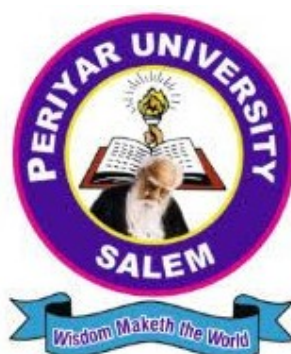


**PERIYAR UNIVERSITY**

**SALEM – 636 011**



**DEGREE OF BACHELOR OF SCIENCE  
CHOICE BASED CREDIT SYSTEM  
SYLLABUS FOR BRANCH IV – B.Sc., CHEMISTRY  
FOR THE STUDENTS ADMITTED FROM  
THE ACADEMIC YEAR 2026 - 2027 ONWARDS**

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## I. INTRODUCTION

### **B.Sc., Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome**

Chemistry is the study of composition and transformation of matter. Science is central to energy production, healthcare, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical Chemistry and specialized courses such as Pharmaceutical Chemistry, Spectroscopy, Chemistry in Nano Materials, Polymer Chemistry, Industrial Chemistry, Analytical Chemistry, Chemistry in Agriculture and so on. Thus, this programme inculcates learners in building a solid foundation for higher studies in Chemistry. The hands-on experience the students gain in practical's enables the students to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through industrial visit and filed visit.

Students completing this program will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to solve problems that mankind is facing today. They can interpret data and present their findings to both scientific community as well as laymen can work as a team and evolve to become an entrepreneur.

The completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc., Chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology and Forensic Science etc. They have employability opportunities in public and private sector jobs in Energy, Pharmaceutical, EV battery, Water testing, Chemical Manufacturing, food and Cosmetic industries etc...

## REGULATIONS

### **1. Condition for Admission**

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent there with Chemistry and Physics and any one of the following subjects namely Mathematics, Botany, Zoology or Biology shall be eligible for admission into B.Sc., course in Chemistry.

### **2. Duration of the Course**

The course for the degree of Bachelor of Science shall consist of three academic years divided into six semesters.

### **3. Course of study**

The course of study for the B.Sc., degree in the Branch IV-Chemistry shall comprise of the following subjects according to the syllabus and books prescribed from time to time. The Syllabus for various subjects shall be demarcated into five units in each subject.

**Part – I**                - Tamil / Other languages

**Part – II**              - English

- Part – III** - Core Courses  
Core Elective Courses  
Allied Courses  
and Practicals
- Part – IV** - Skill Enhancement Courses (SEC)  
Non-Major Elective (NME)  
Environmental Studies  
Value Education  
Disaster Managements  
Internship / Industrial Visit / Field Visit

**Extension Activity** - NSS / NCC / Sports / YRC and other co-curricular or extra-curricular activities offered under part -IV of the programmes

The two Allied subjects may be chosen by the respective colleges and the same must be communicated to the University.

Skill Enhancement Courses (Non-Major Elective) may be chosen by the respective colleges and the same must be communicated to the University.

The college may choose the allied subjects of its choice: Mathematics, Botany, or Zoology for the first year, and Physics for the second year.

#### **4. Examinations**

There shall be six examinations - two in the first year, two in the second year and two in the third year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations.

The syllabus has been divided into six semesters. Examinations (theory) for I, III and V semesters will be held in November / December and Examinations (theory and practical) for II, IV and VI semesters will be held in April / May.

##### **Requirement to appear for the examination**

A candidate shall be permitted to appear for the University examinations for any semester (theory or practical) if He / She secures not less than 75% of attendance in the number of working days during the semester.

#### **5. Passing Minimum**

A candidate who secures not less than 40% in the University (external) Examination and 40% marks in the external examination and continuous internal assessment put together in any course of Part I, II, III & IV shall be declared to have passed the examination in the subject (theory or practical). For practical, the minimum for a pass includes the record notebook marks also. There is no passing minimum for the record note book. However, submission of a record note book is a must.

#### **6. Classification of Successful Candidates**

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% of the marks in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

**Grading:**

Conversion of marks to Grade points and letter grade (Performance in a course / paper)

| Range of marks | Grade Points | Letter Grade | Description  |
|----------------|--------------|--------------|--------------|
| 90-100         | 9.0-10.0     | O            | Outstanding  |
| 80-89          | 8.0-8.9      | D+           | Excellent    |
| 75-79          | 7.5-7.9      | D            | Distinction  |
| 70-74          | 7.0-7.4      | A+           | Very Good    |
| 60-69          | 6.0-6.9      | A            | Good         |
| 50-59          | 5.0-5.9      | B            | Average      |
| 40-49          | 4.0-4.9      | C            | Satisfactory |
| 00-39          | 0.0          | U            | Re-appear    |
| ABSENT         | 0.0          | AAA          | ABSENT       |

$C_i$  = Credits earned for course I in any semester

$G_i$  = Grade point obtained for course I in any semester

N = Refers to the semester in which such course was credited

**Grade point average (for a Semester):**

Calculation of grade point average semester wise and partwise is as follows: GRADE POINT AVERAGE [GPA] =  $\sum C_i G_i / \sum C_i$

$$\text{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the courses offered under each part}}{\text{Sum of the credits of the courses under each part in a semester}}$$

**Calculation of grade point average (CGPA) (for the entire programme)**

A candidate who has passed all the examinations under different parts (Part – I to IV) is eligible for the following part wise computed final grades based on the range of CGPA.

$$\text{CUMULATIVE GRADE POINT AVERAGE [CGPA]} = \frac{\sum \sum C_{ni} G_{ni}}{\sum \sum C_{ni}}$$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme under each part}}{\text{Sum of the credits of the courses of the entire programme under each part}}$$

**Classification of successful candidates:**

A candidate who passes all the examinations in Part I to Part IV securing following CGPA and Grades shall be declared as follows for Part I or Part II or Part III:

| CGPA                        | GRADE | Classification of Final Result |
|-----------------------------|-------|--------------------------------|
| 9.5-10.0                    | O+    | First Class – Exemplary        |
| 9.0 and above but below 9.5 | O     |                                |
| 8.5 and above but below 9.0 | D++   | First Class with Distinction   |
| 8.0 and above but below 8.5 | D+    |                                |
| 7.5 and above but below 8.0 | D     |                                |
| 7.0 and above but below 7.5 | A++   | First Class                    |
| 6.5 and above but below 7.0 | A+    |                                |
| 6.0 and above but below 6.5 | A     |                                |
| 5.5 and above but below 6.0 | B+    | Second Class                   |
| 5.0 and above but below 5.5 | B     |                                |
| 4.5 and above but below 5.0 | C+    | Third Class                    |
| 4.0 and above but below 4.5 | C     |                                |

**7. Ranking**

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

**8. Maximum Duration for the completion of the UG Programme**

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

**9. Commencement of this Regulation**

These regulations shall take effect from the academic year 2026-2027, i.e., for students who are to be admitted to the first year of the course during the academic year 2026-2027 and thereafter.

