.UnderwoodA.L, *Qualitative Analysis,* Prentice Hall,NJ .
5. Khopkar S.M, *Basic Concepts of Analytical Chemistry*, Wiley Eastern. New Delhi.
6. Hargis L.G, (1988), *Analytical Chemistry: Principles and Techniques*, Prentice Hall, New Jersey.
7. Skoog D.A,.LoaryJ.L,.SaundersW.B,(1985),*Principles of Instrumental Analysis*.Saunders College Pub. Co, III Edn., New Jersey.

8. Settle F,(1997), *Handbook of Instrumental Techniques for Analytical Chemistry*, *.ed.,* Prentice Hall PTR, Upper Saddle River, New Jersey.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3					3			3				3		2
CO2	3									3	3			3			3

***1-Low *2-Medium *3-Strong**

Semester IV	19ICHEP45: Practical III - PREPARATION AND ANALYSIS OF ORGANIC COMPOUNDS	L	P	C
		0	8	4

Learning Objective (LO):

LO1	To understand single step preparations of organic compounds.
LO2	To learn about the analysis of organic compounds.

Course Outcomes (CO):

At the end of the course, the student will be able

CO1	To perform single step preparations independently.
CO2	To know the about the procedure for analysing the compounds.
CO3	To know the about reaction mechanism.

Preparations

Single step preparation involving the reactions such as nitration, bromination, hydrolysis, acetylation.

Qualitative Analysis

a) Detection of N, S and Cl in organic compounds

b) Characterization of organic compounds as acidic, basic and neutral

c) Differentiation of organic compounds as saturated, unsaturated and aromatic and non-aromatic

d) Finding the presence of the following functional groups in organic compounds containing only one such functional group – phenolic, carboxyl, dicarboxyl, ester, nitro, amide, ketone, aldehyde

e) Analysis of carbohydrates (reducing and non-reducing)

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	1	1				2		1	3	3			1	2	2

***1-Low** ***2-Medium** ***3-Strong**

Semester IV	Allied II-19IPHYA02 - ALLIED PHYSICS – II	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To indoctrinate and stimulate the interdisciplinary students to understand the fundamental concepts of various topics of physics.
LO2	To understand about an atom model and production of X-rays
LO3	To learn photo electric effect and also the particles and wave nature of the quantum particles..
LO4	To know more about the nuclear detectors and particle accelerators.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the atomic models, production of X-rays and photoelectric effect with its applications
CO2	Understand the various nuclear detectors and particle accelerators.
CO3	Understand the phenomenon of polarization.
CO4	Acquire basic knowledge about number systems and logic gates.

UNIT - I: ATOMIC PHYSICS

Atom model: Bohr, Sommerfeld's and vector atom models -The Pauli's exclusion principle - Various quantum numbers.

X-Rays: Production and properties of X-rays - Bragg's law - Bragg's X-ray spectrometer - Moseley's law - Compton Scattering.

UNIT – II: MODERN PHYSICS

Photo electric effect – Einstein's photo electric equation – verification of Einstein's photo electric equation by Millikan's experiment – photo electric cells – applications

Wave mechanics: De Broglie matter waves – characteristics and calculation of De Broglie wave length – Experimental study of De Broglie matter wave by G.P.Thomson experiment.

UNIT – III: NUCLEAR PHYSICS

Nuclear detectors – Ionization Chamber – Proportional counter –Scintillation counters.

Particle accelerators – Linear accelerator – Cyclotron – synchro cyclotron – Betatron.

UNIT – IV: POLARIZATION

Polarization - Brewster's Law -Huygen's explanation of double refraction in uniaxial crystals - polarizing prisms - Quarter and half wave plates - Production and detection of a plane, circularly and elliptically polarized light.

Optical Activity – Fresnel's explanation of rotation - Fresnel's experiment - Specific rotation - Determination of Specific rotatory by Laurent's half shade polarimeter.

UNIT- V: DIGITAL ELECTRONICS:

Decimal, binary, octal and hexadecimal number systems - Basic logic gates - OR, AND, NOT - universal gates - Boolean algebra - Demorgan's theorem - Verification.

CURRENT STREAMS OF THOUGHT(Not for Final Examinations)

Gamma ray microscope -Nuclear reactor -Electron microscope, Scanning electron microscope - Binary adder and subtractor

Text Books

1. Murugasen, R.& Kiruthiga Sivaprasath, (2016) ,*Modern Physics* ,S.Chand & Co Ltd.,New Delhi.
2. Murugesan, R, (2005), *Allied Physics*,S.Chand& Co, Ltd., New Delhi.
3. Subramaniyam Brijlal,N,and Avadhanulu, M.N , (2018), *A Text Book of Optics*, S. Chand & Co Ltd., New Delhi.

Supplementary reading

1. Saxena, A.K, (2010) ,*Principles of Modern Physics* , Narosa Publishing House.,New Delhi.
2. Rajam,J.B , (2004), *Atomic Physics* , S. Chand & Co Ltd.20th Edition,.New Delhi.
3. Jain, R.P. (2006) , *Modern Digital Electronics* , Tata McGraw Hill, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	3	3	3	3	3	3	2	3	3	3	3	1	3	3	3
CO2	3	3	2	2	1	1	3	1	1	2	3	3	3	3	1	3	3	3
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3

***1-Low *2-Medium *3-Strong**

Semester IV	19IPHYP01 - ALLIED PHYSICS PRACTICAL	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To gain depth of knowledge regarding the physics fundamentals and an instrumentation to arrive solution for various problems.
LO2	To study the aspects related to the application side of the experiments
LO3	To understand the usage of basic laws and theories to determine various properties of the materials given.
LO4	To providing a hands-on learning experience such as in measuring the basic concepts in properties of matter, sound, heat, optics and electricity.

Course Outcomes (CO):

At the end of the course, the student will be able

CO1	Apply knowledge of physics fundamentals and an instrumentation to arrive solution for various problems.
CO2	Understand the usage of basic laws and theories to determine various properties of the materials given.
CO3	Understand the application side of the experiments
CO4	Use of basic laws to study the spectral properties and optical properties of the given prism.

Any Ten Experiments

1. Sonometer – Verification of laws.
2. Spectrometer – Refractive index of a solid prism.
3. Spectrometer – Grating – Normal incidence – λ determination.
4. Potentiometer – Low range voltmeter.
5. Potentiometer – Low range Ammeter.
6. Rigidity modulus by torsional pendulum.
7. Young's modulus – Non uniform bending (pin and microscope).
8. Young's modulus – uniform bending (pin and microscope).
9. Drop weight method - Surface tension of a liquid.

10. Coefficient of viscosities- Hare's apparatus.
11. Field along the axis of a circular coil – deflection magnetometer.
12. V-I characteristics of junction diode.
13. Logic gates – Discrete components.
14. Half wave and full wave rectifier.
15. V-I Characteristics of Zener diode.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	3	3	3	3	3	3	2	3		1	3	2		3		3	3	3
CO2	3	3	3	3	3	3	2	3		1	3	2		3		3	3	3
CO1	3	3	3	3	3	3	3	3		3	3	3		3		3	3	3
CO2	3	3	3	3	3	3	3	3		3	3	3		3		3	3	3

***1-Low *2-Medium *3-Strong**

Semester IV	19ICHEF40–EXTENTION ACTIVITIES	L	P	C
		0	2	1

Learning Objective (LO):

LO1	To learn about an idea of social welfare in students.
LO2	To provide service to society without bias.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Lead a good life despite a scarcity of resources.Invlove in blood donation.
CO2	Help in natural and man-made disasters, by providing food, clothing and first aid to the victims. Help AIDS patients for treatement.

Extension activities are the activities that provide a link between the University and the community such as class-to-land through *NSS/ YRC / RRC* activities. These are integrated within the curricula with a view to sensitise the students about Institutional Social Responsibility (ISR).

NSS Programme

Students may involve in two types of activities: Regular Activities or Annual Special Camp.

YRC Programme

Through Youth Red Cross programme students shall used to serve, to work loyally for the promotion of health and the relief of suffering and distress, wherever found by conducting blood donation camps, cultural programmes for prevention of diseases etc.,

RRC Programme

Students may conduct workshop on AIDS awareness, Blood donation etc.,

Semester V	19ICHEC51 - ORGANIC CHEMISTRY – I	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the important classifications and nomenclature of organic compounds
LO2	To learn the concepts of conformational analysis**.**

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Classify various organic compounds.
CO2	Understand the nomenclature of organic compounds.
CO3	Know the basics of conformational analysis.

Unit – I: Nomenclature – Electron Displacements

Rules of IUPAC nomenclature – nomenclature of condensed carbocyclic and aromatic systems – heterocyclic rings (containing one, two and three hetero atoms) - Fused ring systems.

Unit – II: Preparation and Synthetic uses of Malonic Esters, Ethyl acetoacetate and Grignard Reagents

Carbanions in organic synthesis – Malonic ester - preparation and synthetic application - synthesis of carboxylic acids –heterocyclic compound. Preparation of acetoacetic ester – acid hydrolysis and ketonic hydrolysis – synthetic applications of acetoacetic ester - preparation of alkyl magnesium halides and their synthetic applications.

Unit – III: Conformational Analysis

Conformations of ethane, n-butane, 1,2-dichloroethane and 1,2-ethanediol - relative stabilities of gauche and anti conformations – Representation of conformations of 1,2- disubstituted ethanes, meso- and dl-tartaric acids, erythro- and threo-1,2-dibromo-1- phenylpropane by Newman projection and Sawhorse formulae. Conformation of cyclohexane and its monosubstituted derivatives, conformational energy of a substituent, OH, CH_3, CH_3CH_2, $CH(CH_3)_2$ and $C(CH_3)_3$.

Unit – IV: Heterocyclic Compounds

Five membered heterocyclic compounds – furan, thiophene and pyrrole – six membered heterocyclic compounds – pyridine – structure – source, electrophilic substitution, reactivity

and orientation – nucleophilic substitution in pyridine. Comparison of basicity of pyridine, piperidine and pyrrole. Synthesis of quinoline, isoquinoline and indole. Special reference to Fischer - Indole and Skraup synthesis.

Unit – V: Alkaloids and Terpenoids

General methods of structure elucidation of alkaloids and terpenoids – classification of terpenoids – isoprene rule – structure and synthesis of piperine and nicotine.

Structure and synthesis of citral, geraniol and α-terpineol.

Unit VI: (Not for Final Examination)

Aromatic-Anti aromatic and nonaromatic compounds definition with examples. Huckels rule-Aromaticity of benzenoid and non-benzenoid compounds. Resonance and mesomeric effect.

Preparation, properties and uses of organo lithium and organo copper compounds.

Text Books

1. Ferguson. L. N. (2009), *The Modern Structural theory of Organic Chemistry*, Prentice Hall of India, New Delhi.
2. Finar. I. L., (2012), *Organic Chemistry*, *Volume 1 & 2*, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
3. Eliel. E. L., (2011) ,*Stereochemistry of Carbon Compounds*, 42nd Ed., Tata Mc Graw Hill Noida(UP).
4. Kalsi. P.S., (2017), *Organic Reactions and their Mechanism*, New Age International Publishers, New Delhi.

Supplementary Reading

1. Nasipuri. D., (2016),*Stereochemistry of Organic Compounds*, 3rd Ed.New Age International, New Delhi.
2. Soni. P.L., (2012) ,*Text book of Organic Chemistry*, S. Chand Publications, 29th Edition, New Delhi.
3. Agarwal. O.P., (2015),*Natural Products, Vol. I & II*, 44th Ed. Goyal Publisher, Chennai.
4. Morrison. R. T., Boyd. R.N., (2014),*Introduction to Organic Chemistry*, 7th Ed. Prentice Hall of India, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	1					3		1	3	3			1		3
CO2	3									3	3			3			3

***1-Low *2-Medium *3-Strong**

Semester V	19ICHEC52 - INORGANIC CHEMISTRY – I	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the basic principles of chemical bonding.
LO2	To learn classifications of inorganic compounds and the concepts of nuclearchemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Classify various inorganic compounds.
CO2	Understand the chemical bonding of organic compounds.
CO3	Know the basics concepts of nuclear chemistry.

Unit – I: Nature of Bonding of Main Group Elements

Types of compounds and E – H, E – X, E – O and E – N bond types for B, C, N, Si, P and S, element – element single and multiple bonds, catenation and heterocatenation – polysilanes and polyphosphazenes, alkali and alkaline earth metal complexes of alkylamines, alkaloids and calixarenes; Electron deficient, precise and electron rich compounds, fullerenes – types and structures, carbon nanotubes.

Unit – II: Metallic Bonding

Packing of atoms in metals [BCC, CCP, HCP] – Theories of metallic bonding. Drude & Lorentz theory – Sommerfield free electron theory – Block theory – Band theory, Alloy systems: Classification – Substitutional and interstitial solid solutions – Lauve Zintle phases – Alloys of two true metals (Cu – Au systems) – Alloys of a true metal and B – Sub group element – System of type T2B compounds – Hume – Rothery rules – Theoretical basis of Hume – Rothery rules.

Unit – III: Study of p- Block Elements

Nitrogen family, comparative study of N, P, As, Sb and Bi elements- oxides, oxyacids, halides, hydrides. Structure and uses of hydrazine, hydroxylamine, hydrazoic acids- Preparation and uses of $NaBiO_3$ - Nitrogen fertilizers.

Oxygen family- comparative study of O, S, Se, Te elements-catenation- Chemistry of ozone- Hydrides, oxides, oxyacids of Sulphur including peroxy acids and thionic acids.

Properties of Halogens - Halogen oxides-Oxoacids - Interhalogen compounds.

Noble gases: Electronic configuration - reason for placing in zero group position in the periodic table - Chemical inertness of noble gases – reasons - applications - Clathrates and compounds of Xenon.

Unit – IV: Chemistry of d and f Block Elements

Chemistry of d-block elements – characteristics of d block elements – variable valency – magnetic properties and colour – comparative study of Ti, V, Cr, Mn and Fe group metals – occurrence, oxidation states, magnetic properties and colour – preparation and uses of ammonium molybdate, V_2O_5 and VF_6.

Chemistry of f-block elements – comparative account of lanthanides and actinides, occurrence, elements oxidation states, magnetic properties colour and spectra – lanthanide contraction – causes, consequences and uses – comparison between 3d and 4f block elements.

Unit – V: Nuclear Chemistry – I

Nuclear properties: Nuclear radii, Spin and moments – Nuclear structure: n-p ratio in stable and metastable nuclei, nuclear forces – Nuclear models: liquid drop, shell and collective models.

Modes of radioactive decay: α and β decay, Radioactive decay constant. Radioactive equilibrium, Orbital electron capture, nuclear isomerism, internal conversion – Detection and determination of radioactivity – Cloud chamber, Nuclear emulsion, Bubble chamber, Proportional counter, Geiger – Muller counter, scintillation and Cherenkov counters - particle accelerators: linear, cyclotron, synchrotron, betatron and bevatron.

Unit VI: (Not for Final Examination)

Centrifugation methods: Introduction – sedimentation and centrifugal force – Types of Centrifugation techniques. Electrophoretic techniques: principle – apparatus – support media (paper, cellulose acetate membranes, gels). Stereoisomeric separation and analysis: measurement of optical rotation - chiral solvents and chiral shift reagents – chiral chromatographic techniques using chiral columns.

Text Books

1. Arnikar H.J., (2018), *Essentials of Nuclear Chemistry*, New Age International, New Delhi.
2. Glasstone S, (2014),S.*Source Book on Atomic Energy*, Krieger Publishing Company; 3rd edition.Florida, US.
3. Huheey,J.E, (2013), *Inorganic Chemistry*, 4th Ed. Pearson, London.
4. Cotton F.A., Wilkinson G.,(2013), *Advanced Inorganic Chemistry*, 6th Ed. Wiley Eastern, India.
5. Friedlander G., KennedyJ.W., Miller N.M.,1981)*Nuclear and Radio Chemistry*, John Wiley, New York.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	1						2			3		3		1	1	
CO2	3		3								3		3				

*1-Low *2-Medium *3-Strong

Semester V	19ICHEC53 - PHYSICAL CHEMISTRY - I	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the advanced concepts of electrochemistry.
LO2	To learn basic principles phase equilibria.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the advanced basics of electrochemistry
CO2	Understand fundamentals of physical chemistry like phase equilibria
CO3	Know the basics concepts of molecular structure.

Unit – I: Electrochemistry - II

Types of reversible electrodes – Metal – metal ion, metal – insoluble salt – anion, glass and redox electrodes. Electrode reactions, Single electrode potential, Nernst equation, galvanic cell, E.M.F and its measurement, calculation of thermodynamic parameters from

E.M.F. standard hydrogen electrode, use of calomel as reference electrode, standard electrode potential and its determination, electrochemical series and its significance, Reversible and irreversible cells, conventional representation of electrochemical cells, polarization, overpotential and hydrogen overvoltage.

Unit – II: Phase Equilibrium

Equilibrium between two phases of one component, Clapeyron equation and Clausius-Clapeyron equation - applications.

Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system – water, CO_2 and sulphur systems.

Phase equilibrium of two component system – simple eutectic Bi-Cd and Pb - Ag systems, compound formation and formation of solid solution, phase diagram for Fe-C system.

Unit – III: Binary Systems

Solution, concentration units - molarity, molality and normality – ideal solution ΔH, ΔV, ΔS thermodynamics of ideal solution ΔH_{mix}, ΔV_{mix} and ΔS_{mix}.

Binary liquid systems, Raoult's law, vapour pressure of ideal solution, deviations from ideal behaviour – vapour pressure – composition curves and temperature – composition curves.

Fractional distillation of binary liquid solution, azeotropic distillation.

Partially miscible liquid pairs – phenol – water, triethylamine-water and nicotine-water systems CST and effect of impurities on CST – Immiscible liquids.

Theory and application of steam distillation – Solution of gases in liquids – factors influencing the solubility of gas in a liquid, Henry's law.

Unit – IV: Colligative Properties

Theory of dilute solutions – colligative properties – lowering of vapour pressure, osmotic pressure, elevation of boiling point and depression of freezing point - basic explanation - Thermodynamic derivation of elevation of boiling point and depression in freezing point – determination of molecular mass from boiling point measurements, freezing point measurements and osmotic pressure measurements – abnormal molar mass and van 't Hoff factor – distribution law – distribution coefficient – condition for the validity of the distribution law and thermodynamic derivation – association and dissociation of the solute in one of the solvents.

Unit – V: Group theory

Symmetry elements – symmetry operations– various point groups with examples – point groups – identification and determination – comparison of molecular and crystallographic symmetry-group multiplication table-Matrix representation of symmetry operations.

Unit VI: (Not for Final Examination)

Fiscus Law of diffusion, Half wave potential, phase equilibrium of three component solid-liquid systems, Ehrenfest classification of phase transitions, Distillation of immiscible liquids, Theories of semipermeabilty, use of group theory in factoring the secular equation in MOT, Trans-1,3-Butadiene, Benzene.

Text Books

1. John O.M, Bockris, Amulya K.N. Reddy,(2014),*Modern Electrochemistry*, 2A, 2B, Springer,New York.
2. Moore W.J, (1998), *Physical Chemistry,* 4 th Ed. Longmann.
3. Kundu N, Jain .S.K, (2003), *Physical Chemistry*, S. Chand and Co. Ltd., New Delhi.
4. Glasstone .S, (1966),Text Book of Physical Chemistry, Mac Millan, India.
5. Puri B. R, Sharma. L.R, Pathania .S, (2016), *Principles of Physical Chemistry*, Vishal Publishing Co, New Delhi.
6. Raman K. V, (2004),*Group Theory and its Application to Chemistry*, Tata McGraw Hill, New Delhi.

Supplementary Reading

1. Glasstone. S, (2005), *An Introduction to Electrochemistry*, Affiliated East West Press, New Delhi.
2. Cotton. F. A, (2013),*Chemical Applications of Group Theory*, Wiley Eastern, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3		1	3			3		3	
CO2	3		3						3		3			3			3

***1-Low *2-Medium *3-Strong**

Semester V	19ICHEP54 - PRACTICAL IV - GRAVIMETRIC ANALYSIS	L	P	C
		0	10	5

Learning Objective (LO):

LO1	To learn gravimetric analysis of various anions and cations
LO2	To learn basic principles inorganic reactions.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the basics concepts of inorganic reactions.
CO2	Understand estimation of inorganic ions (as compounds or complexes).

Gravimetric analysis of various anions and cations

1. Estimation of sulphate as barium sulphate
2. Estimation of barium as barium sulphate
3. Estimation of barium as barium chromate
4. Estimation of lead as lead chromate
5. Estimation of silver as silver chloride
6. Estimation of calcium as calcium oxalate monohydrate
7. Estimation of calcium as calcium carbonate
8. Estimation of nickel as Ni-DMG complex
9. Estimation of zinc as zinc oxinate
10. Estimation of magnesium as magnesium oxinate.

Text Book

1. Vogel A. I., (2012), *Textbook of Quantitative Inorganic Analysis*, Pearson Education 7th edition, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	1	1		3		3		3		1	3		3
CO2	3	3		2		2		3		2		2		2	3		3

*1-Low *2-Medium *3-Strong

Semester V	19ICHEV50- VALUE EDUCATION	L	P	C
		2	0	2

Learning Objective (LO):

LO1	To understand the building of human beings with strength and power based upon India's ancient values..
LO2	To develop the qualities of peace and co-operation.
LO3	To promote the personality development and develop individual with sense of patriotism and international understanding.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Gather and analyse a range of information about value education
CO2	Develop a positive and responsible attitude to their own wellbeing, respect for the rights of other people, care and concern for their community and develop a sense of social justice.
CO3	Acquire the knowledge about morality and freedom.
CO4	Know the ethical issues of present society.

Unit – I

1. Value education – Meaning – Nature and Purpose
2. Importance of Value Education

Unit – II

1. Basic Features of Rational Ethics
2. Moral Consciousness and Conscience

Unit – III

1. Morality and Freedom - Human Freedom and Moral Responsibility
2. God, Religion and Morality
3. Sanction for Moral Life.

Unit – IV

1. Social Ethics: Value of Life and Human Beings
2. Liberty, Equality and Fraternity

Unit – V

1. Ethical Issues Today: Religious Ethics, Family Ethics
2. Political Ethics - Business Ethics
3. Ethics and Culture.

Text Books

1. Yojana Yatin Patil. (*2015), Value Education: Need of the Hour. California* (USA): Pasaaydaan Foundation Publication,.
2. Lovat, Terence, Toomey and Ron, Clement and Nevil. (2010), *International Research Hand book on Values Education and Student Wellbeing*.: Springer Science & Business Media, Germany.

Supplementary Reading

1. Ahuja.R. (2000), *Value Oriented Education in India*.: Rawat Publications, Jaipur.
2. Bhat. R.K. (2000), *Towards Value based Education System*. New Delhi: Association of Indian Universities.
3. Bottery.M. (2004),*The Challenges of Education Leadership- Values in a Globalized Age*.: Paul Chapman Publishing, London.
4. William K. Frankena, (1999), *Ethics*,: Prentice Hall of India Pvt. Ltd., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3					1					2				1	
CO2		3		1		1		2		2		2		1		
CO3		2			2					1				2		
CO4	1		2			1						1			2	
CO5	3			3			2		1		3		3		2	

***1-Low *2-Medium *3-Strong**

Semester VI	19 ICHEC61 - ORGANIC CHEMISTRY – II	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn about carbohydrates, amino acids, polymers and dyes.
LO2	To learn important concepts of spectroscopy.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the basics of natural products.
CO2	Understand and appreciate the fundamentals of organic spectroscopy.

Unit – I: Carbohydrates

Classification of carbohydrates – Monosaccharides – structure of glucose and fructose. Reactions of glucose – tests for monosaccharides – osazone formation – lengthening of the carbon chain of aldoses – Kiliani – Fischer synthesis. Shortening of the carbon chain of aldoses – the Ruff degradation. Ring structure of glucose - mutarotation. Interconversion of glucose and fructose – An introduction to disaccharides (sucrose, maltose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. Deoxy and amino sugars.

Unit – II: Amino Acids and Proteins

Preparation of amino acids – reactions of amino acids – structure of amino acids – peptides – structure of peptides – Oxytocin and N- terminal residue analysis – synthesis of peptides. Protein – classification – colour tests – structure of proteins – primary, secondary and tertiary structures.

Unit – III: Polymers

Macromolecules – polymers – methods of polymerization – Addition chain – growth polymerization – free radical polymerization – ionic vinyl polymerization. Copolymerization – polymerization with Zeigler – Natta catalysts. Structure and properties of macromolecules. Uses of polymers.

Unit – IV: Synthetic Dyes, Fats, Oils and Detergents

Classification of dyes and synthesis of methyl orange, congo red, crystal violet, phenolphthalein.

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerols, hydrogenation of unsaturated oils, Saponification value, iodine value, acid value soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit V: Organosulphur compounds

Thiols and Thioethers – Thiocarboxylic acids – classifications – preparations and properties – aromatic sulphonic acid and its derivatives – Introduction – nomenclature – preparations – physical and chemical properties – uses – Benzene sulfonic acid – Benzene sulfonyl chloride – Saccharin – Sulphonylamide.

Unit VI: (Not for Final Examination)

Introduction to UV and IR spectroscopy-Ultraviolet-Visible spectroscopy- types of electronic transition-chromophores and intensity of absorption bands IR spectroscopy-vibrational frequencies and factors affecting them. Identification of functional group.

Text Books

1. Soni. P. L., (2012), *Text Book of Organic Chemistry*, S. Chand Publications, 29th Edition, New Delhi.
2. Finar. I. L., (2012), *Organic Chemistry*, *Volume 1 & 2*, Longman Scientific and Technical, London.
3. Gowarikar. V.R., Viswanathan. N.V., (2017), *Polymer Science*, 2nd Ed. New Age International, New Delhi.
4. Jain. P. C. and Jain. M., (2009), *Engineering Chemistry*, Dhanpat Rai Publishing Company, New Delhi.

Supplementary Reading

1. Venkataraman. K., (1971), *The Chemistry of Synthetic Dyes*, Vol. I & II, Academic Press, New York.
2. Morrison. R. T., Boyd. R.N., (2014), *Introduction to Organic Chemistry*, Prentice Hall of India, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**					**2**	**3**			**3**						
CO2	**3**	**1**								**2**	**3**		**3**				

***1-Low** ***2-Medium** ***3-Strong**

Semester VI	19ICHEC62 - INORGANIC CHEMISTRY – II	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn the concepts of coordination compounds.
LO2	To learn basic principles nanophase materials.
LO3	To learn important concept of environmentalchemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the basics of coordination compounds.
CO2	Understand and appreciate the fundamentals of nanophase materials
CO3	Enable to understand the chemistry of environment.

Unit – I: Coordination Compounds

Werner's coordination theory, Effective atomic number rule, Nomenclature of coordination compounds, Isomerism in coordination compounds, Chelates. Applications of coordination compounds, Complexometric titrations using EDTA, Application of valence bond theory to coordination compounds.

Unit - II: Nanophase Materials

Introduction – techniques for synthesis of nanophase materials –sol-gel synthesis-electrodeposition –inert gas condensation-mechanical alloying –properties of nanophase materials –applications of nanophase materials, composite materials: Introduction –types.

Unit – III: Thermodynamics of Inorganic Reactions

Basic principles of Thermodynamics – Kinetics and Spontaneity of reactions – Formal potential – Electromotive force diagram – Ellingham diagram - Latimer and Frost diagrams – Pourbaix diagram – Relation to spontaneity and application in the prediction of chemical reaction – Oxidation-reduction reactions in water as a function of pH.

Unit – IV: Analytical Applications of Chemical Equilibria

Acid-base equilibria – Common ion effect, Buffer solution, Solubility equilibria, Distribution equilibria, Complex ion equilibria, Factors influencing equilibria.

Principle of inorganic qualitative analysis: Reactions involved in the separation and identification of cations and anion in the analysis- Spot test reagents: Aluminon, Cupferon, DMG, thiourea, Magneson, Alizarin and Nessler's reagent-Semi micro techniques.

Unit – V: Environmental Chemistry

Pollution and its control: Sources of air pollution CO_2, Pb, CO, oxides of nitrogen and sulphur, Freons, smog, greenhouse effect, global warming, methods of control.

Pollution of soil: Fertilizers, insecticides, solid waste and acid rain, methods to control. Pollution of water: Industrial and domestic waste, effluents, sewage waste, Fertilizer,

insecticides oil, toxic metal, COD and BOD. Consequences, methods to control, Rainwater harvesting – its need, methods and advantages.

Noise pollution and radioactive pollution, health hazards.

Unit VI: (Not for Final Examination)

Preparation methods for the complexes – methods of detection for the formation of complexes – co-ordination chemistry of vanadium and molybdenum on biological systems, synthesis of nanoparticles by using plant extract, water resources in India: Demand for water (agricultural, industrial, domestic), over use and depletion of surface and ground water resources, Recent trends in waste water treatment – super critical water oxidation.

Text Books

1. Huheey J.E., (2013), *Inorganic Chemistry*, Pearson, London.
2. Vogel A ,(1999), *Text Book of Quantitative Inorganic Analysis*, ELBS.India.
3. Douglas B.E., D.H.McDaniel A.I.,, AlexanderJ.J., (2017), *Concepts and Models of Inorganic Chemistry,* John Wiley and Sons, Blaisdell Publishing co., London.
4. Shriver D.F., Atkins P.W.,(2010),.Inorganic Chemistry, Langford – Oxford University Publication, London.
5. Uhlig H., Corrosion and Corrosion Control, (1985),4th Edition, John Wiley,India.
6. Tilley R.J.D, (1987), *Defect Crystal Chemistry and its Applications,* Chapman Hall Publication, UK.

Supplementary Reading

1. Lindoy L.F.,(1990), *The Chemistry of Macrocyclic Ligand Complexes*, Cambridge University Press, London.
2. Emeleus S, Sharpe. A.G.,(2007), *Modern Inorganic Chemistry*, Pearson Publication, London,
3. Khophar S.M.,(2020), *Environmental Pollution Analysis*, New Age International Pvt. Ltd, New Delhi.
4. Jain P.C., Jain M.,(2015), *Engineering Chemistry*, Dhanpat Rai Publishing Company, New Delhi.
5. Kenneth J. Klabunde,(2009), *Nanoscale Materials in Chemistry*, Wiley, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						1			3						
CO2	3	3	3	2							3	3				2	2

*1-Low *2-Medium *3-Strong

Semester VI	19ICHEC63 - PHYSICAL CHEMISTRY – II	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn advanced concepts of spectroscopy.
LO2	To learn basic principles of photochemistry
LO3	To learn important concepts of quantum chemistry

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the basics of coordination compounds.
CO2	Understand and appreciate the fundamentals of nanophase materials
CO3	Enable to understand the chemistry of environment.

Unit – I: Spectroscopy - I

Electromagnetic radiation, concept of frequency, wavelength, wavenumber, energy, energy levels, quantization, interaction of electromagnetic energy into matter, basic aspects of atomic and molecular spectroscopy.

Types of molecular spectra, microwave spectroscopy – rotational spectra of diatomic molecule, conditions for a molecule to be active in microwave region, origin of molecular spectra - rotational spectra - rigid rotor and non-rigid rotor, rotational constants (B), selection rule for rotational transition -Intensity of spectral lines – Effect of isotopic substitution.

Unit – II: Photochemistry - I

Light absorption, Beer – Lambert law, its limitations. Laws of photochemistry – Grothus – Draper law, Stark – Einstein law, quantum yield and its determination, chemical actinometers, photochemical decomposition of HI, photochemical combinations of H_2 and Br_2, H_2 and Cl_2 reactions. Difference between photochemical and thermal reactions.

Unit – III: Solid State

Classification of solids – isotropic and anisotropic crystals, laws of crystallography, representation of planes, miller indices, space lattice, crystal systems, seven primitive unit–cells. X-ray diffraction, derivation of Bragg's equation, determination of structure of NaCl by Debye Scherrer (powder) method and rotating crystal method, determination of Avagadro's number, discussion of structures of KCl & CsCl. Defects in crystals – stoichiometric and nonstoichiometric. Packing of ions in crystals – radius ratio rule and its limitations.

Unit – IV: Quantum Mechanics - I

Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation), its demerits, wave-particle duality, de Broglie equation, Heisenberg uncertainty principle, wave nature of electron, Schrodinger's time – independent wave equation (no derivation), wave function and its physical interpretation, Normalization and orthogonal function.

Unit – V: Polymer Science

Polymerization reaction, types of polymerization reactions, addition polymerization and condensation polymerization, mechanism of polymerization, kinetics of polymerization, molecular mass of polymers, number average and mass average molecular mass, determination of molecular mass by osmotic pressure measurement and sedimentation method – important physical properties of polymers.

Unit VI: (Not for Final Examination)

Geometry of excited states, the laser and maser, applications of laser. Super conductivity, imperfections in crystal, point defects, line defects, dislocations, Quasi crystals, electronic spectra of transition complexes, computational quantum chemistry, Walsh diagrams, Density – Functional Theory (DFT) , Time Dependent Perturbation Theory(TDPT).

Text Books

1. Banwell C.N, (2017), *Fundamentals of Molecular Spectroscopy*, Tata McGraw Hill,New Delhi.
2. Rostogi Mukerjee K.K., (2005), P*hotochemistry*, Wiley EasternPress, New Delhi.
3. Lesley Smart and Elaine Moore, (2004), *Solid state chemistry,*.New Age International.
4. Levine W,(2014), *Quantum Chemistry*, Prentice Hall., India.
5. Chandra A.K, (1997), *Introductory Quantum Chemistry*, Tata Mc Graw Hill, New Delhi.
6. Prasad R.K., (2017), *Quantum Chemistry*, New Age International., New Delhi.
7. Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, (2017), *Polymer Science*, New Age International., New Delhi.
8. Moore W.J, (1998), *Basic Physical Chemistry*, Prentice Hall, New Delhi .
9. Billmeyer W., (2002), *Text book of Polymer Science*, John Wiley & Sons, New York.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3						
CO2	3	3	2	1							3			3	1	2	1

*1-Low *2-Medium *3-Strong

Semester VI	19ICHEC64 - PHARMACEUTICAL CHEMISTRY	L	P	C
		5	0	5

Learning Objective (LO):

LO1	To learn advanced concepts of pharmaceutical Chemistry.
LO2	To learn basic principles of drugs.
LO3	To learn important concepts of vitamins and enzymes.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Know the the advanced basics of pharmaceutical chemistry.
CO2	Understand and appreciate the fundamentals of drugs, vitamin.
CO3	Enable to understand the chemistry of hormone and enzymes.

Unit – I Basic Pharmaceutical Chemistry

Definition of the following terms: drug, pharmacophore, pharmacology, Pharmacopeia, bacteria, virus and vaccine. Causes, symptoms and drug for anaemia, jaundice, cholera, malaria and filarial. Indian Medicinal plants and uses – Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.

Unit – II Antibacterials

Sulpha drugs-examples and actions-prontosil, sulphathiazole, sulphafurazole. Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol, erythromycin-tetracyclin – SAR of chloramphenicol only. Antiseptics and disinfectants – definition and distinction – phenolic compounds, chlorocompounds and cationic surfactant.

Unit – III Analgesics and CNS stimulants

Analgesics: Definition and Actions – narcotic and non-narcotic – morphine and its derivatives, pethidine and methadone – disadvantages and uses. Antipyretic analgesics - salicylic

derivative, paracetamol, ibuprofen. Drugs affecting CNS – Definition, distinction and examples for tranquilisers, sedatives, hypnotics, psychedelic drugs – LSD, Hashish – their effects

Unit – IV Anesthetics and Drugs for Chronic diseases

Anaesthetics - definition – local and general – volatile nitrous oxide, ether, Chloroform, cyclopropane – uses and disadvantages – non – volatile intravenous – thiopental sodium, methohexitone, propanidid. Causes, medicines and their mode of action for the treatment of cancer – antineoplastics – diabetes – hypoglycemic agents AIDS – AZT, DDC.

Blood: Grouping, composition, Rh factor, blood pressure, hypertension and hypotension.

Unit – V Vitamins, Harmones and Enzymes

Vitamins – fat soluble vitamins – (i) vitamin A, (ii) vitamin D, (iii) vitamin B complex, (iv) vitamin C, (V) vitamin E, (vi) vitamin K, (vii) vitamin P.