## II. PO AND PSO DESCRIPTIONS

| LEARNING OUTCOMES-BASED ON CURRICULUM FRAMEWORK GUIDELINES AND REGULATIONS FOR UNDERGRADUATE PROGRAMME |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Programme:</b>                                                                                      | <b>B.Sc., Chemistry</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Programme Code:</b>                                                                                 | <b>26UCH</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Duration:</b>                                                                                       | <b>3 Years (UG)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Programme Outcomes:</b>                                                                             | <p><b>PO1: Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.</p> <p><b>PO2: Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p><b>PO3: Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p><b>PO4: Problem solving: Capacity</b> to extrapolate from what one has learned and applies their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p><b>PO5: Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p><b>PO6: Research-related skills:</b> A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.</p> <p><b>PO7: Cooperation/Teamwork:</b> Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.</p> <p><b>PO8: Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p><b>PO9: Reflective thinking:</b> Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.</p> |

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                     | <p><b>PO10: Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p><b>PO11: Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a practicals work completion.</p> <p><b>PO12: Multicultural competence:</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p><b>PO13: Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p><b>PO14: Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p><b>PO15: Lifelong learning:</b> Ability to acquire knowledge and skills, including learning how to learn, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.</p> |
| <b>Programme Specific Outcomes:</b> | <p>On successful completion of Bachelor of Chemistry programme, the student should be able to:</p> <p><b>PSO1: Disciplinary Knowledge:</b> Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.</p> <p><b>PSO2: Critical Thinking:</b> Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions, and communicate effectively.</p> <p><b>PSO3: Problem Solving:</b> Employ theoretical concepts and critical reasoning ability with physical, mathematical, and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.</p> <p><b>PSO4: Analytical &amp; Scientific Reasoning:</b> Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.</p> <p><b>PSO5: Bridging Industry and Research:</b> Adept at evaluating complex industrial processes and field environments to identify technical challenges. Skilled at leveraging these real-world insights to formulate targeted research objectives and align practical industry needs with higher academic studies.</p> <p><b>PSO6: Self-directed &amp; Lifelong Learning:</b> Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.</p>                                                                                                                                                                                                                                                                                                                                                                                       |

| PO/PSO | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 |
|--------|------|------|------|------|------|------|
| PO1    | ✓    |      |      |      |      |      |
| PO2    |      | ✓    |      |      |      |      |
| PO3    |      |      | ✓    |      |      |      |
| PO4    |      |      |      | ✓    |      |      |
| PO5    |      |      |      |      | ✓    |      |
| PO6    |      |      |      |      |      | ✓    |

## 2. Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial visit and exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.
- The core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The general studies and statistics-based problem-solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ maybe at the final Year.
- The curriculum is designed so as to strengthen the industry-Academia interface to provide more job opportunities for the students.
- The statistical quality control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The internship during the second-year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- State-of-the-Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as elective courses, covering conventional topics to the latest DBMS and Computer software for analytics.

### Value additions in the Revamped Curriculum:

| Semester        | Newly introduced components                                                                                                                                                                                                                   | Outcome / Benefits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I               | <b>Basic concepts in chemistry</b><br>To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world. | <ul style="list-style-type: none"> <li>Non chemistry students are equipped with essential skills</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| I, II, III, IV  | <b>Allied &amp; Skill Enhancement papers</b>                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Industry ready graduates</li> <li>Skilled human resource</li> <li>Students are equipped with essential skills to make them employable</li> <li>Training on computing / computational skills enable the students gain knowledge and exposure on latest computational aspects</li> <li>Data analytical skills will enable students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> <li>Entrepreneurial skill training will provide an opportunity for independent livelihood</li> <li>Generates self – employment</li> <li>Create small scale entrepreneurs</li> <li>Training to girls leads to women empowerment</li> <li>Discipline centric skill will improve the technical knowhow of solving real life problems using ICT tools</li> </ul> |
| III, IV, V & VI | <b>Elective papers</b>                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Strengthening the domain knowledge</li> <li>Introducing the stakeholders to the state-of-the-Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background</li> <li>Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors</li> </ul>                                                                                                                                                                                                                                                     |

|                                                              |                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>II Year<br/>Vacation<br/>activity</b>                     | Internship /<br>Industrial Training | <ul style="list-style-type: none"> <li>• Practical training at the Industry / Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students to gain professional experience and also become responsible citizens</li> </ul>                                                                                                                                                                                                                                    |
| <b>II/IV/VI</b>                                              | Practicals                          | <ul style="list-style-type: none"> <li>• Self-learning is enhanced</li> <li>• Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>                                                                                                                                                                                                                                                                                                                       |
| <b>For Advanced Learners /<br/>Honors/ Training / Degree</b> |                                     | <ul style="list-style-type: none"> <li>• Curriculum design accommodates all category of learners; ‘Statistics for Advanced Explain’ component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers;</li> <li>• ‘Training for Competitive Examinations’- caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.</li> </ul> |
| <b>Skills acquired from the<br/>Courses</b>                  |                                     | <ul style="list-style-type: none"> <li>• To cater to the needs of peer learners / research aspirants</li> <li>• Knowledge, Problem solving, Analytical ability, Professional competency, Professional communication and Transferrable skill</li> </ul>                                                                                                                                                                                                                                                 |

**III CREDIT DISTRIBUTION FOR UG B.Sc., CHEMISTRY**  
**Curriculum Design and Credit Distribution for UG Programme in Chemistry**  
**(Course of study and scheme of University Examination)**

**SEMESTER INDEX**  
**FIRST YEAR**

| S.No | Semester | Paper Code | Part | Course Group          | Paper Type | Subject Title                                                   | Hours Week | Exam Hours | Internal Marks | External Marks | Total Marks | Credit |
|------|----------|------------|------|-----------------------|------------|-----------------------------------------------------------------|------------|------------|----------------|----------------|-------------|--------|
| 1    | I        |            | I    | Language              | Theory     | Tamil-I                                                         | 6          | 3          | 25             | 75             | 100         | 3      |
| 2    |          |            | II   | Language              | Theory     | English-I                                                       | 6          | 3          | 25             | 75             | 100         | 3      |
| 3    |          | 26UCH01    | III  | Core                  | Theory     | General Chemistry-I                                             | 5          | 3          | 25             | 75             | 100         | 5      |
| 4    |          | 26UCHP01   | III  | Core                  | Practical  | Practical -I<br>Volumetric Estimations and Organic Preparations | 3          | -          | -              | -              | -           | -      |
| 5    |          |            | III  | Allied                | Theory     | Mathematics (or) Botany (or)<br>Zoology                         | 4          | 3          | 25             | 75             | 100         | 4      |
| 6    |          |            | III  | Allied                | Practical  | Practical -I Mathematics (or) Botany<br>(or) Zoology            | 3          | —          | -              | -              | -           | -      |
| 7    |          |            | IV   | Non-Major<br>Elective | Theory     | Skill Enhancement Course                                        | 2          | 3          | 25             | 75             | 100         | 2      |
| 8    |          | 26UVE01    | IV   | Value<br>Education    | Theory     | Yoga                                                            | 1          | 3          | 25             | 75             | 100         | 1      |
|      |          |            |      |                       |            |                                                                 | 30         |            |                |                |             | 18     |