Hormones – Introduction, properties and function of hormones, chemical nature of hormones. Physiological function of some hormones: Adrenaline, thyroxin, oxytocin, insulin, the sex hormones.

Enzymes – Chemical nature of enzymes, classification of enzymes, properties of enzymes, mechanism of enzyme action. Action of Co-enzymes.

Unit VI: (Not for Final Examination)

Pharmaceutical Chemistry and Research advancements – Pharmaceutical Biotechnology – Pharmaceutical Nanotechnology - Nano Drug Delivery Technologies – Computer application in Pharmaceutical Chemistry – Pharmaceutical Biostatistics. Cancer and Computational Medicinal Chemistry: Advances and Perspectives in Drug Discovery and Design.

Text Books

1. Jayashree Ghosh, (2014), *A Text Book of Pharmaceutical Chemistry*, 3rd Edition, S.Chand & Company Ltd., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3						
CO2	3	3	2	1					2	2	3	3			3		2

*1-Low *2-Medium *3-Strong

Semester VI	19ICHEP65: Practical V –BASIC PHYSICAL CHEMISTRY PRACTICAL	L	P	C
		0	8	4

Learning Objective (LO):

LO1	To learn basic concepts of experimental physical chemistry.
LO2	To learn basic principles electrochemistry.
LO3	To learn the important concept of distribution law and kinetics.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the necessary practical skills to perform physical chemistry practicals.
CO2	Gain expertise in the instrumental analysis.
CO3	Apply the gained knowledge in industries.

Experiments:

1. Critical Solution Temperature
2. Effect of impurity on Critical Solution Temperature
3. Transition Temperature - Determination of molecular weight by depression of freezing point method
4. Rast Method - Determination of molecular weight by depression of freezing point methods
5. Phase Diagram (Simple eutectic system)
6. Kinetics of Ester Hydrolysis
7. Partition Co-efficient of iodine between water and organic solvents.
8. Association factor of benzoic acid / acetic acid between benzene and water

9. Conductometric Titration: Acid vs. Base
10. Potentiometric Redox Titration
11. Determination of cell constant

Text Books

1. Levitt B.P., (1985) *Findlay`s practical Physical Chemistry*, 9th Ed., Longman, London.
2. Gurtu, J.N. Kapoor R., (1987), *Advanced Experimental Chemistry*, Vol.I, S.Chand& Co., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**	**2**					**3**			**3**						
CO2	**3**	**2**						**2**			**3**			**3**	**3**		

***1-Low** ***2-Medium** ***3-Strong**

Semester VI	19 ICHEF60 – EXPERIENTIAL LEARNING	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To focus on practical application of knowledge.
LO2	To develop competence skills.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Enhance educational experience.
CO2	Gain practical knowledge on industrial operations

Experiential Learning is a process of learning through experience. It is specifically defined as "learning through reflection on doing. This provides opportunities to students to connect principles of the discipline with real-life situations.

I. Students shall visit various chemical industries. They may experience and practice what they have learned, see the application of the theoretical concepts in practice, process that application and make generalizations.

II. The students have to prepare the report on industrial visit for about 30 pages and Submission of the same at least one month before the last working day of the VI Semester.

Semester VII	19ICHEC71: ORGANIC REACTION MECHANISMS	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn fundamental mechanisms underlying different chemical reactions.
LO2	To learn basic aspects of stereochemistry.
LO3	To learn conformational analysis of six membered ring systems.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand various types of reaction mechanisms involved in synthetic organic chemistry.
CO2	Analyse basic stereochemistry concepts in a proper perspective.
CO3	Evaluate the principles of Photochemistry.

Unit – I: Organic Reaction Mechanisms – I

Aromaticity - Electronic Effects - Types of organic reactions - Reaction intermediates - formation, structure and stability of carbocations, carbanions, radicals, carbenes and nitrenes.

Aliphatic nucleophilic substitution - S_N1, S_N2 and S_Ni mechanisms with examples. -structure and solvent effect on nucleophilic substitution reactions. Aromatic nucleophilic substitution: Unimolecular, bimolecular and benzyne mechanisms.

Esterification and transesterification - Ester hydrolysis - acid catalysed acyl oxygen and alkyl oxygen fission mechanisms - explanation of the principle of microscopic reversibility.

Unit – II: Organic Reaction Mechanisms – II

Addition to carbon-carbon and carbon-oxygen multiple bonds - electrophilic and nucleophilic addition - addition to conjugated system. Hydration of olefins - Hydroboration

Elimination reactions: E1, E2, E1cB & E2C mechanisms - Pyrolytic eliminations - cis elimination - orientation of double bond - Bredt's rule, Hofmann and Saytzeff rules.

Aliphatic electrophilic substitution - S_E1, S_E2 and S_Ei mechanisms with examples. Aromatic electrophilic substitution - mechanisms of nitration, halogenation and sulphonation reactions. Friedel-Crafts reaction and its modifications. Influence of substituents on reactivity and orientation. Electrophilic substitution of naphthalene - formation of two isomers - explanation of kinetic and thermodynamic controls by sulphonation of naphthalene.

Unit – III: Organic Stereochemistry- I

Optical isomerism - chirality - asymmetry and dissymmetry - enantiotopic and diastereotopic hydrogens. Enantiomers and diastereomers and their representation by flying wedge and Fischer projections – R and S notation.

Walden inversion, asymmetric transformation and asymmetric induction - enantio and diastereo selective synthesis - enantiomeric excess and diastereomeric excess.

Atropisomerism of biphenyls, allenes and spiranes. Geometrical isomerism about C=C bond - E-Z notation - determination of configuration of geometrical isomers - geometrical isomerism in acyclic oximes.

Unit – IV: Organic Photochemistry – I

Principles of photochemistry - Jablonski diagram - Photochemical reactions of saturated ketones - Norrish type - I and II reactions - photoreductions of ketones - Paterno- Buchi reaction - reaction of α,β-unsaturated ketones- isomerisation and cycloadditions - photoreactions of cyclohexadienones. Photochemical cis-trans isomerisation of simple alkenes - photochemical oxidation, oxidative couplings and Barton reaction. Application of photochemical reactions in organic synthesis.

Unit – V: Natural Products – I

Amino acids - classification, general methods of preparation and general properties of amino acids. Proteins - classification - peptides synthesis - primary structure of peptides - end terminal analysis - -secondary structure of proteins - tertiary and quaternary structure of proteins. Classification of enzymes and their specificity - Ribonucleosides and ribonucleotides- RNA - types - structures of DNA and RNA.

Introduction - chemical classification of alkaloids and terpenoids - isoprene rule - General methods of structure elucidation of alkaloids and terpenoids. Structure and synthesis of citral and papaverine.

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UNIT VI (Not for final examination)

Nomenclature of alicyclic, bicyclic and tricyclic compounds (basic skeletal structure only with or without one substituent). Biogenesis- The building blocks and construction mechanism of 1.Terpeniods – Mono Sesqui, Di and Triterpeniods. 2. Alkaloids derived from ornithine, lysine, nicotinic acid, tyrosine and tryptophan

Text Books

1. Smith. M. B., (2016), *March's Advanced Organic Chemistry*, John Wiley & Sons, 7th Ed., New York.
2. Carey. F. and Sundberg. R. J., (2007), *Advanced Organic Chemistry*-Part A and B, Springer Science + Business Media, 5th Ed., Berlin.
3. Clayden. J., Greeves. N. and Warren. S., (2012), *Organic Chemistry*, Oxford University Press, 2nd Ed., UK.
4. Norman. R. O. C. and Coxon. J. M., (2003), *Principles of Organic Synthesis,* Chapman & Hall, 3rd Ed., London (UK).
5. Finar. I. L., *Organic Chemistry* , Vol 1 & 2: Pearson, 7th Ed. (2009) Chennai.

Supplementary reading

1.Eliel. E. N., (2008), *Stereochemistry of Carbon Compounds*, Tata McGraw Hill Ed, Reprint, Noida (UP).
2. Nasipuri. D., (2005), *Stereochemistry of Organic Compounds*, New Age International. Ltd, Reprint New Delhi.
3. Kalsi. P. S, (2007), *Organic Reactions: Stereochemistry and Mechanism through solved problems*, New Age International (P) Ltd, 4th Ed., New Delhi.
4. Eliel. E. L. and Wilen. S. H., (2008), *Stereochemistry of Organic Compounds*, Wiley India Ed. New Delhi.
5. Coxon. J. M. and Halton. B., (2000), *Organic Photochemistry*, Cambridge University Press 2nd Ed. UK.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**						**2**			**3**	**3**				**1**	
CO2	**3**		**3**								**3**	**3**					
CO3	**3**			**3**						**3**	**3**	**3**					
CO4	**3**	**3**						**2**			**3**	**3**					**3**

***1-Low *2-Medium *3-Strong**

Semester VII	19ICHEC72: COORDINATION CHEMISTRY AND INORGANIC REACTION MECHANISMS	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn fundamental mechanisms underlying Coordination Chemistry.
LO2	To learn inorganic reaction mechanisms.
LO3	To learn fundamentas of photoinorganic chemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Appreciate various theories of inorganic complexes.
CO2	Evaluate inorganic reaction mechanisms.
CO3	Apply the concepts of energy transfer to photovoltaics.

Unit-I Coordination Chemistry of Transition Metal ions

Nomenclature of coordination compounds - Stability constants of complexes and their determination (pH metric and spectrophotometric methods). Factors influencing stability, stabilization of unusual oxidation states by complex formation.

Pearson's HSAB concept, acid-base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness. Electronegativity and hardness and softness.

Stereoisomerism of coordination complexes.

Unit-II Theories of Coordination Compounds

VB theory-Crystal field theory- splitting of d-orbitals under various geometries- CFSE- factors affecting the magnitude of 10Dq-Evidences for CFSE- Spectrochemical series- Distortions in octahedral complexes- Jahn-Teller theorem, Jahn-Teller effect, Molecular orbital theory-MO concepts of octahedral and tetrahedral complexes- MO energy level diagrams of sigma and pi bonding in octahedral complexes, nature of metal-ligand pi bonds- Evidences for pi back bonding.

Unit-III Reaction Mechanism-I

Substitution reactions of octahedral complexes: Labilities, inertness, stability and instability of coordination compounds- Nature of substitution reactions- Theoretical approach to substitution mechanisms-Mechanism of substitution reactions of complexes of cobalt-acid hydrolysis-base hydrolysis of cobalt(III) complexes.

Racemisation and isomerisation: Twist mechanisms for isomerisation – Intramolecular mechanisms for racemisation.

Unit-IV Reaction Mechanism-II

Substitution reactions of square planar complexes: Reactions of Pt(II) complexes- Trans effect-Theories of trans effect-Mechanism of substitution- kinetics of Pt(II) complexes.

Electron transfer reactions-Electron tunnelling hypothesis-Marcus-Hush theory. Atom transfer reaction-one electron and two electron transfer-inner sphere and outer sphere mechanism.

Unit-V Photoinorganic Chemistry

Excited states of metal complexes-Energy transfer under conditions of weak interaction and strong interaction-exciplex formation. Conditions of the excited states to be useful as redox reactants-photosubstitution, photooxidation and photoreduction- Photochemical reactions involving Ruthenium(II) bipyridyl complex. Application to photovoltaics-water photolysis-carbon dioxide reduction.

UNIT VI (Not for final examination)

Applications of coordination compounds: Metal complexes in analytical chemistry, medicinal chemistry, industrial process, water suffering process and agriculture.

Photochemistry of Cr(III), Co(III), Pt(II) and Pt(IV) complexes

Text Books

1. Huheey, J.E., (2013), *Inorganic chemistry*, Pearson, London.
2. Shriver, D.F., Atkins, P.W., (2010), *Inorganic chemistry*, Langford-Oxford University Publications, London.
3. Basalo. F, Pearson. R.G,(2000), *Mechanism of Inorganaic Reactions*, John Wiley & Sons, India
4. Kettle. S.F.A,(2013), *Physical Inorganic Chemistry*: *A Coordination Chemistry Approach*, Springer, New York.

Supplementary Reading

1. Tobe.M. L. and Burgess.J.,(1999), *Inorganic Reaction Mechanism*, Longman, New York.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						2			3	3				1	
CO2	3		3								3	3					
CO3	3			3						3	3	3					
CO4	3	3						2			3	3					3

*1-Low *2-Medium *3-Strong

Semester VII	19ICHEC73: CHEMICAL THERMODYNAMICS, PHOTOCHEMISTRY AND GROUP THEORY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn fundamental of thermodynamics.
LO2	To gain more knowledge about photochemistry.
LO3	To learn fundamentas of group theory.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the fundamentals of statistical thermodynamics.
CO2	Appreciate the fundamentals of photochemistry and radiation Chemistry.
CO3	Apply the principles of Group theory.

Unit – I: Classical Thermodynamics

Calculation of adiabatic flame temperature, Maxwell's relations, thermodynamic equation of state, thermodynamics of open systems, partial molar quantities, chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature and pressure, third law of thermodynamics-Determination of absolute entropies of solids, liquids and gases –residual entropy. Nernst heat theorem, chemical equilibrium-Van't Hoff isotherm, standard free energy change of reactions, variation of equilibrium constant with temperature and pressure.

Unit – II: Thermodynamics of Non-Ideal and Irreversible Systems

Fugacity of gases – determination of fugacity using graphical method and van der Waals equation – variation of fugacity with temperature and pressure. Concept of activity and activity coefficients – mean ionic activity and mean activity coefficients - determination of activity and activity coefficients using EMF measurements.

Non-equilibrium thermodynamics - conservation of energy and mass, entropy production in chemical reactions – Microscopic reversibility and Onsager reciprocal relation. General application of non-equilibrium thermodynamics.

Unit –III: Statistical Thermodynamics

Thermodynamic probability and entropy. Maxwell-Boltzmann, Bose-Einstein and Fermi- Dirac statistics.

Partition function – translational, rotational, vibrational and electronic partition functions. Calculations of thermodynamic properties and equilibrium constant in terms of partition functions. Theories of heat capacity of solids-Einstein and Debye theories.

Unit – IV: Photochemistry and Radiation Chemistry

Photophysical process, primary and secondary processes, Quantum yield, Kinetics of collisional quenching – Stern Volmer equations. Photosensitization, Chemiluminescence, Photosynthesis, solar energy conversions, Semiconductor photocatalysis, lasers.

Radiation Chemistry-linear energy transfer, G-value, dosimeters, radiolysis of water, solvated electrons.

Unit – V: Principles and Applications of Group Theory

Reducible and irreducible representations, properties of irreducible representations orthogonality theorem. Construction of character tables of C_2v and C_3v. Selection rules for IR and Raman spectra, procedure for determining symmetry of normal modes of vibration of H_2O and NH_3 molecules - hybrid orbitals in BF_3, CH_4 and NH_3.

UNIT VI (Not for final examination)

Application of Bose-Einstein statistics to photon gas and superfluidity of liquid helium Application of Fermi-Dirac statistics to electron gas and thermionic emission.Applications of Group theory to IR, Raman and Electronic spectra - SALC procedure - evaluation of energies and MO's for systems like ethylene, butadiene.Metal Oxide Semiconductors and Doped Metal Oxide Semiconductors and its applications. Mechanism of photocatlysis and its applications

Text Books

1. Gurdeep Raj, (2004), *Thermodynamics,* Goel Publishers, Chennai.
2. Moore W. J., (1998), *Basic Physical Chemistry*, Orient Longman, India.
3. Peter Atkins, Julio de Paula, (2013), *Physical Chemistry*, Oxford Univ.press,UK.
4. Rohatgi-Mukherjee.K.,(2005), *Fundamentals of Photochemistry*, New Age International,.Hyderabad.

5. Cotton F. A., (2003), *Chemical Applications of Group Theory*, Wiley Eastern, India.

6. Raman, K. V(2004), *Group Theory and its Application to Chemistry*, Tata McGraw Hill,New Delhi.

Supplementary Reading

1. Glasstone. S, (1966),*Text Book of Physical Chemistry*, Mc Millan,India.

2. Kuriacose.J.C, Rajaram.J, (1986),*Thermodynamics for Chemistry,* Shoban Lal Nagain Chand, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**		**3**	**3**					**1**		**3**						
CO2	**3**		**2**	**3**							**3**						
CO3	**3**		**2**	**3**						**3**	**3**						**3**
CO4	**3**		**2**	**3**						**3**	**3**				**3**		

***1-Low *2-Medium *3-Strong**

Semester VII	19ICHEP74: ORGANIC CHEMISTRY PRACTICAL – I	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To learn different types of organic reactions and its mechanisms
LO2	To undertake experiments on organic reactions.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire basic laboratory skills required to carry out organic reactions.
CO2	Independently perform two step organic preparations
CO3	Gain the expertise to apply it to specific research problems.

Preparations:

Preparation of organic compounds involving two step reactions.

Text Books

1. Vogel. A. I., Tatchell. A. R., Furnis. B. S., Hannaford. A. J., Smith. P.W.G., (2005), *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson, Chennai.

Supplementary reading

1. Ahluwalia. V. K., Bhagat. P. and Aggarwal. R., (2005), *Laboratory Techniques in Organic Chemistry*, I.K. Int., New Delhi.
2. Gnanaprakasam. N. S. and Ramamurthy. G., (2000), *Organic Chemistry Lab Manual,* S.V. Printers, Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2	3			3			3	3				3	
CO2	3		3	2					3		3	3				3	
CO3	3		3	3						3	3	3				3	
CO4	3		2	3						3	3				3		

*1-Low *2-Medium *3-Strong

Semester VII	19ICHEP75: PHYSICAL CHEMISTRY PRACTICAL – I	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To learn principles and verification of electrochemistry and binary solutions
LO2	To perform experiments in order to study the important concepts electrochemistry and binary systems.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the practical knowledge of understanding important equations in distribution experiments.
CO2	Independently perform conductometric experiments
CO3	Gain the expertise to analyze analytical problems.

Experiments

I. Conductivity Experiments

1) Determination of cell constant

2) Determination of the solubility of sparingly soluble salt

3) Verification of DHO equation – Equivalent conductance of strong electrolyte

4) Dissociation constant of weak electrolyte (verification of Ostwald's dilution law)

II. Conductometric titrations

5) Acid-base titrations

i) HCl vs NaOH, ii) CH_3COOH vs NaOH,

6) Displacement titrations (NH_4Cl vs NaOH)

7) Precipitation titrations

i) $CuSO_4$ vs NaOH, ii) $BaCl_2$ vs Na_2CO_3, iii) KCl vs $AgNO_3$

8) Titration of mixtures

i) HCl + CH_3COOH vs NaOH, ii) HCl + $CuSO_4$ vs NaOH iii) HCl + NH_4Cl vs NaOH

III. Distribution Law Experiments

1) Partition coefficient of iodine between two immiscible solvents

2) Study of the equilibrium constant of the reaction: KI + $I_2 \leftrightarrows KI_3$

3) Estimation of iodide ion using partition experiment

4) Distribution of ammonia between water and chloroform

5) Determination of formula of cuprammonium complex.

Text Books

1. Levitt B.P., (1985), Ed., *Findlay`s Practical Physical Chemistry*, 9th Ed., Longman, London.

2. Gurtu J.N.,. Kapoor R, (1987), *Advanced Experimental Chemistry*, Vol.I, S. Chand & Co.,New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3				1			3		3				3
CO2	3		3								3		3	3	3		
CO3	3		3	3						3	3		3	3			
CO4	3	3	3					1		3	3		3				

***1-Low *2-Medium *3-Strong**

Semester VIII	19ICHEC81: ORGANIC PHOTOCHEMISTRY AND MOLECULAR REARRANGEMENTS	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn addition, elimination, rearrangement reactions.
LO2	To gain more knowledge about name reactions along with their mechanisms.
LO3	To learn various types of oxidation and reduction reactions..

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the theoretical basis and mechanisms underlying additions and elimination reactions.
CO2	Appreciate reaction mechanisms involved in rearrangements
CO3	Evaluate the chemistry of heterocyclic molecules and dyes and their synthetic utilities.

Unit – I: Organic Photochemistry – II

Classification of pericyclic reactions - electrocyclic reactions – cycloaddition reaction - sigmatropic shifts - Woodward-Hoffmann selection rule – analysis of pericyclic reactions - Correlation diagram – Frontier Molecular Orbital approach and Perturbation Molecular Orbital approach - Sommlet-Hauser, Cope and Claisen rearrangements. Molecular Rearrangements.

A detailed study of the following rearrangements: Carbon-carbon migration: Pinacol-Pinacolone, Wagner-Meerwein and Favorskii. Carbon-nitrogen migration: Hoffmann, Schmidt, Lossen, Curtius and Beckmann, Carbon- oxygen migration: Baeyer-Villiger. Nature of migration, migratory aptitude.

Unit – II: Organic Stereochemistry- II

Conformational analysis of 1,2-disubstituted ethanes - relative stabilities of gauche and anti conformations. Representations of the conformations of diastereomers with two asymmetric carbons using Newmann and Sawhorse projections - relative stabilities of diastereomers. Conformation and stereochemistry of *cis*- and *trans*- decalin and 9 - methyldecalin.

Unit – III: Synthetic Dyes and Supramolecular Chemistry

Colour and constitution (Electronic concept). Classification of dyes, Chemistry and Synthesis of methyl orange, congo red, malachite green, crystal violet, fluorescein, alizarin and indigo.

Definition of Supramolecular Chemistry, Nature of binding interactions in supramolecular structure: ion-ion, ion-dipole, dipole-dipole, Hydrogen bonding, cation-π, anion- π, π-π and Van der Waals interaction. Synthesis of crown ethers, cryptands, calixarenes, cyclodextrins, cyclophanes, cryptophanes and dendrimers.

Unit – IV: Small Ring and Higher Ring Heterocycles

Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes. Benzo-Fused Five- Membered Heterocycles -Synthesis and reactions of benzopyrroles, bezofurans and benzothiophenes.

Six membered Heterocycles with two or more Heteroatoms. Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Seven-and Large-membered Heterocycles - Synthesis and applications of azepines, oxepines, thiepines, diazepines thiazepines, azocines, diazocines, dioxocines and dithiocines.

Unit – V: Natural Products – II

Antibiotics: classification, structure and uses of penicillins, fluoroquinolones, chloramphenicol, and streptomycin - Structural elucidation and synthesis of chloramphenicol. Vitamins: Classification, structure and uses of vitamins A, B1, B6, C, D, E and K.

Steroids: Occurrence - Diel's hydrocarbon - nomenclature of Steroids - Structure and biological importance of cholesterol, cholic acid, estrone, estradiol, testosterone and androsterone.

UNIT VI (Not for final examination)

Problems in each type of photochemical reactions and molecular rearrangements. Aromatic transition state – general rule for pericyclic reactions. Structural elucidation of tetracyclins, streptomycin, penicillins.Estriol and progesterone.

Text Books

1. Sankararaman. S., (2015), *Pericyclic Reactions – A Text Book*, Narosa, 1st Ed., New Delhi.

2. Smith. M. B., (2016), *March's Advanced Organic Chemistry*, John Wiley & Sons, 7th Ed., New York.

3. Carey. F. and Sundberg. R. J., (2007), *Advanced Organic Chemistry*-Part A and B, Springer Science and Business Media, 5th Ed., Berlin.

4. Clayden. J., Greeves. N. and Warren.S., (2012), *Organic Chemistry,* Oxford University Press, 2nd Ed., UK.

5. Norman. R. O. C. and Coxon. J. M., (2003), *Principles of Organic Synthesis*, Chapman & Hall, 3rd Ed., London.

6. Stuart Warren, (2007),*Organic Synthesis: Disconnection Approach*, Wiley India (P) Ltd., New Delhi.

Supplementary Reading

1. Ahluwalia. V. K., (2012), *Oxidation in Organic Synthesis*, CRC Press, 1st Ed., Florida.

2. Ahluwalia. V. K., (2012), *Reduction in Organic Synthesis*, CRC Press, 1st Ed., Florida.

3. Ingold. C. K., (1994), *Structure and Mechanism in Organic Chemistry*, CBS Pub., 2nd Ed., New Delhi.

4. Mukherji. S. M. and Singh. S. P., (2016), *Reaction Mechanism in Organic Chemistry*, Trinity Press, Revised Ed., New Delhi.

5. Eliel. E. L. and Wilen. S. H., (2008), *Stereochemistry of Organic Compounds*, Wiley India Ed., New Delhi.

6. Finar. I. L., (2009), *Organic Chemistry* , Vol 1 and 2: Pearson, 7th Ed., Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3	3					3
CO2	3		3								3	3					
CO3	3			3						3	3	3					
CO4	3	3						3			3	3			3	3	3

***1-Low *2-Medium *3-Strong**

Semester VIII	19ICHEC82: SOLID STATE AND ORGANOMETALLIC CHEMISTRY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn principles of solid state chemistry.
LO2	To gain more knowledge about polymeric inorganics.
LO3	To learn organometallic Chemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the various classes of polymeric inorganic compounds.
CO2	Appreciate the classification and factors influencing phase transitions
CO3	Evaluate the structure and applications of organometallic compounds

Unit-I: Solid State Structures and Structural Defects

Ionic bonding, Lattice energy, Born equation and its derivation, Limiting radius ratio rules, Radius ratio for trigonal, tetrahedral, octahedral and cubic sites.

Structures of some ionic crystals (sodium chloride, caesium chloride, rutile, wurtzite, fluorite).

Crystal defects: Stoichiometric defects-Schottky and Frenkel defects – colour centres in alkali halide crystals – Nonstoichiometric defects- metal excess and metal deficiency defects – extended defects – line and plane defects.

Unit-II: Polymeric Inorganic Compounds

Structures and classification of higher boranes - carboranes - metallocarboranes- silicates-silicones - Phosphazenes - Linear and cyclic phosphazenes -Sulfur - nitrogen compounds-S_4N_4- one-dimensional conductor [(SN)x]–Metal clusters-binuclear metal halide clusters-structure and bonding in octachlorodirhenate(III). Isopoly and heteropolyacids- structure and bonding of isopoly & 6- and 12-heteropoly anions.

Unit – III: Phase Transitions

Buerger's classification – Thermodynamic classification – Ubbelohde's classification – Kinetics of phase transitions – Nucleation rate – Avrami equation – Factors that affect the kinetics of phase transitions – Crystal chemistry and phase transitions – Martensitic transformations – Order- disorder transitions.

Unit-IV: Organometallic Chemistry-I

Types of ligands- Concept of haptacity-18 electron rule and its limitations- bonding in metal carbonyls- - Polynuclear carbonyls with and without bridging groups-Applications of IR spectra in the study of structure of metal carbonyls-structure and bonding in metal nitrosyls and dinitrogen complexes-Preparation, structure and bonding in metal alkenes (Zeise's salt), alkynes and allyl complexes- Metallocenes: preparation, properties, structure and bonding in ferrocene.

Unit-V: Organometallic Chemistry –II (Catalysts and Reaction Mechanisms)

Homogeneous catalysis: Alkene hydrogenation, synthesis gas, hydroformylation, synthetic gasoline and Monsanto acetic acid process, Wacker process, polymerization by Ziegler-Natta Catalysis – Isomerization of alkenes – Fluxional behaviour of organometallic compounds – Isolobal concept in organometalic compounds and metal clusters.

UNIT VI (Not for final examination)

Structure and properties of solid – prototypical oxides, fluorides, sulfides and related compounds. Monoxides of 3d metals, higher oxides and glasses – layered MS_2 compounds and intercalations.Organosilicon compounds – organometallic compounds of arsenic, antimony and bismuth – catenated and multiply bonded

Text Books

1. Huheey, J.E, Keiter. E. L, Keiter. R. L., Medhi. O.K(2011),. *Inorganic chemistry*, Pearson press, London
2. Huheey, J.E.,(2013), *Inorganic chemistry*, Pearson press, London
3. Lee, J.D., (2012) ,*Concise inorganic chemistry*, Wiley. India
4. Cotton. F.A, Wilkinson. G,(2013), *Advanced Inorganic Chemistry*, Wiley Eastern, New Delhi.
5. Douglas. B.,(2017), *Concept and Models of Inorganic Chemistry*, Wiley, New Delhi.

Supplementary Reading

1. Anthony R. West,(2016), *Solid-state Chemistry and its applications*, John Wiley, New Delhi.

2. Shriver, D.F., Atkins, P.W., (2011), *Inorganic chemistry*, Langford-Oxford University Publications, 5 th edition, London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3		3				3		3	3		3				
CO2	3	3		3							3		3		1		
CO3	3	3		3						3	3		3				
CO4	3	3		3				3		3	3		3				

***1-Low *2-Medium *3-Strong**

Semester VIII	19ICHEC83: CHEMICAL KINETICS AND QUANTUM MECHANICS	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn the basic concepts in chemical kinetics.
LO2	To gain more knowledge about quantum theory.
LO3	To learn about catalysis.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand theoretical basis underlying the kinetics of different chemical reactions
CO2	Appreciate the theories of molecular dynamics
CO3	Comprehend the quantum mechanics of simple systems

Unit – I: Chemical Kinetics and Catalysis

Absolute Reaction Rate Theory in thermodynamic terms – Significance of entropy and volume of activation. Ionic reactions – primary and secondary salt effects - Acid-base catalysis – Bronsted relations, catalytic coefficients and their determination. Enzyme catalysis- Michaelis-Menten equation – Heterogeneous catalysis-Langmuir-Hinshelwood and Eley- Rideal mechanisms

General features of fast reactions – Study of fast reactions by flow methods.

Unit – II: Chemical Dynamics

Potential energy surfaces, Kinetic isotopic effects - Dynamics of unimolecular reactions – Lindemann-Hinshelwood – Rice Ramsperger Kassel (RRK) theory and Rice Ramsperger Kassel – Marcus (RRKM) theory.

Study of fast reactions by laser, relaxation, flash Photolysis and nuclear magnetic resonance methods.

LFERs – Hammett equation, Taft equation, separation of polar, resonance and steric effects.

Unit – III: Quantum Mechanics of Simple System -I

Operators and commutation relations-Postulates of quantum mechanics – derivation of Schrodinger's time-independent wave equation and its application to particle in a one-

dimensional box, particle in a three-dimensional box, harmonic oscillator, rigid rotor and Schrodinger equation for hydrogen atom-separation of variables-energy levels-radial factors of the hydrogen atom wave functions .

Unit – IV: Applications of Quantum Chemistry - II

Covalent bonding – Born-Oppenheimer approximation-Hydrogen molecule ion, LCAO – MO and VB treatments of the hydrogen molecule. Antisymmetry and Pauli's exclusion principle. Slater determinantal wave function, term symbols and spectroscopic states – Russell- Saunders coupling.

Unit – V: Applications of Quantum Chemistry - III

The variation Theorem, linear variation principle, perturbation theory (first order and non degenerate). Applications of variation method and perturbation theory to the helium atom. Hybridization-determination of bond angles of sp, sp^2 and sp^3 hybridizations. Huckel pi-electron (HMO) theory and its applications to ethylene, butadiene and benzene. HMO orbital construction, calculation of properties –delocalization energy, electron density and bond order. A brief idea of self consistent field theory.

UNIT VI (Not for final examination)

Computer Applications in Chemistry Introduction to computers and computing - Block diagram of a PC and the functions of the various units of computer - High and low level languages - Introduction to net working - LAN, WAN, Internet and Intranet - WorldWideWeb - ChemWeb - E-journals - search engines for chemistry. Introduction to C language - Structure of C program - Control statements.

Examples of simple chemistry Programmes. 01. Conversion of Celsius temperature to Kelvin temperature 02. Applications of Beer-Lambert Law. 03. Linear least square - Fit log k vs I/T plot to get Arrhenius parameters. 04. Determination of Anharmonicity constant and dissociation energy calculation.

Text Books

1. Atkins P., PaulaJ. D,(2013),*Physical Chemistry*, Oxford University Press, UK.
2. Laidler K. J.,(2014), *Chemical Kinetics*, Tata Mc Graw Hill, New Delhi.
3. Prasad R. K., (2017), *Quantum Chemistry*, New Age International, Hydrabad.
4. Puri, Sharma, Pathania,(2017),*Principle of Physical Chemistry*, Vishal Publishing Ltd., New Delhi.
5. Sen K. B. K.,(1992), *Quantum Chemistry*, Tata McGraw Hill, New Delhi.

Supplementary Reading

1. Chandra A. K., (1997), *Introduction to Quantum Chemistry*, Tata McGraw Hill, New Delhi.
2. Levine W., (2014), *Quantum Chemistry*, PHI Learning, India.
3. Agrawal G.L, (1990), *Basic Chemical Kinetics*, Tata McGraw Hill,New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3		3				3
CO2	3		3								3		2				3
CO3	3			3						3	3		3	3	3		
CO4	3	3						3		3	3		3	3		3	3

***1-Low *2-Medium *3-Strong**

Semester VIII	19ICHEP84: ORGANIC CHEMISTRY PRACTICAL – II	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To undertake separation techniques of organic mixtures.
LO2	To analysis the organic mixtures containing two component system.
LO3	To learn about different reactions of organic compounds.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the necessary practical skills to independently analyse organic compounds.
CO2	Gain expertise in the separation of two component mixtures of organic compounds.
CO3	Apply the knowledge in chemical industries.

Qualitative Analysis:

Analysis of two component mixture. Separation and systematic analysis of the separated two individual components.

Text Books

1. Mohan. J., (2003), *Organic Analytical Chemistry*, Theory and Practice, Narosa., New Delhi.
2. Ahluwalia. V. K., Bhagat. P., Aggarwal. R., (2005), *Laboratory Techniques in Organic Chemistry,* I. K. International., New Delhi.
3. Vogel. A. I., Tatchell. A. R., Furnis. B. S., Hannaford. A. J., and Smith. P.W.G., (2005), *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Prentice Hall., New Delhi.

Supplementary reading

1. Gnanaprakasam. N. S. and Ramamurthy., (2000), G., *Organic Chemistry Lab Manual*, S.V. Printers., Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3					3	
CO2	3		3								3	3				3	3
CO3	3			3							3			3		3	
CO4	3	3				3	3	3			3	3		3	3	3	3

*1-Low *2-Medium *3-Strong

Semester VIII	19ICHEP85: INORGANIC CHEMISTRY PRACTICAL – I	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To develop skill in the identification of cations including rare earth metals
LO2	To develop the skill in the estimation of metal ions by complexometric titrations.
LO3	To learn about different reactions of inorganic chemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the practical skills to independently analyse inorganic compounds.
CO2	Gain expertise in the systematic analysis of inorganic compounds.
CO3	Apply the knowledge in chemical industries.

Semi Micro Qualitative Analysis

Mixture containing two common cations and two of the following less familiar cations. Se, Te, W, Mo, Be, Ti, Ce, Th, Zr, U, V, Tl and Li.

Text Books

1. Ramanujam V, (1988), *Inorganic Semi Micro Qualitative Analysis*, National Pubs., Chennai.
2. Vogel A.I, (1989), *Text Book of Quantitative Inorganic Analysis,* 5th Ed., Longman., London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3		1	1		2			3		3			2	3
CO2	3		3								3		3				3
CO3	3	1	3	1				2		3	3		3			3	3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEC91: SYNTHETIC ORGANIC CHEMISTRY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn the new techniques in planning an organic synthesis.
LO2	To acquire knowledge about polymers.
LO3	To learn about industrial importance of polymers.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the concepts of retrosynthetic analysis.
CO2	Appreciate various organic reagents used in synthetic organic chemistry.
CO3	Comprehend the selective synthetic methods.

Unit – I: Planning Organic Synthesis

An introduction to retrosynthesis - Synthon, Synthetic equivalent, Target molecule, Functional group interconversion - Disconnection approach - One group disconnection - Disconnection of alcohols, olefins and ketones - Logical and illogical disconnections. Two group disconnection - 1,2-, 1,3-, 1,4-, 1,5- and 1,6-dioxygenated skeletons and dicarbonyls. Retro Diels - Alder reaction - Pericyclic reactions – Retrosynthesis of some heterocycles containing two nitrogen atoms. Retrosynthetic analysis of Camphor, Longifiline and Reserpine.