### FIRST YEAR

| S.No | Semester | Paper Code | Part | Course Group          | Paper Type | Subject Title                                                      | Hours Week | Exam Hours | Internal Marks | External Marks | Total Marks | Credit |
|------|----------|------------|------|-----------------------|------------|--------------------------------------------------------------------|------------|------------|----------------|----------------|-------------|--------|
| 1    | II       |            | I    | Language              | Theory     | Tamil-II                                                           | 6          | 3          | 25             | 75             | 100         | 3      |
| 2    |          |            | II   | Language              | Theory     | English-II                                                         | 4          | 3          | 25             | 75             | 100         | 3      |
| 3    |          | 26UCH02    | III  | Core                  | Theory     | General Chemistry-II                                               | 5          | 3          | 25             | 75             | 100         | 5      |
| 4    |          | 26UCHP01   | III  | Core                  | Practical  | Practical -I<br>Volumetric Estimations and<br>Organic Preparations | 3          | 3          | 40             | 60             | 100         | 5      |
| 5    |          |            | III  | Allied                | Theory     | Mathematics (or) Botany (or)<br>Zoology                            | 4          | 3          | 25             | 75             | 100         | 4      |
| 6    |          |            | III  | Allied                | Practical  | Practical -I Mathematics (or)<br>Botany (or) Zoology               | 3          | 3          | 40             | 60             | 100         | 3      |
| 7    |          |            | IV   | Non-Major<br>Elective | Theory     | Skill Enhancement Course                                           | 2          | 3          | 25             | 75             | 100         | 2      |
| 8    |          | 26UDM01    | IV   |                       | Theory     | Disaster Management                                                | 1          | 3          | 25             | 75             | 100         | 1      |
| 9    |          |            | IV   | NMSDC                 | Theory     | Naan Mudhalvan                                                     | 2          | 3          | 25             | 75             | 100         | 2      |
|      |          |            |      |                       |            |                                                                    | 30         |            |                |                |             | 28     |

## SECOND YEAR

| S.No | Semester | Paper Code | Part | Course Group               | Paper Type | Subject Title                                                         | Hours Week                   | Exam Hours | Internal Marks | External Marks | Total Marks | Credit |
|------|----------|------------|------|----------------------------|------------|-----------------------------------------------------------------------|------------------------------|------------|----------------|----------------|-------------|--------|
| 1    | III      |            | I    | Language                   | Theory     | Tamil-III                                                             | 6                            | 3          | 25             | 75             | 100         | 3      |
| 2    |          |            | II   | Language                   | Theory     | English-III                                                           | 6                            | 3          | 25             | 75             | 100         | 3      |
| 3    |          | 26UCH03    | III  | Core                       | Theory     | General Chemistry-III                                                 | 4                            | 3          | 25             | 75             | 100         | 4      |
| 4    |          | 26UCHP02   | III  | Core                       | Practical  | Practical -II Qualitative Inorganic Analysis & Inorganic Preparations | 3                            | -          | -              | -              | -           | -      |
| 5    |          |            | III  | Allied                     | Theory     | Physics                                                               | 4                            | 3          | 25             | 75             | 100         | 4      |
| 6    |          |            | III  | Allied                     | Practical  | Practical -I Allied Physics                                           | 3                            | -          | -              | -              | -           | -      |
| 7    |          | 26UCHS01   | IV   | Skill Enhancement Course-I | Theory     | Polymer Chemistry                                                     | 2                            | 3          | 25             | 75             | 100         | 2      |
| 8    |          |            | IV   | NMSDC                      | Theory     | Naan Mudhalvan                                                        | 2                            | 3          | 25             | 75             | 100         | 2      |
| 9    |          |            | IV   | Health & Wellness          |            |                                                                       | Commended / Highly Commended |            |                |                |             | 1      |
|      |          |            |      |                            |            |                                                                       | 30                           |            |                |                |             | 19     |

## SECOND YEAR

| S.No | Semester | Paper Code | Part | Course Group                 | Paper Type | Subject Title                                                         | Hours Week | Exam Hours | Internal Marks | External Marks | Total Marks | Credit |
|------|----------|------------|------|------------------------------|------------|-----------------------------------------------------------------------|------------|------------|----------------|----------------|-------------|--------|
| 1    | IV       |            | I    | Language                     | Theory     | Tamil-IV                                                              | 6          | 3          | 25             | 75             | 100         | 3      |
| 2    |          |            | II   | Language                     | Theory     | English-IV                                                            | 6          | 3          | 25             | 75             | 100         | 3      |
| 3    |          | 26UCH04    | III  | Core                         | Theory     | General Chemistry-IV                                                  | 4          | 3          | 25             | 75             | 100         | 5      |
| 4    |          | 26UCHP02   | III  | Core                         | Practical  | Practical -II Qualitative Inorganic Analysis & Inorganic Preparations | 3          | 3          | 40             | 60             | 100         | 5      |
| 5    |          |            | III  | Allied                       | Theory     | Physics                                                               | 4          | 3          | 25             | 75             | 100         | 4      |
| 6    |          |            | III  | Allied                       | Practical  | Practical -I Allied Physics                                           | 3          | 3          | 40             | 60             | 100         | 3      |
| 7    |          | 26UCHS02   | IV   | Skill Enhancement Course -II | Theory     | Chemistry in Agriculture                                              | 2          | 3          | 25             | 75             | 100         | 2      |
| 8    |          |            | IV   | NMSDC                        | Theory     | Naan Mudhalvan                                                        | 2          | 3          | 25             | 75             | 100         | 2      |
|      |          |            |      |                              |            |                                                                       | 30         |            |                |                |             | 27     |

### THIRD YEAR

| S.No | Semester | Paper Code | Part | Course Group                                                  | Paper Type | Subject Title                                                         | Hours Week | Exam Hours | Internal Marks | External Marks               | Total Marks | Credit |
|------|----------|------------|------|---------------------------------------------------------------|------------|-----------------------------------------------------------------------|------------|------------|----------------|------------------------------|-------------|--------|
| 1    | V        | 26UCH05    | III  | Core                                                          | Theory     | Organic Chemistry-I                                                   | 4          | 3          | 25             | 75                           | 100         | 5      |
| 2    |          | 26UCH06    | III  | Core                                                          | Theory     | Inorganic Chemistry-I                                                 | 4          | 3          | 25             | 75                           | 100         | 5      |
| 3    |          | 26UCH07    | III  | Core                                                          | Theory     | Physical Chemistry-I                                                  | 4          | 3          | 25             | 75                           | 100         | 5      |
| 4    |          | 26UCH08    | III  | Core                                                          | Theory     | Analytical Chemistry                                                  | 4          | 3          | 25             | 75                           | 100         | 4      |
| 5    |          | 26UCHE01   | III  | Major Elective -I                                             | Theory     | Industrial Chemistry                                                  | 3          | 3          | 25             | 75                           | 100         | 3      |
| 6    |          | 26UCHP03   | III  | Core                                                          | Practical  | Practical-III Gravimetric Estimation and Qualitative Organic Analysis | 3          | -          | -              | -                            | -           | -      |
| 7    |          | 26UCHP04   | III  | Core                                                          | Practical  | Practical-IV Physical Chemistry Practicals                            | 3          | -          | -              | -                            | -           | -      |
| 8    |          | 26UCHS03   | IV   | Skill Enhancement Course-III                                  | Theory     | Chemistry in Nano Materials                                           | 2          | 3          | 25             | 75                           | 100         | 2      |
| 9    |          | 26UES01    | IV   | EVS                                                           | Theory     | Environmental Studies                                                 | 1          | 3          | 25             | 75                           | 100         | 2      |
| 10   |          |            | IV   | NMSDC                                                         | Theory     | Naan Mudhalvan                                                        | 2          | 3          | 25             | 75                           | 100         | 2      |
| 11   |          |            | IV   | Internship (Carried out in II-year summer vacation-Two weeks) |            |                                                                       |            |            |                | Commended / Highly Commended |             | 2      |
|      |          |            |      |                                                               |            |                                                                       | 30         |            |                |                              |             | 30     |