Unit – II: Reagents in Organic Chemistry:

Uses of the following reagents in organic synthesis and functional group transformations. Sodium borohydride, Lithium aluminium hydride, tri-n-butyltin hydride, Lithium dimethyl cuprate, Lithium diisopropyl amide, Trimethylsilyl iodide, dicyclohexylcarbodiimide, OsO_4, DDQ, SeO_2, PCC. Phase Transfer Catalysts - Benzyltriethylammonium halides - Crown ethers.

Oxidation and reduction:

Oxidation - Swern and Dess-Martin oxidations, Corey-Kim oxidation, PCC and $KMnO_4$ oxidations. Reduction using hydride reagents, $LiAlH_4$, $NaBH_4$ and other organoboranes: chemo- and stereoselectivity, catalytic hydrogenation (homogenous and heterogeneous catalysts).

Unit – III: Organic Reactions and Advanced Mechanisms

Formation of C-C single bond: Aldol condensation, Claisen ester reaction, Stobbe condensation, Knoevenagel reaction, Michael addition, Dieckmann condensation - Stork enamine reaction - Mannich reaction. Formation of C=C double bond: Wittig reaction, Claisen- Schmidt condensation and Peterson's synthesis.

Cannizaro and cross Cannizaro reactions, Benzoin condensation, Wolff-Kishner reduction, Clemmenson reduction, Birch reduction and Chichibabin reaction.

General methods of investigation of organic reaction mechanisms - kinetic and non- kinetic methods - Baldwin rules - cross over experiments - isotopic labeling primary and secondary kinetic isotopic effects - solvent kinetic isotopic effects. S_N1', S_N2' and S_Ni' mechanisms - Neighbouring group participation - non-classical carbocation and memory effect.

Unit – IV: Selective Synthetic Methods

Need for protection of functional groups during chemical reactions - protection of hydroxyl, mercapto, amino, carbonyl and carboxylic groups.

Asymmetric synthesis with chiral substrate: Nucleophilic addition to α-chiral carbonyl compounds, Electrophilic addition to α-chiral olefins - epoxidation, cyclopropanation, hydroboration. Asymmetric synthesis using chiral reagents and catalysts: Chiral organo boranes - application in hydroboration, reduction and allylation reactions, epoxidation catalyst,

semicorin catalyst, Jacobson catalyst - Uses of Camphor derived auxiliaries and menthol derived auxiliaries in asymmetric synthesis.

Unit – V: Polymers

Chemistry of polymerisation, Kinetics of polymerisation, Chemical and geometrical structure of polymer molecules, Glass transition temperature, Crystallinity in polymers - Copolymerisation. Polymer stereochemistry.Industrial polymers - Synthesis, structure and applications of industrially important polymers like PVC, nylon 6,6, buna-S rubber and Polytetrafluoroethylene (Teflon). Conducting polymers - Synthesis and applications of polyacetylenes, polyanilines, polypyrroles and polythiophines.Polymers as aids in organic synthesis - Polymeric reagents, catalysts and substrates.Polymers in Optical lithography - Drug delivery - Drug carriers.

UNIT VI (Not for final examination)

Uses of following reagents in organic synthesis and functional group transformation. Synthesis and uses of drugs- anxiolytics, neuroleptics, hypnotics, sedatives, local anaesthetics, anti-coagulants, hypoglycaemic agents, antihistaminic agents, antimalarials, analgesics, antipyretics and anti-inflammatory.

Text Books

1. Smith. M. B., (2016), *March's Advanced Organic Chemistry*, John Wiley & Sons, 7th Ed., New York.
2. Finar. I. L., (2009), *Organic Chemistry* Vol 1 and 2, Pearson, 7th Ed., Chennai.
3. Norman. R. O. C. and Coxon. J. M., (2003), *Principles of Organic Synthesis*, Chapman & Hall, 3rd Ed., London.
4. Kalsi. P. S., (2007), *Organic Reactions: Stereochemistry and Mechanism through solved problems*, New Age International (P) Ltd, 4th Ed., New Delhi.
5. Eliel. E. L., (2011), *Stereochemistry of Organic Compounds*, Wiley India 42nd Ed., New Delhi.

Supplementary reading

1. Michael B. Smith, (2010), *Organic Synthesis*, Elsevier, 4th Ed., New York.
2. Charles. C. K., (2012), *Organic Synthesis*, Narosa, 1st Ed., New Delhi.
3. Ahluwalia. V. K., and Renu Aggarwal, (2006), *Organic Synthesis*, Narosa, 2nd Ed., New Delhi.
4. Gowariker. V. R., Viswanathan. N. V. and Jayadev Sreedhar, (2017), *Polymer Science*, New Age International, 2nd Ed., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**									**3**	**3**					
CO2	**3**		**3**								**3**	**3**					
CO3	**3**									**3**	**3**	**3**					
CO4	**3**	**3**				**3**					**3**	**3**					**3**

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEC92: GREEN CHEMISTRY, COMPUTATIONAL CHEMISTRY, DRUG DESIGN AND SPECTROSCOPY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn basic aspects of Green Chemistry.
LO2	To study Spectroscopy of organic compounds.
LO3	To learn about Computational Chemistry

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Correlate the UV absorption and molecular structure.
CO2	Interpret the ^{1}H and ^{13}C NMR spectra of organic compounds.
CO3	Analyze the unknown compounds by spectroscopy.

Unit – I: Green Chemistry

Introduction and principle of green chemistry - Environmental friendly green techniques - solvent supported catalysts and reagents, heterogeneous reactions, Examples of organic reactions involving green chemistry techniques.

Techniques in Organic Synthesis - Use of microwave, ultrasound, ionic liquids, supercritical fluid extraction in organic synthesis – Heterogenized reactions

Unit – II: Computational Chemistry

An introduction to concepts of potential energy surface, Basic principles of molecular mechanics, Ab initio method, Semiempirical calculations (SE) and Density functional theory (DFT) software.

Drug Design and Synthesis

Development of new drugs - Procedures followed in drug design. Physicochemical parameters: Lipophilicity, partition coefficient, electronic ionization constants - Concepts of drug receptors and Drug receptor interactions. Structure-Activity Relationship and Quantitative Structure-Activity Relationship. Free Wilson and Hansch analysis - Case study using morphine and penicillins.Synthesis of Benzodiazepene, Sulfonyl urea and Diclofenac drugs.

Unit – III: Mass Spectrometry

Principles – measurement techniques – (EI, CI, FD, FAB, SIMS) – presentation of spectral data – molecular ions – isotope ions – simple and multicentre fragmentation – fragment ions of odd

and even electron types – factors affecting cleavage patterns – rearrangement ions – McLafferty rearrangement – Retro Diels–Alder fragmentation. Mass spectra of hydrocarbons, alcohols, phenols, aldehydes, ketones, carboxylic acids, amines and their derivatives - MALDI-TOF and its applications.

Unit – IV: NMR Spectroscopy

Nuclear spin and magnetic moment of a nucleus – nuclear energy levels in the presence of magnetic field - basic principles of NMR experiments – CW and FT NMR – ^{1}H NMR chemical shift - factors influencing proton chemical shifts - coupling constants – factors influencing coupling constants – ^{1}H NMR spectra of simple organic molecules such as: CH_3CH_2Cl, CH_3CHO, etc., AX, AB and AMX spin system – spin decoupling – nuclear overhauser effect – chemical exchange.

Introduction to ^{13}C NMR - chemical shifts – additivity principle – factors affecting ^{13}C NMR chemical shifts - proton decoupled, off-resonance, INEPT and DEPT ^{13}C NMR spectra – ^{13}C NMR spectra of simple organic molecules.

Unit – V: Multidimensional NMR Spectroscopy:

Basic principles of 2D NMR spectroscopy – HOMOCOSY, HSQC, HMBC, TOCSY and NOESY spectra and their applications.

Introduction of 3D NMR experiment, HCCH-TOCSY, HNCA experiment, HNCO experiment, HN(CA)CO experiment, Backbone assignments and Side-chain assignments - Spectroscopic identification of Organic Compounds - Identification of organic compounds using data of UV, IR and NMR spectroscopy and mass spectrometry.

UNIT VI (Not for final examination)

Techniques in organic synthesis – use – Neat reaction, Grinding techniques. Synthesis of Phenothiazines, Piperidinediones, Aminobenzoic acid and its derivatives, 1,3-Indanedione derivatives, Ethylenediamine derivatives, Aminoquinolines, Paracetamol and Phenylbutazone

Text Books

1. Rashmi Sanghi, Srivastava, (2012), *Green Chemistry*, Narosa Publishing House, 5th Ed., New Delhi.
2. Albert S. Matlack, ., (2010), *Introduction to Green Chemistry*, CRC Press, 2nd Ed Florida.
3. Ashutosh Kar, (2015), *Medicinal Chemistry*, New Age International, 6th Ed., New Delhi.
4. Errol Lewars, (2015), *Computational Chemistry*, Springer, 3rd Ed., Berlin.
5. Patrick. G. K., *Medicinal Chemistry*, (2015), Garland Science, 1st Ed., New York.

6. Silverstein. R. M., Webster. F. X., Kiemle. D. J. and Bryce. D. L., (2016), *Spectrometric Identification of Organic compounds*, John Wiley, 8th Ed., New York.
7. Jagmohan, *Organic Spectroscopy*, (2016), Narosa, 2nd Ed., New Delhi.
8. R. S. Macomber, (1998), *A Complete Introduction to NMR Spectroscopy*, Wiley, New York.
9. Jag Mohan, (2016), *Organic Spectroscopy, Principles & Applications*, Narosa , 2nd Ed., New Delhi.

Supplementary Reading

1. Sameuel Delvin, *Green Chemistry*, (2006), IVY Publishing House, 1st Ed., London.
2. Srivastava. M. M., and Rashmi Sanghi, (2005), *Chemistry for Green Environment*, Narosa, 1st Ed., New Delhi.
3. Ahluwalia. V. K., (2012), *Medicinal Chemistry*, Ane Books P Ltd. 2nd Edition, New Delhi.
4. William Kemp, (2008), *Organic Spectroscopy*, Macmillan Education UK, 3rd Ed., London.
5. Kalsi. P. S., (2005), *Spectroscopy of Organic Compounds*, New Age International Publishers, 6th Ed, Reprint., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3			1			3		1	3	3					
CO2	3		3								3	3			3		
CO3	3		2	3						3	3	3			3		
CO4	3	3	3	2	2			3			3	3	3				3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEC93: SPECTRAL AND ANALYTICAL TECHNIQUES	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To study the electronic and magnetic properties of complexes.
LO2	To study applications of diffraction methods.
LO3	To know the characterization of inorganic compounds using ESR, NQR and Mossbauer spectroscopies..

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Evaluate the spectral and magnetic properties of complexes.
CO2	Analyse the spectral techniques like PES and ESR.
CO3	Gain knowledge on ORD and CD.

Unit-I: Spectral and Magnetic Properties of Complexes

Ground state Terms for d^1-d^9 ions- Derivation of terms for p^2 and d^1configurations. Characteristics of d-d transitions. Energy level diagrams – Orgel diagrams of d^1-d^9 - Tanabe-Sugano diagram of d^6. Effect of Jahn-Teller distortion, Nephelauxetic effect, - Selected examples of d-d spectra –$[Ti(H_2O)_6]^{3+}$, *trans*–$[Cr(en)_2F_2]^{+}$, $[Ni(en)_3]^{2+}$, $[Co(ox)_3]^{3-}$, $[Cu(H_2O)_6]^{2+}$.

Magnetism: dia, para, ferro and antiferro – magnetism – quenching of orbital angular momentum, Temp independent paramagnetism – Effect of spin orbit coupling on spectral and magnetic properties.

Unit – II: Photoelectron and ESR Spectroscopies

Valence and core binding energies – Measurement technique – Koopman's theorem – Chemical shifts in X-ray photoelectron spectroscopy – Auger spectroscopy – Applications of ESCA in chemistry.

Electron spin Resonance Spectroscopy – Origin of the spectrum – method of recording - hyperfine splitting – g value and hyperfine splitting constant - ESR spectra of simple organic radicals - application of ESR spectra to transition metal complexes

Unit - III: NQR and Mossbauer Spectroscopies

NQR spectroscopy – Theory of NQR – instrumentation – Nuclear quadrupole coupling constants – Applications.

Mossbauer spectroscopy – principle – source and absorber – isomer shift – quadrupole splitting – magnetic interactions – applications to Fe and Sn compounds.

Unit-IV: Diffraction Methods

Crystal systems and lattice types. Miller indices and Bravais lattices. Unit cells and its identification from systematic absence - the concept of reciprocal lattice – Structure factor and its relation with electron density –Analysis by powder X-ray diffraction and single crystal photography and its applications.

Electron and neutron diffraction – Elementary treatment – Wierl equation – Scattering of neutron by solids and liquids – comparison with X-ray diffraction – Magnetic scattering – measurement techniques – Elucidation of structure of a simple gas phase molecule.

Unit – V: Chromatography and ORD

Principles of gas – liquid and gas – solid chromatography – Instrumentation – Applications.

Principles and Applications of HPLC – supercritical fluids chromatography – Properties of supercritical fluids – Instrumentation and applications.

Theories of Optical Rotatory Dispersion and Circular Dichroism – correlation between structure and optical rotation – axial haloketone rule – Cotton effect – Octant rule – Deduction of absolute configuration of organic molecules and inorganic complexes.

UNIT VI (Not for final examination)

^{1}H, ^{13}C, ^{19}F, ^{17}O, ^{31}P and ^{119}Sn NMR spectra of coordination compounds – IR and Mass spectra of complexes – Hirshfield surface analysis.

Text Books

1. Huheey, J.E., (2011), , E. L. Keiter, R. L. Keiter, O. K. Medhi, *Inorganic chemistry,*Pearson Press, 5th edition, India.
2. Lee J.D., (2012), *Concise inorganic chemistry*, 5th edition, Wiley India,.
3. Kettle S. F. A, (1998),*Coordination Compounds*, Oxford University Press, London.
4. Day R. A., Underwood A. L. (2019), *Quantitative Analysis*, 6th edition, PHI Learning Pvt. India.
5. Drago R.S.(2015), *Physical Methods in Chemistry*, East West Press, 2nd edition.India.
6. Ebsworth. E. A. V, Rankine. D.W.H., Craddock. S.,(2000), *Structural Methods in Inorganic Chemistry*, Boca Raton, FL : CRC Press, Florida
7. Eland J.H.D., Butterworth, (1983), *Photoelectron Spectroscopy*, 2nd Edition, Elsevier.

8. Eliel E.L., (2011), *Stereochemistry of Carbon Compounds*, 42nd Ed. Tata McGraw Hilll India.
9. Eland. J.H.D., Butterworth, (2013),*Photoelectron Spectroscopy*, Butterworth-Heinemann, United Kindom.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3		3				
CO2	3		3								3		3				
CO3	3			3						3	3		2	3			
CO4	3	3								3	3		3				3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEC94: ELECTROCHEMISTRY AND SPECTROSCOPY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn the theories of electrochemistry.
LO2	To study detailsof Batteries and fuel cells.
LO3	To know the fundamental concepts of molecular, UV and IR spectroscopy.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the theories of strong electrolytes.
CO2	Acquire the knowledge about various electro analytical techniques.
CO3	Solve the numerical problems related to electrochemistry.

Unit – I: Electrochemistry - Theories of Strong Electrolytes and Electrochemical Cells

Debye-Huckel-Onsager equation and its verification, conductance at high field and high frequency, Debye-Huckel limiting law.

Electrochemical cell reactions, Nernst equation – electrochemical series. electrode- electrolyte interface, electrical double layer- Helmholtz-Perrin, Gouy-Chapmann and Stern theories – electro kinetic phenomena- Lipmann equation, corrosion and passivity –Pourbaix and Evans diagrams-methods of protection of metals from corrosion.

Unit – II: Electrochemistry- Electrode Reactions, Battery and Fuel Cell

Ion-solvent interactions – Born Model, Enthalpy, free energy and entropy of ion-solvent interactions. Primary and secondary solvations (salting in and salting out). Electrode kinetics – Butler-Volmer equation, Tafel equation, polarization and over voltage –mechanism of hydrogen evolution and oxygen evolution reactions. Batteries-Lead –acid battery, Lithium-Iron and Nickel-Cadmium battery. Fuel cell-hydrogen-oxygen and hydrocarbon-oxygen fuel cell.

Unit – III: Electroanalytical Methods

Principle and applications of electrogravimetry, coulometry – amperometry – potentiometry– conductometry – polarography – voltammetry – cyclic voltammetry – anodic stripping voltammetry.

Unit – IV: Molecular Spectroscopy

Origin of molecular Spectra-Vibrational spectra – harmonic and anharmonic oscillators – fundamental vibrations and overtones – hot bands. Rotational spectra of diatomic molecules-rigid rotor and non- rigid rotor-Effect of isotopic substitution. Vibrational-rotational spectra – P, Q, R branches. Electronic spectra of diatomic molecule – Potential energy curves – Franck-Condon Principle.

Raman spectra – theory – Selection Rules – Rotational Raman Spectra and Vibrational Raman Spectra. Mutual exclusion principle.

Comparison of Raman and IR spectra – structural determination from Raman and IR spectroscopy, rule of mutual exclusion.

Unit-V: UV – Visible and IR -Spectroscopy

Ultraviolet – Visible spectroscopy – types of electronic transitions – chromophores and auxochromes - factors influencing positions and intensity of absorption bands – absorption spectra of dienes, polyenes and , α ,β- unsaturated carbonyl compounds – Woodward – Fisher rules.

IR Spectroscopy – vibrational frequencies and factors affecting them – identification of functional groups – intra and inter molecular hydrogen bonding – finger print region – Far IR region – metal ligand stretching vibrations.

UNIT VI (Not for final examination)

Advanced Spectral Techniques

Raman Micro spectrometry applied to the Study of Electrode Materials-(Coherent Anti Stokes Raman spectroscopy (CARS), Resonance Raman, Time Resolved Raman Spectroscopy and Surface enhanced Raman spectroscopy and its applications. 2D IR Spectroscopy and Single photon Fluorescence spectroscopy and its applications - Single molecule spectroscopy and its applications.

Text Books

1. Glasstone S., (2008), *Introduction to Electrochemistry*, East West Pvt., Ltd. New Delhi.
2. Bockris O.M and. Reddy A. K. N,(2014), *Modern Electrochemistry*; Vol. 1 and 2, 2nd Ed., Plenum Press, New York.
3. Banwell C.N, (1993),*Fundamentals of Molecular Spectroscopy*, Tata McGraw Hill, ND.
4. William Kemp,(2011), Organic Spectroscopy,Mac Millan, UK.

5. Atkins P, Paula J. D,(2013), *Physical Chemistry*, 8th.Ed.Oxford University Press,Great Britan.

6. John R Dyer, (2005), *Application of absorption spectroscopy of organic compounds*, Prentice-Hall of India Pvt. Ltd, New Delhi.

Supplementary Reading

1. Antropov L., (2001),*Theoretical Electrochemistry;* University Press of the Pacific, US.

2. Compton R. G, (1987),*Electrode Kinetics: Reactions*; Elsevier Science Press, Chennai.

3. Levine. I. N, (1974), *Molecular Spectroscopy*, John Wiley & Sons, New York.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3										3			3			
CO2	3		3								3			2			
CO3	3		3	3						3	3			3			
CO4	3		2	1				3			3			3		3	3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEP95: INORGANIC CHEMISTRY PRACTICAL – II	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To develop skills in the determination of a metal ion in presence of another ion.
LO2	To determine the inorganic ions using appropriate technique.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the necessary practical skills to determine metal ions independently.
CO2	Gain expertise in systematic analysis of inorganic compounds.
CO3	Apply the knowledge in chemical industries.

Quantitative analysis

1) Determination of Ba^{2+} and Ca^{2+} ions
2) Determination of Cu^{2+} and Ni^{2+} ions
3) Determination of Cu^{2+} and Zn^{2+} ions
4) Determination of Cu^{2+} and SO^{2-} ions
5) Determination of Ca^{2+} and Mg^{2+} ions
6) Analysis of pyrolusite

Text Books

1. Vogel A. I, (2015), *Quantitative Inorganic Analysis*, 5th Ed., Prentice Hall, London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3					3			3						3
CO2	3	3	3					1	3		3						
CO3	3	3	3	1				2		3	3		3				3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEP96: PHYSICAL CHEMISTRY PRACTICAL – II	L	P	C
		0	6	3

Learning Objective (LO):

LO1	To learn the principles and verification of basic Electrochemistry
LO2	To learn the principles and verification of Kinetics.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the necessary practical skills in instrumental analysis.
CO2	Gain expertise in systematic calculations and graphical representation.
CO3	Apply the knowledge in industries.

I. Potentiometry Experiments

1) Single electrode potentials

2) Solubility of sparingly soluble salt

3) Redox titrations

a) Ferrous iron (II) Vs dichromate (Fe^{2+} vs $K_2Cr_2O_7$)

b) Iodide ion (I-) Vs KMnO4

c) Ferrous iron (II) Vs Cerium (IV) ion (Fe^{2+} Vs Ce^{4+})

4) Precipitation titrations

a) Chloride Vs Silver ion

b) Iodide Vs Silver ion

c) Mixture of chloride and iodide ions Vs Silver ion

5) Potentiometric titrations (by quinhydrone electrode)

a) Strong acid Vs Strong base

b) Mixture of acids (HCl + weak acid) Vs NaOH

II. Chemical Kinetics

1) Acid catalysed hydrolysis of an ester.

2) Comparison of acid strengths.

3) Persulphate – iodide kinetics – clock reaction – Primary salt effects

4) Saponification of an ester

5) Iodination of acetone

Text Books

1. Levitt B.P.,(1985), *Findlay`s Practical Physical Chemistry*, 9th Ed., Longman, London.
2. Gurtu J.N., KapoorR., (1987), *Advanced Experimental Chemistry*, Vol.I, S.Chand & Co., New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						1			3			3			
CO2	3		3								3			3			
CO3	3			3						3	3			3		3	3

***1-Low *2-Medium *3-Strong**

Semester IX	19IPSC090- CONSTITUTION OF INDIA	L	P	C
		2	0	2

Learning Objective (LO):

LO1	To understand the basic features of Indian Constitution.
LO2	To grasp about the basic Rights and Duties of Indian Citizens.
LO3	To ponder over the form of Indian Political System.
LO4	To have broad understanding about the pivotal provisions related with liberty, equality and fraternity.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Imbibe with the basic features of Indian Political System.
CO2	Enlighten themselves with the rights and duties of Indian Citizens.
CO3	Understand the significance of rule of law.
CO4	Inculcate with basic liberties.

Unit I : Constitution of India – Basic Features and Fundamental Principles

Making of Indian Constitutional Law and Constitutionalism- Historical Perspective of the Constitution of India –Salient features and Characteristics of the Constitution of India.

Unit II : Fundamental Rights and Duties

Scheme of Fundamental Rights-The Scheme of Fundamental Duties and its legal status-The Directive Principles of State Policy – Its Importance and Implementation.

Unit III : Legislative and Financial Powers of States

Federal Structure and Distribution of Legislative and Financial powers between the Union and the States-Parliamentary form of Government of India- The Constitution powers and States of the President of India.

Unit IV : Constitutional Amendments in India

The Historical Perspectives of the Constitutional Amendments in India – Emergency Provisions : National Emergency, President Rule- Financial Emergency.

Unit V : Fundamental Rights

Schemes of the Fundamental Right to Equality – Scheme of the Fundamental Rights to certain Freedom under Article 19 – Scope of the Right to Life and PersonalLiberty under Article 21.

Recent Ammendments in Constitution of India

Faculty member will impart the knowledge on Recent Ammendments in Constitution of India to the students and these components will not cover in the examination.

Text Books

1. Bipan Chandra, Mridula Mukherjee, AdilityMakherjee (2016)., *India After Independence 1947- 2000,* Penguin Publishers, New Delhi.
2. Durga Das Basu, (2018), *Introduction to the Constitution of India*, Prentice Hall, New Delhi.
3. JogendraYadav (2000), *Transforming India: Dynamics of Democracy*, Oxford University Press, New Delhi.

Supplementary Reading

1. *The Constitution of India*(1950)(Bare Act), Government of India Publications.
2. Busi S.N Ambedkar B.R(2015), *Framing of Indian Constitution.*
3. Jain M.P(2014*), Indian Constitution Law*, Lexis Nexis.
4. Paul R.Brass (1999),*The Politics of India Since Independence*,Cambridge University Press,India.
5. Granvila Austin (2006),*The Indian Constitution :Cornerstone of a Nation*, Oxford University Press, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		3	3		2					2					3
CO2		3	2		3	2					3			3	2
CO3	3	2		3	2					2			3	2	2

***1-Low *2-Medium *3-Strong**

Semester X	19ICHECX1: NUCLEAR, BIOINORGANIC AND MATERIALS CHEMISTRY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To study the radioisotopes and their applications.
LO2	To understand bioinorganics andtheir applications.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand lanthanides and actinides.
CO2	Acquire the knowledge andappreciate about bioinorganic chemistry
CO3	Learn preparative techniques in inorganic chemistry..

Unit-I: Nuclear Chemistry

Radioactive decay and equilibrium, Nuclear Q – value and nuclear cross sections, different types of nuclear reactions, fission and fusion. Theories of fission. Fissile and Fertile isotopes.-Nuclear fusion – stellar energy, Theories of α- and β- decay, orbital electron capture, nuclear isomerism, internal conversion. Hot atom chemistry. Radio isotopes and their Applications: Activation analysis, Isotopic dilution technique-radiometric titration- tracer technique. Counting techniques such as G. M. counter and proportional counter. Applications of nuclear science in industry, agriculture and biology.

Unit-II: Chemistry of Lanthanides and actinides

Correlation of electronic structures, occurrence and isolation, separation - Chemistry of separation of Np, Pu & Am from U & fission products. Oxidation states and general properties– Comparison with 'd' block elements, Lanthanide contraction and its significance, Coordination compounds of lanthanides - Spectral and magnetic characteristics of lanthanides and actinides - Position in the periodic table. Similarities between the actinides and lanthanides.

Unit-III: Bioinorganic Chemistry-I

Role of alkali and alkaline earth metals in biological systems– Mechanism of ion transport across membranes, Sodium – potassium pump - Ionophores – Metalloporphyrins –

cytochromes – iron-sulfur proteins: rubredoxin and ferredoxins. Oxygen carriers: hemerythrin and hemocyanin- structural features and function of myoglobin and haemoglobin – .Photosynthesis - PS-I and PS-II.

Unit-IV: Bioinorganic Chemistry-II

Enzymes-Inhibition and poisoning, Vitamin B_{12} and B_{12} coenzymes, metallothionine. Metalloenzymes-Carbonic anhydrase and Carboxy peptidase. -Nitrogen fixation- in vitro and in vivo. Transition metal-nucleic acid interaction. Anticancer activity of Pt-complexes-different types of active platinum complexes- Mechanism of anticancer activity of cis-platin. Nonactivity of trans-platin - Lithium therapy in psychiatric mind disorder.

Unit-V: Preparative techniques of inorganic materials

Principle of solid state reactions with reference to MgO and Al_2O_3 - Reaction conditions – Structural considerations – reaction rates – Wagner mechanism – nucleation and diffusion – surface structure and reactivity. Synthesis of $MgAl_2O_4$ (a spinel) – experimental procedure. Synthesis of a Zeolite - $(Na_x(AlO_2)_x(SiO_2)_y)mH_2O$ - Preparation of thin films – cathode sputtering – Preparation of metastable phase by sol-gel technique – Hydrothermal technique-Zone melting – Melts – vapour phase transport methods.

UNIT VI (Not for final examination)

Uses of nuclear radiations: Radiation sterilization – Radiation energy for chemical synthesis – Radioisotopes as a source of electricity.

Biological role of some trace non-metals: boron, silicon, sulphur, selenium, arsenic, fluorine, chlorine, bromine, iodine – role of metal complexes in conventional drug resistant to malaria.

Text Books

1. Keiter, E. L.,. Keiter R. L,. Medhi O. K, (2011), *Inorganic Chemistry - Principles of Structure and Reactivity*, Pearson Press, 5th edition, India.
2. Arnikar H. J., (2011), *Essential of Nuclear Chemistry*, New Age International,India.
3. Glasstone S., (2014), Source Book of Atomic Energy, Krieger Publishing Company, Florida.
4. Huheey, J.E., (2013), *Inorganic chemistry*, Pearson, London.
5. Anthony R. West,(2017), *Solid state chemistry and its applications*, John Wiley, New Delhi.
6. Arumugam. M.,(2003), *Material Science*, Anuradha Agencies, India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3	3				2	2
CO2	3		3								3	3				2	
CO3	3			3						3	3	3				2	
CO4	3	3						3			3	3				3	3

*1-Low *2-Medium *3-Strong

Semester X	19ICHECX2: NANO MATERIALS, MACROMOLECULAR AND SURFACE CHEMISTRY	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To learn about the synthesis and characterization techniques of nanomaterials
LO2	To understand the principle of various adsorption isotherms.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Evaluate the principle and applications of industrially important materials.
CO2	Understand concepts of polymers, mechanism, kinetics and applications.
CO3	Know various methods of preparations of nanomaterial and its characterization.

Unit - I: Synthesis and Applications of Nanomaterials

Preparation of nanomaterials – sol-gel synthesis, Chemical Vapour Deposition (CVD), electrodeposition, ball milling, plasma arcing, uses of natural nanoparticles. Synthesis and applications of carbon nanotubes.

Self assembled monolayers – monolayers on gold – preparation – structure – growth process – patterning monolayers – mixed monolayers.

Core-Shell nanoparticles – introduction – types of systems – characterization – properties. Monolayer–protected metal nanoparticles – characterization – functionalization – Application. Semiconductor quantum dots – synthesis – electronic structure & spectral properties

Sensors – Classification, Types of sensors, properties, chemical sensor, electrochemical sensors, optical sensors, biosensors, nanosensors, nanobiosensors, Applications of Nanosensors.

Unit - II: Characterization of Nanomaterials

Electron microscopes – scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning Transmission Electron Microscopy (STEM), Scanning Probe

Microscopy (SPM) – scanning tunneling microscopy (STM) – Atomic manipulations, Focused Ion beam (FIB) technique – Atomic force microscopy (AFM) – scanning probe Lithography (SPL), Dip pen nanolithography (DPN) - Optical microscopies for nanoscience and Technology – Confocal microscopy – scanning near-field optical microscopy – particle size analysis.

Unit - III Material Science

Band theory - insulators, semiconductors and conductors and their applications - superconductors and their applications – A study of conducting polymers, liquid crystals, NLO, LCD, LED and photochromic materials and their applications. Principle, properties and applications of ferroelectric, piezoelectric and pyroelectric materials.

Unit IV: Properties of Polymers

Polymer Processing: Plastics elastomers and fibres. Compounding processing techniques: calendaring, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

Polymer structure and physical properties –crystalline melting point Tm. Determination of Tg. Relationship between Tm and Tg..

Biopolymers – biomaterials. Polymers in medical field - High temperature and fire – resistant polymers.

Unit – V: Surface Chemistry

Langmuir and BET isotherms, Adsorption from solutions – Gibbs adsorption isotherm, surface area determination – Applications of adsorption – adsorption indicators. Study of surface film, surface tension, surface free energy: Pressure across an interface –Laplace and Kelvin equations. Surfactant-classification of surfactants, hydrophobic interaction, micellization of surfactant, critical micelle concentration, factors affecting the critical micelle concentration, thermodynamics of micellization.

UNIT VI (Not for final examination)

Nanostructures Carbon clusters: Discovery of C60 - alkali doped C60 - superconductivity in C60 - larger and smaller fullerenes. Carbon nanotubes: Synthesis-single walled carbon nanotubes – structure and characterization - Mechanism of formation - chemically modified carbon nanotubes – doping - Functionalizing nanotubes - Application of carbon nanotubes. Nanowires: Synthetic strategies - Gas phase and solution phase growth - Growth control - Properties.

Text Books

1. Pradeep T, (2007), *Nano-The Essentials*, Tata McGraw Hill, New Delhi.
2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, (2005), *Nanotechnology*, Overseas Press, India.
3. Billmeyer .W., (1984), *Text Book of polymer Science,* Johnwiley&Sons ,Newyork.
4. Arumugam M., (2016), *Materials Science*, Anuradha Agencies, 3rd Edition,.India.
5. Peter Atkins, Julio de Paula(2013), *Physical Chemistry*, Oxford press,Great Britain.

Supplementary Reading

1. Journals like Chemistry of Materials, Journal of Materials Chemistry, Advanced Materials etc. Web resource: http://chemistry.uohyd.ernet.in/~cy551/.
2. Rao C. N. R, Muller A and Cheetham A. K. (2004)(Eds), *The Chemistry of Nanomaterials*: Vol. 1 and 2; Wiley-VCH; Germany, Weinheim.
3. Gowrikar V. R., (2015), *Polymer Science*, New Age International. Hyderabad.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3	3				2	2
CO2	3		3								3	3				2	
CO3	3			3						3	3	3				2	
CO4	3	3						3			3	3				3	3
CO5	3			3						3	3	3				3	2

***1-Low *2-Medium *3-Strong**

Semester X	19ICHEPX3: ORGANIC CHEMISTRY PRACTICAL – III	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To understand the basic aspects of quantitative experiments in Organic Chemistry
LO2	To estimate the given organic compounds.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand and carry out quantitative analysis of organic compounds
CO2	Analyse glucose and ketones
CO3	Apply the knowledge in industries

Experiments:

Quantitative analysis and Estimation of phenol, aniline, methyl ketone and glucose by Volumetric analysis.

Text Books

1. Mohan. J., (2003), *Organic Analytical Chemistry-Theory and Practice*, Narosa., New Delhi.
2. Ahluwalia. V. K., Bhagat. P. and Aggarwal. R., (2005), *Laboratory Techniques in Organic Chemistry,* I.K. Int., New Delhi.
3. Gnanaprakasam. N. S., and Ramamurthy. G., (2000), *Organic Chemistry Lab Manual*, S.V. Printers., Chennai.
4. Vogel. A. I., Tatchell. A. R., Furnis. B. S., Hannaford. A. J., Smith. P.W.G., (2005), *Vogel's Textbook of Practical Organic Chemistry*, 5th Ed., Pearson., Chennai.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3	3					
CO2	3		3								3	3					
CO3	3			3						3	3	3					
CO4	3	3						3			3	3					3
CO5	3			3						3	3	3			3		3

*1-Low *2-Medium *3-Strong

Semester X	19ICHEPX4: INORGANIC CHEMISTRY PRACTICAL – III	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To know the colorimetric estimation of metal ions
LO2	To understand the complexometric titrations.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the colorimetric estimations of metal ions.
CO2	Evaluate the water quality like hardness etc.
CO3	Apply the knowledge in industries

Colorimetric analysis:

Colorimetric estimations of copper, nickel, iron and chromium using photoelectric colorimeter.