### THIRD YEAR

| S.No                     | Semester | Paper Code | Part | Course Group        | Paper Type | Subject Title                                                            | Hours Week | Exam Hours | Internal Marks | External Marks | Total Marks | Credit |   |
|--------------------------|----------|------------|------|---------------------|------------|--------------------------------------------------------------------------|------------|------------|----------------|----------------|-------------|--------|---|
| 1                        | VI       | 26UCH09    | III  | Core                | Theory     | Organic Chemistry-II                                                     | 5          | 3          | 25             | 75             | 100         | 5      |   |
| 2                        |          | 26UCH10    | III  | Core                | Theory     | Inorganic Chemistry-II                                                   | 5          | 3          | 25             | 75             | 100         | 5      |   |
| 3                        |          | 26UCH11    | III  | Core                | Theory     | Physical Chemistry-II                                                    | 5          | 3          | 25             | 75             | 100         | 5      |   |
| 4                        |          | 26UCHE02   | III  | Major Elective -II  | Theory     | Spectroscopy                                                             | 4          | 3          | 25             | 75             | 100         | 3      |   |
| 5                        |          | 26UCHE03   | III  | Major Elective -III | Theory     | Pharmaceutical Chemistry                                                 | 3          | 3          | 25             | 75             | 100         | 3      |   |
| 6                        |          | 26UCHP03   | III  | Core                | Practical  | Practical-III<br>Gravimetric Estimation and Qualitative Organic Analysis | 3          | 6          | 40             | 60             | 100         | 3      |   |
| 7                        |          | 26UCHP04   | III  | Core                | Practical  | Practical-IV<br>Physical Chemistry Practicals                            | 3          | 3          | 40             | 60             | 100         | 3      |   |
| 8                        |          |            | IV   | Extension Activity  |            |                                                                          |            | -          | -              | -              | -           | -      | 1 |
| 9                        |          |            | IV   | NMSDC               | Theory     | Naan Mudhalvan                                                           | 2          | 3          | 25             | 75             | 100         | 2      |   |
|                          |          |            |      |                     |            |                                                                          | 30         |            |                |                |             | 30     |   |
| Overall Credit (I to VI) |          |            |      |                     |            |                                                                          |            |            |                |                |             | 152    |   |

### Consolidated Semester wise and Component wise Credit distribution

| Parts    | Sem I | Sem II | Sem III | Sem IV | Sem V | Sem VI | Total Credits |
|----------|-------|--------|---------|--------|-------|--------|---------------|
| Part I   | 3     | 3      | 3       | 3      | -     | -      | 12            |
| Part II  | 3     | 3      | 3       | 3      | -     | -      | 12            |
| Part III | 9     | 17     | 8       | 17     | 22    | 27     | 100           |
| Part IV  | 3     | 5      | 5       | 4      | 8     | 3      | 28            |
| Total    | 18    | 28     | 19      | 27     | 30    | 30     | 152           |

**\*Part I, II and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components IV have to be completed during the duration of the programme as per the norms, to be eligible to obtain the UG degree.**

### IV. METHODS OF EVALUATION & METHODS OF ASSESSMENT

| Methods of Evaluation-Theory    |                                                                                                                 |                  |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------|
| Internal Evaluation             | Continuous Internal Assessment Test                                                                             | 25 Marks         |
|                                 | Assignments and Seminar                                                                                         |                  |
|                                 | Attendance and Class Participation                                                                              |                  |
| External Evaluation             | Odd & Even End Semester Examination                                                                             | 75 Marks         |
|                                 | <b>Total</b>                                                                                                    | <b>100 Marks</b> |
| Methods of Evaluation-Practical |                                                                                                                 |                  |
| Internal Evaluation             | Continuous Internal Assessment Test                                                                             | 40 Marks         |
|                                 | Attendance, Class Participation and Observation correction                                                      |                  |
| External Evaluation             | Even Semester Examination                                                                                       | 60 Marks         |
|                                 | Record                                                                                                          |                  |
|                                 | <b>Total</b>                                                                                                    | <b>100 Marks</b> |
| Methods of Assessment           |                                                                                                                 |                  |
| Recall(K1)                      | Simple definitions, MCQ, Recall steps, Concept definitions                                                      |                  |
| Understand/ Comprehend (K2)     | MCQ, True/False, Short essays, Concept explanations, short summary or Over view                                 |                  |
| Application (K3)                | Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain                          |                  |
| Analyze(K4)                     | Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge |                  |
| Evaluate(K5)                    | Longer essay/Evaluation essay, Critique or justify with pros and cons                                           |                  |
| Create(K6)                      | Check knowledge in specific or off beat situations, Discussion, Debating or Presentations                       |                  |

## **PATTERN OF QUESTION PAPER**

**Time: 3 Hours**

**Maximum: 75 Marks**

**Part A: 15x 1=15 (Answer all questions)**

**Choose the correct answer**

(Three questions from each unit)

**Part B: 2 x 5 = 10 (Answer any two questions)**

(One question from each unit with internal choice)

**Part C: 5 x 10= 50 (Answer All questions)**

[One question from each unit with internal choice (Either/Or)]

## **INTERNSHIP 2 WEEKS**

The students have the option to select any organization – Government / private like industry, R & D organizations, scientific companies, etc., in consultation with the staff coordinator & Head of the Department. The students have to undergo training for a period of two weeks at the end of semester- IV during vacation. The students must maintain a work diary and prepare a report of the training undergone and submit the same.

## **STUDY TOUR / INDUSTRIAL VISIT**

During the fifth or sixth semester, students may be permit to visit a chemical industry or research Centre and submit a supervised report. These visits allow students to explore industrial processes-such as petrochemical processing and pharmaceutical formulation-while applying classroom knowledge of unit operations and safety.

To ensure students develop professional analytical and synthetic skills, the curriculum facilitates direct engagement with national laboratories and chemical companies.