Complexometric Titrations:

a) Standardization of EDTA.

b) Determination of Mg^{2+}, Zn^{2+}, Ni^{2+} and Ca^{2+}

Water analysis:

a) Estimation of total alkalinity of water sample

b) Estimation of dissolved oxygen in waste water

c) Estimation of chloride content in water sample

d) Estimation of hardness in water sample by EDTA

e) Chemical oxygen demand (COD)

Preparation of the followings:

1) Tris (thiourea) copper(I) chloride

2) Potassium trioxalatoferrate

3) Tetraammine copper(II) sulphate

4) Microcosmic salt

5) Chrome alum

6) Trans-Diaquadioxalatochromate(III)

Text Books

1. Ramanujam V., (1988),*Inorganic Semi Micro Qualitative Analysis*, National Pubs, India.
2. Vogel A.I., (1989)*Text Book of Quantitative Inorganic Analysis*, 5th Ed., Longman,London.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3		3				
CO2	3		3						3		3		3				
CO3	3			3						3	3		3				
CO4	3	3						3			3		3			1	3
CO5	3			3						3	3		3				

***1-Low *2-Medium *3-Strong**

Semester X	19ICHEPX5: PHYSICAL CHEMISTRY PRACTICAL – III	L	P	C
		0	4	2

Learning Objective (LO):

LO1	To learn the principles and verification of Kinetics.
LO2	To understand the Phase diagrams.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Gain expertise in the instrumental analysis
CO2	Evaluate calculations involving in physical chemistry
CO3	Apply the gained knowledge in industries

Electrochemistry

1. Kinetics of saponification of ester by conductometric method.
2. Determination of activity, activity coefficient of ions
3. Determination of pH of a Buffer solution (potentiometer)
4. Determination of dissociation constant of weak acid by Potentiometer.

pH Metry

5. Dissociation constant of monobasic acid
6. Dissociation constant of dibasic acid
7. Dissociation constant of tribasic acid

Chemical Kinetics

8. Study the influence of cu^{2+} and Fe^{2+} on the reaction between persulfate and iodide ions.

9. Determination of energy of activation (Ea) for acid catalyzed hydrolysis of an ester.

Adsorption

10.Study of adsorption of acetic acid/oxalic acid on charcoal

Phase Rule

11. Two component system-simple Eutectic

12. Three component system.

Text Books

1. Levitt B.P., (1985), *Findlay`s practical Physical Chemistry*, 9th Ed., Longman, London.
2. Gurtu J.N., Kapoor R., (1987), *Advanced Experimental Chemistry*, Vol.I, S.Chand & Co.,New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3			3			
CO2	3		3								3			3			
CO3	3			3						3	3			3			
CO4	3	3						3		3	3			3		3	3

***1-Low *2-Medium *3-Strong**

Semester X	19ICHEDX6: PROJECT WORK	L	P	C
		0	12	6

Learning Objective (LO):

LO1	To learn the basics of research work.
LO2	To carry out selective academic and applied projects.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Acquire the practical knowledge of understanding research problems.
CO2	Gain knowledge about basic principles of various components of research.
CO3	Apply the principles of chemistry in various fields.

Project Work: Selective academic and applied projects

1. The students will be allotted under the guidance of On-Campus Teachers as **PROJECT GUIDES** by the Head of the Department.
2. The Project Students have to discuss with the respective project guide about their area of interest for selection of the Project Topic and submit the written **PROJECT TOPICS** to the Head of the Department which is certified by the research guide.
3. The students have to prepare the **Project Report/Dissertation** (not less than 50 pages) and Submission of the same at least one month before the last working day of the X Semester through their Research Guide.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3	3	3		3	3		3	3	3	3	3	3	3
CO2	3	3	3	3	3	3		2	3		3	3	3	3	3	3	2
CO3	3	3	3	3	3	2		3	3	3	3	3	3	3	3	3	3

***1-Low *2-Medium *3-Strong**

DEPARTMENT ELECTIVE COURSES

Semester I	19ICHEE15: APPLIED CHEMISTRY Elective I	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To study about basic chemistry of water technology
LO2	T o gain knowledge about fuels and corrosion.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the concept of water technology
CO2	Understand the mechanism of corrosion
CO3	Know about fuels and cementing materials.

UNIT-I: Water Technology-I

Introduction-Types of impurities in water, Hardness of water-Temporary and permanent hardness, equivalents of calcium carbonate - Determination of hardness by EDTA method-Disadvantages of hard water- Softening of hard water-Zeolite process - Analysis of water-alkalinity, chlorides, BOD and COD- Purification of water for domestic use: use of chlorine, ozone and UV light

UNIT-II: Water Technology-II

Water for industrial purposes-Boiler feed water (Water for steam making) Boiler troubles-carry over- priming- foaming – scales and sludges-water treatment- external treatment (lime soda process and ion exchange process, RO process) – Internal treatment (colloidal, phosphate, calgon, carbonate conditioning).

Unit-III: Corrosion

Definition-Theories of corrosion- dry corrosion (direct chemical attack), wet corrosion (electrochemical theory) – methods of prevention of corrosion- modifyingmetal properties by alloying- surface coatings: Galvanization- electroplating and anodisation -cathodic protection: sacrificial anode method- impressed voltage method. Modifying the environment –use of inhibitors.

Unit-IV: Fuels

Fuels: classification – combustion and chemical principles, units of heat – calorific value: gross and net calorific values and their determination by bomb calorimeter. Solid fuels: proximate and ultimate analysis of coal and their importance – high and low temperature carbonisation, coke: Petroleum - Chemical composition and fractional distillation, cracking of heavy oil residues – thermal and catalytic cracking, knocking and chemical structure, octane number and cetane number and their significance.

Unit –V: Inorganic cementing materials

Cement: Chemical constituents and composition of cement-Important process parameters for manufacturing good cement clinker – Methods of manufacturing cement- wet and dry process-sequence of operations- additives for cement- properties of cement: setting and hardening – Types of Portland cement – use of fly ash as cementing materials.

Current Streams of Thought: The Faculty will impart the current developments in the applied chemistry during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Jain & Jain, (2006).*A text book of Engineering Chemistry* by, DhanpatRai Publishing Company,15th Ed. New Delhi.
2. Murthy C.P., C.V. Agarwal and Naidu A., (2007), *Chemistry of Engineering Materials by* BS Publication Hyd. India.
3. Dara S.S., (2004), *A text book of Engineering Chemistry* by S.Chand& Co, New Delhi.
4. Kuriacose J C and Rajaram J., (2004), *Engineering Chemistry*, Tata McGraw-Hill Co, New Delhi .
5. Gopalan R., Venkappaya D and Nagarajan S (2004).*Engineering Chemistry*, Vikas Publishing House, New Delhi .

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	3							3			1			
CO2	3	3	3								3			1		1	
CO3	3	3	3					1			3			1	1		1

***1-Low *2-Medium *3-Strong**

Semester I	19ICHEE16: INDUSTRIAL CHEMISTRY Elective 2	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To study about fuels .
LO2	To gain knowledge about energy sources.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Categorize fuels and energy sources
CO2	Describe the types of polymerization methods as well as preparation and uses
CO3	Describe the composition and manufacturing process of cements and fertilizers

Unit I: Fuels and Energy Resources

Petroleum - origin of petroleum, composition, refining of petroleum fractionation composition of various fractions, cracking - catalytic and thermal cracking, synthetic petrol, knocking, octane and cetane numbers, anti knocking agents, coal gas, producer gas, Methane production from biomass, alcohol as fuel.

Unit II: Cement and Fertilizers

Cement - manufacture of Portland cement - composition - setting of cement -

special cements - Aluminium cement - white Portland cement - waterproof cement. Fertilizers - nitrogenous fertilizers - ammonium sulphate- urea - manufacture and action -potassium fertilizers -potassium sulphate - manufacture - phosphate fertilizers –superphosphate.

Unit III: Iron, Steel and Alloys

Manufacture of pig iron by blast furnace, wrought iron by puddling processes- steel by Bessemer's process - Heat treatment of steel. Alloys-purpose of making alloys - preparation of alloys by fusion method-electro deposition and reduction method - effects of carbon, silicon, phosphorus and sulphur - application of alloy steels.

Unit IV: Glass, Ceramics and Refractories

Glass, raw materials and colouring agents - chemical reaction involved in glass manufacture - some special glasses (borosilicate, alkali silicate, optical glass, soda lime glass, their properties and applications). Ceramics - various classes of ceramics, general properties, porous and non-porous wares, raw materials for ceramics, uses. Refractories - manufacture of refractories - properties and uses of common refractory bricks - silica bricks - fire clay bricks, magnesite bricks and dolomite bricks.

Unit V: Surface Coatings

Pre-treatment of the surface, metallic coating, galvanizing, tinning - Inorganic coatings.

Text Books

1. Jain & Jain, (2006).*A text book of Engineering Chemistry* by, DhanpatRai Publishing Company,15th Ed. New Delhi.
2. Murthy C.P., C.V. Agarwal and Naidu A., (2007), *Chemistry of Engineering Materials by* BS Publication, Hyderabad. India.
3. Dara S.S., (2004), *A text book of Engineering Chemistry* by S.Chand & Co, New Delhi.
4. Kuriacose J C and Rajaram J., (2004) *Engineering Chemistry*, Tata McGraw-Hill Co, New Delhi .
5. Gopalan R., Venkappaya D and. Nagarajan S (2004).*Engineering Chemistry*, Vikas Publishing House, New Delhi.

Current Streams of Thought: The Faculty will impart the current developments in the industrial chemistry during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**										**3**						
CO2	**3**	**3**									**3**					**3**	
CO3	**3**	**3**	**3**	**3**	**3**						**3**		**3**				
CO4	**3**	**3**									**3**		**3**				**3**

***1-Low** ***2-Medium** ***3-Strong**

Semester III	19ICHEE35: CHEMISTRY FOR MANKIND Elective 3	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To develop an understanding of food components such as carbohydrates, aminoacids, proteins etc.
LO2	To provide comprehensive introduction to sulpha drugs, antibiotics, fuels, polymers etc.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Describe the chemistry ofcarbohydrates.
CO2	Determine the structures of selected alkaloids and terpenes.
CO3	Classify proteins and demonstrate the primary and secondary structure of proteins.

Unit I - Carbohydrates

Introduction - classification-preparation and properties of glucose and fructose structure of glucose (configuration-not expected) mutarotation- interconversion of aldose and ketose. Increasing and decreasing the length of the carbon chain in sugars - polysaccharides-preliminary study of starch and cellulose. Industrial applications of starch and cellulose.

Unit II -Amino Acids and Proteins

Classification-preparation and properties of amino acids, isoelectronic point-tests for amino acids- polypeptides, peptide linkage, proteins - classification-denaturation of proteins, colour reactions, biological significance of proteins, structure of proteins, primary structure of proteins, end group analysis, preliminary study of secondary structure, introduction to DNA and RNA.

Unit III - Dyes, Leather and Fibers

Introduction-structural features of a dye-classification of dyes, preparation of methyl orange, fluorescein, malachite green, alizarin and uses (both textile and non-textile).

Leather:Basic principles in tanning and dyeing of leather, types of tanning (chrome and vegetable tanning) Fibers: Synthetic fibers derived from cellulose, nylon and terylene.

Unit IV - Sulpha Drugs, Antibiotics and Fuels

Introduction to sulpha drugs - sulphanilamide, sulphameracine, sulphaguanidine - preparation, mode of action of sulpha drugs. Antibiotics: very brief study of chloramphenicol, penicillin and tetracycline-their uses (detailed chemistry not required).

Fuels: Classification, characteristics of good fuel. Composition and uses of LPG, producer gas, water gas, method of production of gobar gas. Petroleum - knocking-use of tetraethyl lead diesel- octane and cetane number. Synthetic petrol, Bergius process.

Unit V - Polymers

Different types of polymerization-addition, condensation, ionic and free radical polymerization-mechanisms, synthesis and applications of the following polymers-PVC, polyester, polythene, Teflon, and polystyrene - rubber-natural rubber, vulcanization of rubber- synthetic rubber-neoprene

Text Books

1. Morrison R. T. and Boyd R.N., (2011), *Organic Chemistry*, 7th Edn ,Prentice Hall of India Pvt. Ltd., New Delhi.
2. Bahl A., Bhal B. S., (2016) *A Textbook of Organic chemistry*, S. Chand and Company Ltd, 22ndEdn., New Delhi.
3. Jain & Jain, (2006) *A text book of Engineering Chemistry* by, DhanpatRai Publishing Company,15th Ed. New Delhi.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3									2	3	3				3	
CO2	3	3		2					2		3	3		3			
CO3	3		2								3	3			3		3
CO4	3	3									3		3				3

***1-Low *2-Medium *3-Strong**

Semester III	19ICHEE36: FOOD CHEMISTRY Elective 4	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To learn about the food laws and general composition and quality criteria of the food products
LO2	To knowthe importance of toxicology and also the analysis of common adulterants..

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Describe the food laws.
CO2	Determine toxins and adulterants of food.
CO3	Describe about food additives.

UNIT – I: Food Laws and regulations

Food Laws and regulations (Mandatory) - Food Safety and Standards Act, 2006 (FSSA), Edible Oils Packaging (Regulation) Order, 1998, Environment (Protection) Act, 1986, Fruit Products Order, 1955 (FPO), Meat Food Products Order, 1973 (MFPO), Milk and Milk Product Order, 1992 (MMPO), Solvent Extracted Oil, De-oiled Meal-Introduction to various food laws (Voluntary) - Agmark Standards (AGMARK), Codex Alimentarius Standards, BIS Standards and Specifications, Consumer Protection Act, 1986-Codex standards for Cereals & Pulses- Codex standards for Fruits and Vegetables-Role of voluntary agencies and legal aspects of consumer protection

UNIT - II

General Composition and quality -Dairy products -Oil and Fats-Spices and condiments -Food Grains-Flours-Canned Foods-Fruit and Vegetables products-Meat and poultry-Sugar-Beverages- Alcoholic and Non Alcoholic drinks

UNIT- III

Importance of food toxicology -naturally occurring toxins in various foods -microbial and parasitic-food poisoning and food infections or foodborne illness-mycotoxins - aflatoxin-bacterial toxin-residual chemical contaminants-pesticides-heavy metals, hormones in food.

UNIT-IV

Comparison of adulterants and additives-food additives-antioxidants-Natural oxidants-synthetic oxidants-colour-stabilizer-surface active agents-artificial sweetener-flavor enhancers-Intentional adulterants-Incidental adulterants

UNIT - V

Analysis of adulterants- morphological and anatomical characterization-physical techniques-chemical/biochemical techniques-electrophoresis and immunology based techniques-molecular techniques-PCR and sequencing based techniques.

Text Books

1. Curtis P. A. (2013), *An operational Text Book, Guide to Food Laws and regulations*, Wiley Blackwell publishers, 2nd Edn.,UK.
2. Negi J. (2016), *Food & Beverage Laws - Food Safety and Hygiene*. ABD Publishers : Distribution, India.

Current Streams of Thought: The Faculty will impart the current developments in the food chemistryt during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3		3								3	3					3
CO2	3		3					2			3	3					
CO3	3	3		3							3	3					
CO4	3	3		3				2		2	3	3				1	3

*1-Low *2-Medium *3-Strong

Semester V	19ICHEE55: CLINICAL CHEMISTRY Elective 5	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To understand the basics of human organ functions
LO2	To impart knowledge on clinical biochemistry and laboratory practices.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the concepts of clinical chemistry
CO2	Get an idea aboutl laboratory techniques
CO3	Describeabout human organ functions.

Unit I - Basics of Human Metabolism

Basics of Human Organ Functions - Plasma proteins in disease - Liver function and disease - Carbohydrate metabolism and its disorders - Disorders of detoxification and excretory mechanisms - renal function, Acid base disorders, Electrolyte and water balance.

Unit II - Laboratory Techniques

Introduction to Clinical Laboratories - Laboratory Work Flow cycle - Phlebotomy equipments - Identification of Blood Collection Tubes &Preparation of Blood Plasma and Serum, Reticulocyte Count - Preparation of Blood Film -Blood staining, Liver Function Tests - Measurement of Serum ALT &AST, Liver Function Tests, Measurement of Serum Bilirubin (Total, direct &indirect).

Unit III - Renal Function

Renal Function Tests, Measurement of Serum BUN -Renal Function Tests - Measurement of Serum Creatinine Clearance -lipid Profile, - Routine Urine Analysis & Identification of Normal Physical and Chemical Urine Constituents.

Unit IV - Urine Analysis

Identification of Pathological Physical and Chemical Urine Constituents & Microscopic examination of Urine, Quantitative Determination of Urine Protein Proteinuria &Microalbuminuria Quantitative Determination of Urine Uric Acid Quantitative Determination of Urine Creatinine.

Unit V - Blood Analysis

Measurement of Serum Total cholesterol, Measurement of Serum LDL-C, Measurement of Serum HDL-C,-Measurement of Serum TG, Diabetic Profile Tests Measurement of Blood Glucose.

Text Books

1. Mohanty B and Basu, S. (2006), *Fundamentals of Practical Clinical Biochemistry*, B.I. publishers, New Delhi.

2. Chawla R., (2003),*Practical Clinical Biochemistry*: Methods and Interpretations, Jaypee Brothers Medical Publishers, 3rdEdn.,New Delhi.

Current Streams of Thought: The Faculty will impart the current developments in the clinical chemistry during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	3	2				3	1	3	3	3			2	2	3
CO2	3		3					2			3	3					

***1-Low *2-Medium *3-Strong**

Semester V	19ICHEE56: AGRICULTURAL CHEMISTRY Elective 6	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To know the importance of agricultural chemistry
LO2	To analyse and find a suitable method to promote agricultural methods.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the basics of soil.
CO2	Classify and explain plant nutrients and fertiliizers
CO3	Describe the structure and functions of plant growth regulators

Unit I - Chemistry of soil

Composition of soil - Organic and Inorganic constituents. - Chemical aspects of soil - acid, alkali and saline soil. Nitrogen fixation in soils - biological nitrogen fixation.

Unit II - Plant Nutrients and Fertilizers

Plant nutrients - Sources and roles of macro and micronutrients in plant growth - Nutritional deficiency in plants - symptoms, corrective measures - Fertilizers - classification of NPK fertilizers - natural and synthetic.

Unit III - Pesticides

Definition - Classification - organic and inorganic pesticides and its mechanism of action - Safe handling of pesticides, Fungicides - definition - classification - mechanism of action - sulfur, copper and mercury compounds.

Unit IV - Herbicides

Definition - classification - mechanism of action - Arsenic and boron compounds - urea compounds, nitro compounds and chlorocompounds.

Unit V - Plant Growth Regulators

Definition - Classification - Structure and functions of - Abscisic acid - Auxins - Cytokinins Ethylene - Gibberellins.

Text Books

1. Nelson S.L., and Beaton, W.L. Tisdale, J. D (1990) *Soil Fertility and Fertilizers*, Macmillian Publishing Company, New York.
2. Buchel K.H., (2008), *Chemistry of Pesticides*, John Wiley & Sons, New York.

Current Streams of Thought: The Faculty will impart the current developments in the agricultural chemsitry during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3									3	3					
CO2	3		3	2				2	2	3	3						
CO3	3		3								3	2					
CO4	3	3								3	3						3

*1-Low *2-Medium *3-Strong

Semester VIII	19ICHEE86: SELECTIVE MATERIALS, TECHNIQUES AND ENVIRONMENTAL CHEMISTRY Elective 7	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To know the importance of agricultural chemistry.
LO2	To learn basics of important instruments and study the aspects of pollution.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the chemical and biochemical principles of environmental processes in air, soil and water body.
CO2	Develop an understanding of chemicals and their effects on the environment.
CO3	Acquire broad knowledge of the field of environmental toxicology.

Unit I: Chemistry of Selective Materials

Glasses – Oxide glasses – bond type – Viscosity - Zachariasen's rules – Sun-Rawson criterion - Chalcogenide glass – the photocopying process – glass ceramics – applications – refractories – applications

- Solid electrolytes: AgI, RhAg4I5, β-Alumina – NASICON – Principles and Applications of solid electrolytes - Ferroelectric, piezoelectric and pyroelectric materials – principle, properties and applications. LED – principle

types – advantages and disadvantages of LED displays - Liquid crystal display LCD – properties – twisted nematic field display – Advantages and disadvantages of LCD – comparison of LCD & LED - Shape Memory alloys (SMA) – classification – working principles. Non-linear optical materials – second harmonic generators.

Unit II: Spectral and thermal techniques

Instrumentation of AAS, AES, Spectrofluorimetry, types of optical instruments components, sample preparation application in quantitative analysis - IR spectroscopy-instrumentation-detectors- various types of sources- monochromators- sample cell considerations - sample preparations - Principle of TGA, DTA and DSC – applications.

Unit III: Air and water pollution

Air Pollution: Sources of pollutants - SO_2,NO_2,CO_2, hydrocarbons and lead-pollutant particle size – aerosols and particulates – photochemical and industrial smogs - Air pollution - upper atmosphere – greenhouse effect - biochemical effect of heavy metals, PAN and cyanide

Water Pollution: Dissolved oxygen - BOD, COD - heavy metals as pollutants - thermal pollution– Chemical pollution.

Unit IV: Soil and radioactive pollutions

Soil pollution: Introduction – indicators of soil pollution - plants as indicators of soil pollution - sources of soil pollutions – fertilizers and pesticides - radioactive pollutants - solid wastes - treatments radioactive pollution.

Unit-V: Environmental Toxicology

Chemical solution to environmental problems, biodegradability, principles of decomposition, better industrial processes. Bhopal gas tragedy , Three Mile Island, Sewazo and Minamata disasters. Industrial Pollution: Cement, sugar, distillery, drug paper and pulp, thermal power plants, nuclear power plants, metallurgy polymers drugs etc., radio nuclide analysis, disposal of wastes and their management.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Anthony R.,(2017*), Solid state Chemistry and its applications, John wiley,*India.
2. Khopkar. S. M., (2008), *Basic concepts of Analytical Chemistry, New Age International Pvt Ltd Publishers,* India.
3. De. A.K.,(2017), *Environmental Chemistry, New Age International (P) Ltd,* India.
4. Khopkar. S.M.,(2005), *Environmental Pollution Analysis, New Age International (P) Ltd, Publishers,* India.
5. Baird. C.*, Cann. M.,(2012), Environmental Chemistry, Macmillan,* India.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	**3**	**3**						**3**			3						
CO2	**3**		**3**					3	**3**		3						
CO3	**3**			**3**				3		**3**	3			**1**			
CO4	**3**	**3**				**3**		**3**			3	**1**	**1**		3		**3**

***1-Low *2-Medium *3-Strong**

Semester VIII	19ICHEE87: APPLIED CHEMISTRY Elective 8	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To know the importance of Polymers and Fuels.
LO2	To learn about water pollution and nanomaterials.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the applications of nanomaterials.
CO2	Develop knowledge to analyse fuels.
CO3	Develop an understanding of some basic principles of photochemistry.

Unit - I: High Polymers

Naturally occurring Polymers -– Silk, Wool and collagen Synthesis, Properties and uses of the following polymers. PE, PP, PVC, PTFE, PMMA, PS, Bakelite, nylons, polyesters, polyamides, polyureas, Synthetic rubbers - Catenanes – 34 Carbon acyloin. Ion Exchange Resins.

Unit - II: Analysis of Water Pollution

Origin of waste water, types, water pollutants and their effects. Sources of water pollution – domestic, industrial, agricultural soil and radioactive wastes as source of pollution, objectives of analysis – parameter for analysis – colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy metal pollution. Public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic.General survey of instrumental technique for the analysis of heavy metals in aqueous systems.Measurement of DO, BOD and COD.Pesticides as water pollutants and analysis.Water pollution laws and standard.

Unit - III: Applied Photochemistry

Photographic sensitizers – cyanins – pinacyanine, Kryptocyanine – ultraviolet screening agents – Uvinol, Tinuvin – Fluorescent whitening agent – Blankophor– β calcofluor – SD color photography.Additive and subtractive processes.Chemistry of color Developers Flash photolysis.Chemistry of vision – organic transistors - Introduction examples, organic light emitting diodes – Applications.

Unit - IV: Fuel Analysis and Agricultural Chemistry

Solid, liquid and gaseous fuels – ultimate and proximate analysis – calorific values – gradingof coal – Liquid fuels – flash point, aniline point, octane number and carbon residues. Gaseous fuels - producer gas and water gas.

Analysis of soil: moisture, pH, total nitrogen, phosphorous, silica, lime, magnesia, manganese, sulphur and alkali salts.

Fertilizers: Fertilizer industries in India, manufacture of ammonia, ammonium salts, urea, nitrates, phosphates and superphosphates – mixed fertilizers – nitrogen fixation.

Unit - V: Organic Nanomaterials

Fullerenes – synthesis and purification – magnetic and optical properties.Carbon nanotubes – synthesis purification and functionalization.

Nanosensors – nanoscale organisation for sensors – Self-assembly-template method-biological assembling – Lithographic techniques – molecular nanomachines – introduction – single molecular devices.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Donald J. Abraham, (2003), *John Burger's Medicinal Chemistry and Drug Discovery*, Vol. I. Wiley & Sons, 2nd edition, New York.
2. Pradeep T., (2007),.*Nano: The Essentials*", Tata McGraw Hill, India .
3. Khopkar S. M., (1993), E*nvironmental Pollution Analysis*: *Wiley Eastern* Ltd, New Delhi.
4. De A.K.(1990), *Environmental Chemistry* ,WileyEastern., Ltd, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3						
CO2	3		3								3	2					
CO3	3			3						3	3			3			
CO4	3	3						3		2	3	3	3			3	3

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEE97: SCIENTIFIC RESEARCH METHODOLOGY Elective 9:	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To search for knowledge, purpose of research and scientific methods.
LO2	To learn sources of chemical literature and method of writing research reports.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the basics of research.
CO2	Appreciate the tools of research
CO3	Get exposure to research problems

UNIT - 1: Meaning of Research

The search for knowledge, purpose of research, scientific method, role of theory, characteristics of research - Types of research: fundamental or pure research, applied research, action research, historical research, experimental research.

UNIT - 2: Chemical Literature

Sources of chemical information: primary, secondary and tertiary sources - Indexes and abstracts in science and technology: applied science and technology index,biological abstracts, chemical abstracts, chemical titles, current chemical reactions, current contents, engineering index, index chemical, index medics, physics abstracts, science citation index - Classical and comprehensive reference works in chemistry. Beilstein, compilations of data, synthetic methods and techniques, treatises, reviews .

UNIT - 3: Chemical Abstracts

Current awareness searching: CA weekly issues, CA issue indexes - Retrospective searching: CA volumeindexes – general subject index, chemical substance index, formula index, index of ring systems, author index, patent index - 3CA Collective indexes: Collective index (CI), decennial index (DI) - Access points for searching CA indexes: index guide, general subject terms, chemical substance names, molecular formulas, ring systems, author names, patent

numbers - Locating the reference: finding the abstract, finding the original document, chemical abstract service source index.

UNIT - 4: Scientific Writing

Scientific writings: research reports, theses, journal articles, and books - requirement of technical communications: eliminating wordiness and jargon-tautology, redundancy, imprecise words, superfluous phrases - Steps to publishing a scientific article in a journal: types of publications-communications, articles, reviews; when to publish, where to publish, specific format required for submission, organization of the material - Documenting: abstracts-indicative or descriptive abstract, informative abstract, footnotes, endnotes, referencing styles, bibliography-journal abbreviations (CASSI), abbreviations used in scientific writing.

UNIT - 5: Computer Searches of Literature

ASAP Alerts, CA Alerts, SciFinder, ChemPort, ScienceDirect, STNInternational Journal home pages.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Dominoswki R. L., (1981), *Research Methods*, Prentice Hall,. New Delhi.
2. Best J. W., (1981), *Research in Education*, 4th ed. Prentice Hall, New Delhi.
3. Ebel H. F.,. Bliefert C and. Russey W. E, (1988), *The Art of Scientific Writing*, VCH, Weinheim.
4. Cain B. E., (1988),*The Basis of Technical Communicating*, ACS., Washington, D.C.
5. Kanare H. M., (1985), *Writing the Laboratory Notebook*; American Chemical Society: Washington, DC.
6. Dodd J. S, Ed., (1985),The ACS Style Guide: *A Manual for Authors and Editors*; American Chemical Society: Washington, DC.
7. Gibaldi J, Achtert W. S. (1987), *Handbook for writers of Research Papers*; 2nd ed.; Wiley Eastern, New Delhi.
8. Joseph, (1986), *A. Methodology for Research*; Theological Publications: Bangalore.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3		3	3		3	3			3		3				
CO2	3		3	3		3			3		3	2		2		2	2
CO3	3			3					3	3	3				1		

***1-Low *2-Medium *3-Strong**

Semester IX	19ICHEE98: ORGANIC CHEMICALTECHNOLOGY Elective10:	L	P	C
		3	0	3

Learning Objective (LO):

LO1	To understand the elements of chemical engineering in organic synthesis
LO2	To know the unit processes in organic chemical technology.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Understand the basics of chemical technology.
CO2	Appreciate principle of chemical engineering
CO3	Get idea about applications of chemistry in industries

UNIT - 1: Elements of Chemical Engineering

Unit operations in chemical engineering: Fluid flow: Reynold's number, Laminar and turbulent flow. Bernoulli's equation, head loss in piping.Calculation of head as an aid in selecting pumps. Turbulent flow and its relevance in heat transfer. Agitation and mixing of liquids - Heat transfer: Heat transfer coefficient, Importance of heat transfer in chemical process. Special provisions for heat transfer in highly exothermic reactions. Corrosion and scale formation in heat exchangers and condensers. Preliminary data to aid design of heat transfer equipment - Mass transfer: Distillation - two and three component systems. Ideal and non-ideal systems, various types of fractioning columns.

UNIT - 2: Applications of Thermodynamics in Organic Unit Processes

Energy balance over a flow system, heat of reaction, effect of temperature upon heat of reaction - Chemical equilibrium, calculation of equilibrium conversion, entropy changes, simultaneous reactions.

UNIT - 3: Organic Chemical Process Kinetics

Factors vapour phase and liquid phase catalytic reactions affecting chemical processes - Type and shape of reactors used, the method of operation, temperature control - Batch or flow process, batch mixing, fixed or fluidized bed.

UNIT - 4: Unit Process in Industrial Organic Synthesis

Study of Organic reactions as they apply to industrial processes. Process parameters of importance in scaling up of these reactions from laboratory to pilot plant to main plant - Selection of suitable plant equipment, especially the shape and size of the reactor stirrer, condenser etc. choice of material of construction - Study of industrial scale nitration, sulphonation, homogeneous and heterogeneous hydrogenation, oxidation and halogenation reactions.

UNIT-5: Study of Detailed Technologies of Manufacture – a dye, a drug and a pigment

Three specific chemicals, one each from the above category will be discussed, illustrating the chemical engineering principles used in proper selection of equipment - The logic involved in the layout of the plant, the control tests for the process itself and isolation methods of the product and its standardization - Importance of quality control and technical service to customers will be pointed out.

Text Books

1. McCabe W.L. and SmithJ.C., (1976), *Unit Operations of Chemical Engineering*, McGraw-Hill., Third Edition,New York.
2. Dridens, (2001), *Outlines of Chemical Technology*, Affiliated East-West Press Pvt. Ltd,New Delhi.
3. BIOS, CIOS and FIAT technical reports on the German chemical industry.
4. Chris A. Clausen and Guy Matson, (1978), *Principles of Industrial Chemistry*, John Willey & Sons, New York.

Current Streams of Thought: The Faculty will impart the current developments in the organic chemical technology during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3				2		3			3	3					
CO2	3		3				2		3		3	3				3	
CO3	3			3						3	3	3			3		3

*1-Low *2-Medium *3-Strong

ANCILLARY COURSES OFFERED TO THE OTHER DEPARTMENTS

Semester I/III	19ICHEA01: CHEMISTRY I	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To develop knowledge in Coordination Chemistry.
LO2	To understand basics in Chemical Kinetics and Photochemistry.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Analyze the experimental data and present it systematically.
CO2	Appreciate, describe and adopt suitable separation techniques.
CO3	Understand the role of metal ions in biological systems.

Unit–I : Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophilic & electrophilic) , elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect.

Unit–II : Chemistry of Some Useful Organic Compounds

Structure and uses of the following:

Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF_2Cl_2. Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III : Acid-Base Equilibria

Bronsted definition, Lewis definition, K_a K_b, pK_a and pK_b for Bronsted acids and bases. Relative strengths of Bronsted acids and bases. pH Buffer solution, Henderson's equation, Theory of acid-base indicators.

Unit–IV: Coordination Chemistry

Definition of terms-classification of ligands-chelation- Nomenclature of coordination compounds. Effective Atomic Number and its application to $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$ Role of metal ions in biological systems such as Hemoglobin, Vitamin B_{12}.

Unit–V : Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photsensitisation.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Text Books

1. Veeraiyan V,(2006), *Text book of Ancillary Chemistry*, High mount Publishing house, Chennai.
2. James E.Huheey, (1983), *Inorganic Chemistry*, 3rd edition, Harper & Row,Publishers, Asia, Pvt Ltd., Singapore.
3. Soni P.L. (2006), *Textbook of Organic chemistry*, S. Chand and Company,.New Delhi.
4. Soni P.L. (2006),*Text book of Inorganic Chemistry*, S. Chand and Company, New Delhi.
5. Puri B.R., Sharma and Pathania, (2006), *Text book of Physical Chemistry*, Vishal Publishing Co., Punjab.
6. Dara S.S., (2006), *Text book of Environmental chemistry and Pollution Control*.- S.Chand and Co. New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3									
CO2	3		3						3		3						
CO3	3			3						3							
CO4	3	3				3	3	3								3	3

*1-Low *2-Medium *3-Strong

Semester II/IV	19ICHEA02: CHEMISTRY II	L	P	C
		4	0	4

Learning Objective (LO):

LO1	To develop knowledge in Electrochemistry and Industrial chemistry.
LO2	To understand Quantitative Analysis and separation techniques.

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Analyze the quality of water samples
CO2	Appreciate , describe and adopt suitable separation techniques.
CO3	Identify compounds using spectral techniques.

Unit–I : Chemistry of Natural Products

Terpenoids: Structure and uses – Camphor, vetivones. Alkaloids – Structure and uses, papavarine, cocaine Structures and important biological properties

Unit–II : Electrochemistry

Galvanic cells – emf - standard electrode potential - reference electrodes -electrochemical series and its applications-glass electrode and pH determination - Electroplating process -Nickel and Chrome plating - Different types of cells - primary cell, secondary cell. Fuel cells. Corrosion and methods of prevention.

Unit–III : Industrial Chemistry

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

Unit–IV : Analytical Chemistry-I

Introduction to Quantitative Analysis and separation techniques - Principle of volumetric and gravimetric analysis-Estimation of hardness by EDTA method. Estimation of Ni, Ba and Cu by gravimetric methods. Electrogravimetry – theory of electrogravimetric analysis – determination

of copper (by constant current procedure) - Separation techniques - extraction - distillation – crystallization.

Unit–V : Analytical Chemistry-II

Colorimetric methods, Beer's law and its validity, estimation of fluoride ion by photocolorimeter, flame photometry and atomic absorption spectroscopy- NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

Text Books

1. Veeraiyan. V, (2006), *Text book of Ancillary Chemistry*, Highmount Publishing house, Chennai.
2. Vaithyanathan. S, (2006),.*Textbook of Ancillary Chemistry*, Priya Publications, Chennai.
3. Soni. P. L,(2006),*Text book of Organic chemistry*, Sultan Chand &Company,New Delhi.
4. Puri, Sharma and Pathania, (2006.),*Text book of Physical Chemistry*, Vishal Publishing Co., Jalandar.
5. Dara. S.S, (2006).*Text book of Environmental chemistry and Pollution Control*- S.Chand and Co., New Delhi.
6. Day. R.A and Underwood. A.L(1999), *Quantitative Analysis*, Prentice Hall,New Delhi.
7. Kemp.W, (1989), *Organic spectroscopy*, Palgrave, USA.
8. Silverstein R.M and F.X.Webster(1998)*Spectrometric identification of organic compounds*, John Wiley,New York.
9. Jag Mohan, (2000) *Organic spectroscopy* (Principles & Applications), Narosa Publishing house, India.

Current Streams of Thought: The Faculty will impart the current developments in the subject during the semester to the students and this component will not be a part of Examinations.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3					3										
CO2	3		3					3		3		3					
CO3	3			3					3								
CO4	3	3			3	3	3									3	3

***1-Low *2-Medium *3-Strong**

Semester II/IV	19ICHEP01: CHEMISTRY PRACTICAL - I	L	P	C
		0	4	4

Learning Objective (LO):

LO1	To develop knowledge in volumetric titrations.
LO2	To understand reactions involved in complexometric titrations..

Course Outcomes (CO):

At the end of the course, the student will be able to

CO1	Estimate commercial caustic soda for carbonate and hydroxide content.
CO2	Estimation of metal ions using EDTA and EBT as indicator.

Titrametric Analysis

1. Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution.
2. Standardization of given sodium hydroxide solution using potassium hydrogen phthalate.
3. Estimation of commercial caustic soda for carbonate and hydroxide content.
4. Titration involving $KMnO_4$ and standard sodium oxalate.
5. Estimation of Mg^{2+} using EDTA and EBT as indicator.
6. Estimation of Zn^{2+} using EDTA and EBT as indicator.

Text Books

1. Vogel A. I., (2002), *Textbook of Quantitative Inorganic Analysis*, Pearson India Publishers. Noida.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3						3			3						
CO2	3		3						3		3						

***1-Low *2-Medium *3-Strong**