**B.Sc. CHEMISTRY (CBCS)**  
**PAPER CODES MAJOR**  
(Core, Elective, Skill Enhancement Course etc)

| <b>Semester</b>            | <b>CORE COURSE</b>                                                                  | <b>Course Code</b> | <b>Page No.</b> |
|----------------------------|-------------------------------------------------------------------------------------|--------------------|-----------------|
| I                          | General Chemistry-I                                                                 | 26UCH01            | 19              |
| II                         | General Chemistry-II                                                                | 26UCH02            | 26              |
| II                         | Practical-I Volumetric Estimations and Organic Preparations                         | 26UCHP01           | 33              |
| III                        | General Chemistry-III                                                               | 26UCH03            | 36              |
| III                        | Skill Enhancement Course I – Polymer Chemistry                                      | 26UCHS01           | 39              |
| IV                         | General Chemistry-IV                                                                | 26UCH04            | 42              |
| IV                         | Skill Enhancement Course-II Chemistry in Agriculture                                | 26UCHS02           | 45              |
| IV                         | Practical-II Qualitative Inorganic Analysis & Inorganic Preparations                | 26UCHP02           | 47              |
| V                          | Organic Chemistry-I                                                                 | 26UCH05            | 49              |
| V                          | Inorganic Chemistry-I                                                               | 26UCH06            | 52              |
| V                          | Physical Chemistry-I                                                                | 26UCH07            | 55              |
| V                          | Analytical Chemistry                                                                | 26UCH08            | 58              |
| V                          | Industrial Chemistry (Elective-I)                                                   | 26UCHE01           | 61              |
| V                          | Skill Enhancement Course III- Chemistry in Nano Materials                           | 26UCHS03           | 64              |
| VI                         | Internship                                                                          | 26UCHITR1          | -               |
| VI                         | Organic Chemistry-II                                                                | 26UCH09            | 67              |
| VI                         | Inorganic Chemistry-II                                                              | 26UCH10            | 70              |
| VI                         | Physical Chemistry-II                                                               | 26UCH11            | 73              |
| VI                         | Spectroscopy (Elective-II)                                                          | 26UCHE02           | 76              |
| VI                         | Pharmaceutical Chemistry (Elective-III)                                             | 26UCHE03           | 79              |
| VI                         | Practical-III Gravimetric Estimation and Qualitative Organic Analysis               | 26UCHP03           | 83              |
| VI                         | Practical-IV Physical Chemistry Practicals                                          | 26UCHP04           | 85              |
| VI                         | Extension Activity                                                                  | 26UEX01            | -               |
| <b>ALLIED CHEMISTRY</b>    |                                                                                     |                    |                 |
| I/III                      | Allied Chemistry-I                                                                  | 26UCHA01           | 88              |
| II/ IV                     | Allied Chemistry-II                                                                 | 26UCHA02           | 91              |
| II/ IV                     | Allied Chemistry Practical- Volumetric Estimations and Qualitative Organic Analysis | 26UCHAP01          | 94              |
| <b>NON-MAJOR CHEMISTRY</b> |                                                                                     |                    |                 |
| I                          | Basic Concepts in Chemistry                                                         | 26UCHN01           | 22              |
| I                          | Chemistry in Daily Life                                                             | 26UCHN02           | 24              |
| II                         | Food Chemistry                                                                      | 26UCHN03           | 29              |
| II                         | Cosmetics and Personal Care Products                                                | 26UCHN04           | 31              |

| Title of the Paper              | GENERAL CHEMISTRY-I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Semester-I                      | Core Chemistry-Major Paper I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Paper Code:26UCH01 |
| <b>Objectives of the Course</b> | <p>The course aims at giving an overall view of the</p> <ul style="list-style-type: none"> <li>• Various atomic models and atomic structure</li> <li>• Wave particle duality of matter</li> <li>• Periodic table, periodicity in properties and its application in explaining the chemical behaviour</li> <li>• Nature of chemical bonding, and</li> <li>• Fundamental concepts of organic chemistry</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                   |                    |
| <b>Course Outline</b>           | <p><b>UNIT-I Atomic structure and Periodic trends</b></p> <p>History of atom (J.J.Thomson); Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength - Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions - Hund's rule, Pauli's exclusion principle and Aufbau principle</p>                                                                                                                                                                                                                                                                                                                                       |                    |
|                                 | <p><b>UNIT-II Introduction to Quantum mechanics</b></p> <p>Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics-wave functions, formulation of Schrodinger wave equation (derivation not needed) - Probability and electron density-visualizing the orbitals and significance of <math>\Psi</math> and <math>\Psi^2</math>.</p> <p><b>Modern Periodic Table:</b> Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, and Covalent radii; ionization energy, electron affinity, electro negativity-electro negativity scales, applications of electro negativity.</p>                                                                            |                    |
|                                 | <p><b>UNIT-III: Structure and bonding - I</b></p> <p><b>Ionic bond:</b> Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle - lattice energies, relative effect of lattice energy and solvation energy; Ion polarization - polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds..</p> <p><b>Covalent bond</b> : Shapes of orbitals, overlap of orbitals - <math>\sigma</math> and <math>\pi</math> bonds-hybridization; VSEPR theory - shapes of molecules of the type <math>AB_2(H_2O)</math> and <math>AB_3(NH_3)</math> Partial ionic character of covalent bond - dipole moment, application to molecules of the type <math>A_2</math>, <math>AB</math> and <math>AB_2</math>.</p> |                    |
|                                 | <p><b>UNIT-IV: Structure and bonding – II</b></p> <p><b>VB theory</b> application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species - <math>CO_2</math>, <math>NO_2</math>, limitations of VBT</p> <p><b>MO theory</b> - bonding, antibonding and nonbonding, orbitals, bond order- MO diagrams of <math>H_2</math>, <math>O_2</math>, <math>N_2</math>, <math>CO</math>. Magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of <math>BF_3</math>, <math>NH_3</math> – properties</p> <p><b>Band theory</b> - mechanism of conduction in solids; conductors, insulator, semiconductor -P, N types, applications of semiconductors-Weak Chemical Forces - Vander Waals forces, Hydrogen bonding and its types</p>        |                    |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                       | <p><b>UNIT-V: Basic concepts in Organic Chemistry and Electronic effects</b></p> <p><b>Basic Nomenclature of Hydrocarbon, Hybridisation:</b> Shapes of molecules - Types of bond cleavage- Homolytic and heterolytic fissions with suitable examples. Types, shape and relative stability of carbocations, carbanions, carbenes and free radicals.</p> <p>Electrophiles and nucleophiles, and introduction to types of organic reactions: addition, elimination and substitution reactions.</p> <p><b>Electron displacement effects and their applications:</b> Inductive, Inductomeric, Eelectromeric, resonance, mesomeric, hyperconjugation and steric effect - Concept of dipole moment, acidity and basicity.</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Madan, R. D. and Sathya Prakash, <i>Modern Inorganic Chemistry</i>, 2<sup>nd</sup>ed.; S. Chand and Company: New Delhi, 2003.</li> <li>2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000.</li> <li>3. Puri, B. R. and Sharma, L. R. <i>Principles of Physical Chemistry</i>, 38<sup>th</sup>ed.; Vishal Publishing Company: Jalandhar, 2002.</li> <li>4. Bruce, P. Y. and Prasad K. J. R. <i>Essential Organic Chemistry</i>, Pearson Education: New Delhi, 2008.</li> <li>5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand &amp; Sons: New Delhi, 2016</li> </ol>                                        |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, 4<sup>th</sup>ed. The Macmillan Company: Newyork, 1972.</li> <li>2. Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London, 1991.</li> <li>3. Gurudeep Raj, Advanced Inorganic Chemistry, 26<sup>th</sup>ed.; Goel Publishing House: Meerut, 2001.</li> <li>4. Atkins, P.W. &amp; Paula, J. Physical Chemistry, 10th ed.; Oxford University Press: New York, 2014.</li> <li>5. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4<sup>th</sup> ed .; Addison, Wesley Publishing Company: India, 1993.</li> </ol>                                         |
| <b>Website and e-learning source</b>                                                                                                  | <ol style="list-style-type: none"> <li>1) <a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a></li> <li>2) <a href="http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm">http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm</a></li> <li>3) <a href="http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html">http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html</a></li> <li>4) <a href="https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding">https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding</a></li> <li>5) <a href="https://www.chemtube3d.com/">https://www.chemtube3d.com/</a></li> </ol>           |

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to****CO1:** Explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.**CO2:** Classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.**CO3:** Apply the theories of atomic structure, bonding, to calculate energy of a spectral transition,  $\Delta x$ ,  $\Delta p$  electro negativity, percentage ionic character and bond order.**CO4:** Evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects**CO5:** Construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO 5 |
|----------------------------------------------------------|------|------|------|------|-------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3     |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3     |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3     |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3     |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3     |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15    |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0   |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>BASIC CONCEPTS IN CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Semester - I</b>             | <b>Non Major Elective-I</b> <b>Paper Code: 26UCHN01</b>                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Objectives of the course</b> | <p>The Course aims to make the students to</p> <ol style="list-style-type: none"> <li>1. Understand the lab safety measures</li> <li>2. Outline the basic concepts of organic chemistry</li> <li>3. Describe the importance of periodic table</li> <li>4. Explain the fundamentals of physical properties</li> <li>5. Understand the importance of redox chemistry</li> </ol>                                                                                              |
| <b>Course Outline</b>           | <p><b>Unit-I : Chemistry Lab-General Awareness and First Aid Techniques</b><br/>           Safety in chemistry lab- introduction to laboratory glass wares-storage and handling of chemicals-carcinogenic chemicals - handling of ethers - toxic and poisonous chemicals.<br/>           Burns and damages due to organic substances- acids, alkalies - burns in the eye-inhalation of toxic vapours-hazardous chemicals-dealing with bromine, phenol and hot objects.</p> |
|                                 | <p><b>Unit-II: Introduction to Organic Chemistry</b><br/>           Catenation-Classification - Homologous Series - General Molecular Formula-Functional Groups - General and IUPAC Nomenclature - Modern concept of bonding in organic molecules, <math>sp^3</math>, <math>sp^2</math> and <math>sp</math> hybridization in carbon by taking methane, ethane and benzene as examples.</p>                                                                                 |
|                                 | <p><b>Unit-III : Introduction to Inorganic Chemistry</b><br/>           Atomic orbitals and concept of atomic orbitals - shape of s,p and d orbitals-periodic table and the classification of elements - Electronic configuration of elements up to atomic number 30, Types of Chemical bonds – Schematic Illustration of bonds.</p>                                                                                                                                       |
|                                 | <p><b>Unit-IV: Introduction to Physical Chemistry</b><br/>           Units - Fundamental units - derived units and SI Units - Significant Figures-States of matter - types - properties of solids, liquids and gases - solid state - types of solids - amorphous and crystalline solids - properties of liquids and gases.</p>                                                                                                                                             |
|                                 | <p><b>Unit-V: Basic concepts of Redox Chemistry</b><br/>           Definition - oxidation and reduction reactions-calculation of oxidation numbers- Equivalent weight-definition-calculation of equivalent weight of acids, bases and salts. Reduction potential and electrochemical series.</p>                                                                                                                                                                           |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC and others to be solved<br>(To be discussed during the tutorial hours)                                                                                                                                                                                                                                                                                                                            |
| Skills acquired from this course                                                                                                      | Knowledge, Problem Solving, Analytical ability, Professional Competency, professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Recommended Text Books</b>                                                                                                         | <ol style="list-style-type: none"> <li>1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 33<sup>rd</sup> Edition, Milestone Publishers and Distributors, New Delhi, India (2020)</li> <li>2. Arub Bahl, B.S. Bahl, A Text Book of Organic Chemistry, 22<sup>nd</sup> Edition, S. Chand &amp; Co (2019).</li> <li>3. B.R. Puri, L.R. Sharma &amp; M.S. Pathania, Principles of Physical Chemistry, 48<sup>th</sup> Edition, Vishal Publishing Co (2020).</li> </ol> |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

### CO-PO Mapping (Course Articulation Matrix)

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>CHEMISTRY IN DAILY LIFE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Semester - I</b>             | <b>Non Major Elective-II</b> <b>Paper Code: 26UCHN02</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Objectives of the course</b> | <p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• Importance of Chemistry in everyday life</li> <li>• Chemistry of building materials and food</li> <li>• Chemistry of Drugs and pharmaceuticals</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Course Outline</b>           | <p><b>UNIT-I</b><br/>General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution</p> <p><b>UNIT-II</b><br/>Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.</p> <p><b>UNIT-III</b><br/>Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents - balanced diet - Calories minerals and vitamins (sources and their physiological importance). Cosmetics - tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.</p> <p><b>UNIT-IV</b><br/>Chemicals in food production - fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.</p> <p><b>UNIT-V</b><br/>Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.</p> |
| <b>Recommended Text</b>         | <ol style="list-style-type: none"> <li>1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.</li> <li>3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.</li> <li>4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor &amp; Francis Group, 2019.</li> <li>5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &amp; Co. Publishers, second edition, 2006.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977.<br>2. W.A.Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.<br>3. A.K.De, Environmental Chemistry, New Age International Public Co., 1990. |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to</b><br><b>CO1:</b> Learn about the chemicals used in everyday life as well as air pollution and water pollution.<br><b>CO2:</b> Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters,<br><b>CO3:</b> Acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.<br><b>CO4:</b> Discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses<br><b>CO5:</b> Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications. |                                                                                                                                                                                                                                                                          |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PO                                                   | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>GENERAL CHEMISTRY - II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Semester - II</b>            | <b>Core Chemistry-Major Paper II</b> <b>Paper Code:26UCH02</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Objectives of the course</b> | <p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• Chemistry of acids, bases and ionic equilibrium</li> <li>• Properties of s and p-block elements</li> <li>• Chemistry of hydrocarbons</li> <li>• Applications of acids and bases</li> <li>• Compounds of main block elements and hydrocarbons</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Course Outline</b>           | <p><b>UNIT-I Acids, bases and Ionic equilibria</b><br/> <b>Concepts of Acids and Bases</b> - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; dissociation constant; ionic product of water, pH scale, pH of solutions; Degree of dissociation, , factors affecting degree of dissociation.</p> <p><b>Buffer solutions</b> - types, mechanism of buffer action in acid and basic buffer, Henderson - Hasselbach equations. Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases;<br/> Solubility product - determination and applications; numerical problems involving the core concepts.</p> <p><b>UNIT-II Chemistry of s - Block Elements</b><br/> Hydrogen: Position of hydrogen in the periodic table. Alkali metals, alkaline earth metals. Basic properties and uses of alkali and alkaline earth metals: Ionic radii, atomic radii, ionization energy, electron affinity, electronegativity and screening effect. Physical and chemical properties of alkali and alkaline earth metals. Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, KClO<sub>3</sub> alkaline earth metals.</p> <p><b>Chemistry of p- Block Elements (Group 13 &amp; 14)</b><br/> Preparation and structure of diborane and borazine - Chemistry of borax - Extraction of Al and its uses – Chemistry of Metals, Nonmetals and metalloids: Alloys of Al, Comparison of carbon with silicon - Per carbonates, per mono carbonates and per di carbonates</p> <p><b>UNIT-III Chemistry of p- Block Elements (Group 15-18)</b><br/> General characteristics of elements of Group - 15; Chemistry of H<sub>2</sub>N-NH<sub>2</sub> , PH<sub>3</sub> and PCl<sub>5</sub> - Oxy acids of phosphorous H<sub>3</sub>PO<sub>3</sub> and H<sub>3</sub>PO<sub>4</sub>.</p> <p>General properties of elements of Group - 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - Oxy acids of sulphur (Caro's and Marshall's acids).</p> <p>Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO<sub>4</sub>). Inter-halogen compounds (ICl, ClF<sub>3</sub>, BrF<sub>5</sub> and IF<sub>7</sub>).</p> <p>Noble gases: Position in the periodic table. Preparation, properties and structure of XeF<sub>2</sub>, XeF<sub>4</sub> and XeOF<sub>4</sub></p> |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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|                                                                                                                                       | <p><b>UNIT-IV Hydrocarbon Chemistry-I</b></p> <p><b>Alkanes:</b>, Preparation Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.</p> <p><b>Cycloalkanes:</b> Preparation by Dieckman condensation, Baeyer's strain theory and applications.</p> <p><b>Alkenes:</b> Preparation Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction), addition of HX (Markownikoff's and anti Markownikoff's addition).</p> <p><b>Alkynes:</b> Preparation of acetylene from <math>\text{CaC}_2</math> and conversion into higher alkynes by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.</p> <p><b>UNIT-V Hydrocarbon Chemistry – II</b></p> <p><b>Benzene:</b> Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's <math>(4n+2)</math> rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation.</p> <p><b>Polynuclear Hydrocarbons</b></p> <p>Introduction, Classification, Structure, Nomenclature and uses. Aromaticity of polynuclear hydrocarbons, structure elucidation of Naphthalene and general methods of preparation of naphthalene and anthracene- Physical properties and chemical Properties for Naphthalene and Anthracene.</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved</p> <p>(To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Recommended Text                                                                                                                      | <ol style="list-style-type: none"> <li>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup>ed, S.Chand and Company, New Delhi.</li> <li>2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17<sup>th</sup> ed., S.Chand and Company, New Delhi.</li> <li>3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3<sup>rd</sup> ed., S.Chand and Company, New Delhi.</li> <li>4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2<sup>nd</sup> ed., Vikas Publishing House, New Delhi.</li> <li>5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38<sup>th</sup> ed., Vishal Publishing Company, Jalandhar.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4<sup>th</sup> ed., The Macmillan Company, Newyork.</li> <li>2. Barrow G M, (1992), Physical Chemistry, 5<sup>th</sup> ed., Tata McGraw Hill, NewDelhi.</li> <li>3. Lee J D, (1991), Concise Inorganic Chemistry, 4<sup>th</sup>ed., ELBS William Heinemann, London.</li> <li>4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4<sup>th</sup> ed., Addison Wesley Publishing Company, India.</li> <li>5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26<sup>th</sup> ed., Goel Publishing House, Meerut.</li> <li>6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8<sup>th</sup>ed., Goel Publishing House, Meerut.</li> </ol> |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <a href="https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html">https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html</a><br><a href="http://www.auburn.edu/~deruija/pdareson.pdf">http://www.auburn.edu/~deruija/pdareson.pdf</a><br><a href="https://swayam.gov.in/course/64-atOMIC-structure-and-chemical-bonding">https://swayam.gov.in/course/64-atOMIC-structure-and-chemical-bonding</a><br><b>MOOC components</b><br><a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a><br>Lecture 1: Classification of elements and periodic properties<br><a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a>                                              |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><b>On completion of the course the students should be able to</b><br><b>CO1:</b> Explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons<br><b>CO2:</b> Discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids<br><b>CO3:</b> Classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons<br><b>CO4:</b> Explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements<br><b>CO5:</b> Assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>FOOD CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Semester-II</b>              | <b>Non Major Elective-III</b> <b>Paper Code: 26UCHN03</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Objectives of the course</b> | <p>This course aims at giving an overall view of the</p> <ul style="list-style-type: none"> <li>● Types of food</li> <li>● Food adulteration and poisons</li> <li>● Food additives and preservation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Course Outline</b>           | <p><b>UNIT-I Food Adulteration</b><br/>Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.</p> <p><b>UNIT-II Food Poison</b><br/>Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.</p> <p><b>UNIT-III Food Additives</b><br/>Food additives -artificial sweeteners - Saccharin - Cyclamate and Aspartate Food flavours -esters, aldehydes and heterocyclic compounds - Food colours - Emulsifying agents - preservatives -leavening agents. Baking powder - yeast - tastemakers - MSG - vinegar.</p> <p><b>UNIT-IV Beverages</b><br/>Beverages-soft drinks-soda-fruit juices - alcoholic beverages-examples. Carbonation-addiction to alcohol - diseases of liver and social problems.</p> <p><b>UNIT-V Edible Oils</b><br/>Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.</p> |
| <b>Recommended Text</b>         | <ol style="list-style-type: none"> <li>1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &amp; Co.Publishers, second edition, 2006.</li> <li>3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.</li> <li>5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science &amp; Business Media, 4<sup>th</sup> Edition, 2009.</li> <li>2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.</li> <li>3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.</li> <li>4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.</li> <li>5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.</li> </ol> |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to</b><br><b>CO 1:</b> Learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.<br><b>CO 2:</b> Get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion<br><b>CO 3:</b> Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.<br><b>CO 4:</b> Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.<br><b>CO 5:</b> Study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>COSMETICS AND PERSONAL CARE PRODUCTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Semester-II</b>              | <b>Non Major Elective-IV</b> <b>Paper Code: 26UCHN04</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Objectives of the course</b> | <p>This course aims at familiarizing the students with</p> <ul style="list-style-type: none"> <li>• Formulations of various types of cosmetics and their significance</li> <li>• Hair, skin and dental care</li> <li>• Makeup preparations and personal grooming</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Course Outline</b>           | <p><b>UNIT-I Skin care</b><br/> Nutrition of the skin, skin care and cleansing of the skin; face powder - ingredients; creams and lotions - cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels - formulation and advantages; astringent and skin tonics - key ingredients, skin lightness, depilatories.</p> <p><b>UNIT-II Hair care</b><br/> Shampoos - types - powder, cream, liquid, gel – ingredients; conditioner – types- ingredients<br/> <b>Dental care</b><br/> Tooth pastes - ingredients - mouth wash</p> <p><b>UNIT-III Make up</b><br/> Base - foundation - types - ingredients; lipstick, eyeliner, mascara, eyeshadow, concealers, rouge</p> <p><b>UNIT-IV Perfumes</b><br/> Classification - Natural - plant origin - parts of the plant used, chief constituents; animal origin - amber gries from whale, civetone from civet cat, musk from musk deer; synthetic - classification emphasizing characteristics - esters - alcohols - aldehydes - ketones</p> <p><b>UNIT-V Beauty treatments</b><br/> Facials - types - advantages - disadvantages; face masks - types; bleach - types - advantages - disadvantages; shaping the brows; eyelash tinting; perming - types; hair colouring and dyeing ; permanent waving - hair straightening; wax -types - waxing; pedicure, manicure - advantages – disadvantages</p> |
| <b>Recommended Text</b>         | <ol style="list-style-type: none"> <li>1. Wilkinson J. B. E. and Moore R. J., (1997), <i>Harry's Cosmeticology</i>, 7th ed., Chemical Publishing Co., London.</li> <li>2. Barel A. O., Paye M. and Maibach H. I., (2014), <i>Handbook of Cosmetic Science and Technology</i>, 4th ed., CRC Press, Boca Raton.</li> <li>3. Draelos Z. D., (2005), <i>Cosmetic Formulation of Skin Care Products</i>, Taylor &amp; Francis, New York.</li> <li>4. Paye M., Barel A. O. and Maibach H. I., (2001), <i>Handbook of Cosmetic Science and Technology</i>, Marcel Dekker Inc., New York.</li> <li>5. Poucher W. A., (2000), <i>Poucher's Perfumes, Cosmetics and Soaps</i>, 10th ed., Kluwer Academic Publishers, Dordrecht.</li> <li>6. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chetten</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ol style="list-style-type: none"> <li>1. Milady, (2016), <i>Milady Standard Cosmetology</i>, 13th ed., Milady Publishing, Clifton Park, New York.</li> <li>2. Baran R. and Maibach H. I., (1998), <i>Textbook of Cosmetic Dermatology</i>, 2nd ed., Martin Dunitz Ltd., London.</li> <li>3. Butler H., (2000), <i>Poucher's Perfumes, Cosmetics and Soaps</i>, 10th ed., Kluwer Academic Publishers, London.</li> <li>4. Schlossman M. L., (2015), <i>The Chemistry and Manufacture of Cosmetics</i>, 4th ed., Allured Publishing Corporation, Illinois.</li> <li>5. Dayan N. and Kromidas L., (2011), <i>Formulating, Packaging and Marketing of Natural Cosmetic Products</i>, Wiley-Blackwell, New Jersey.</li> </ol> |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ol style="list-style-type: none"> <li>1. <a href="http://www.khake.com/page75.html">http://www.khake.com/page75.html</a> Net.foxsm/list/284</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><br><b>On completion of the course the students should be able to</b><br><br><b>CO1:</b> know about the composition of various cosmetic products<br><b>CO2:</b> understand chemical aspects and applications of hair care and dental care and skin care products.<br><b>CO3:</b> understand chemical aspects and applications of perfumes and skin care products.<br><b>CO4:</b> to understand the methods of beauty treatments their advantages and disadvantage<br><b>CO5:</b> understand the hazards of cosmetic products. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>VOLUMETRIC ESTIMATIONS AND ORGANIC PREPARATIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Semester-II</b>              | <b>Core Practical - I</b> <b>Paper Code: 26UCHP01</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Objectives of the course</b> | <p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• Laboratory safety</li> <li>• Handling glass wares</li> <li>• Quantitative estimation of</li> <li>• Preparation of Organic compounds</li> <li>• Compare the migration distance of an unknown compound against pure substance Confirm identity standard references</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outline</b>           | <p><b>UNIT- I (Not for Examination)</b></p> <p><b>Chemical Laboratory Safety in Academic Institutions</b></p> <p>Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.</p> <p><b>Common Apparatus Used in Quantitative Estimation (Volumetric)</b></p> <p>Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.</p> <p><b>Principle of Quantitative Estimation (Volumetric)</b></p> <p>Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</p> <p>Determination of boiling point of liquids.</p> <p><b>UNIT-II Quantitative Estimation (Volumetric)</b></p> <p><b>Acidimetry and Alkalimetry</b></p> <ol style="list-style-type: none"> <li>1.Estimation of hydrochloric acid using standard oxalic acid</li> <li>2.Estimation of sodium hydroxide using standard sodium carbonate</li> </ol> <p><b>Permanganometry</b></p> <ol style="list-style-type: none"> <li>1.Estimation of oxalic acid using standard ferrous ammonium sulphate</li> <li>2. Estimation of ferrous iron using standard oxalic acid</li> </ol> <p><b>Dichrometry</b></p> <ol style="list-style-type: none"> <li>1.Estimation of ferric alum using standard dichromate (external indicator)</li> <li>2.Estimation of ferrous iron using standard ferrous sulphate (internal indicator-diphenyl amine)</li> </ol> <p><b>Iodometry</b></p> <ol style="list-style-type: none"> <li>1.Estimation of copper in copper sulphate using standard dichromate</li> </ol> |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | <p><b>Unit-III Complexometric</b><br/> 1.Estimation of Zn and Mg using EDTA<br/> 2.Estimation of hardness of water<br/> <b>Estimations</b><br/> 1.Estimation of iron in iron tablets Estimation of ascorbic acid</p> <p><b>Unit-IV Preparation of Organic Compounds</b></p> <ul style="list-style-type: none"> <li>• Halogenation - p-Bromo acetanilide from Acetanilide</li> <li>• Oxidation - Benzoic acid from Benzaldehyde</li> <li>• Methyl benzoate to Benzoic acid</li> <li>• Salicylic acid from Methyl Salicylate</li> <li>• Hydrolysis of Benzamide to Benzoic Acid</li> <li>• Nitration - p-nitro acetanilide and m-dinitrobenzene</li> <li>• Preparation of Methyl Orange</li> </ul> <p><b>Unit-V Chromatography</b><br/> Thin-Layer Chromatography (TLC) or Paper Chromatography qualitatively identify and differentiate organic preparations by monitoring reactant disappearance and confirming product formation based on variations in their molecular structures, functional groups, and overall polarities</p> |
| Skills acquired from this course | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Recommended Text                 | 1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry, 2 <sup>nd</sup> ed.; Sultan Chand & Sons: New Delhi, 1997.<br>2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in Practical Chemistry, 3 <sup>rd</sup> ed.; New Central Book Agency: Kolkata, 2007.<br>3. Stahl E., (1969), Thin Layer Chromatography: A Laboratory Handbook, 2nd ed., Springer-Verlag, Berlin.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Reference Books                  | 1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; <i>Vogel's Textbook of Quantitative Chemical Analysis</i> , 6 <sup>th</sup> ed.; Pearson Education Ltd: New Delhi, 2000.<br>2. Sharma B. K., (2011), <i>Instrumental Methods of Chemical Analysis</i> , 24th ed., Goel Publishing House, Meerut.<br>3. Chatwal G. R. and Anand S. K., (2014), <i>Instrumental Methods of Chemical Analysis</i> , 5th ed., Himalaya Publishing House, Mumbai.<br>4. Furniss B. S., Hannaford A. J., Smith P. W. G. and Tatchell A. R., (1989), <i>Vogel's Textbook of Practical Organic Chemistry</i> , 5th ed., Longman Scientific & Technical, London.                                                                                                                                                                                                                                                                                                                                                                  |
| Website and e-learning source    | <b>Web References:</b><br>1) <a href="http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis">http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis</a><br>2) <a href="https://chemdictionary.org/titration-indicator/">https://chemdictionary.org/titration-indicator/</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On successful completion of the course the students should be able to**

**CO1:** Explain the basic principles involved in titrimetric analysis and organic preparations.

**CO2:** Compare the methodologies of different titrimetric analysis.

**CO3:** Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.

**CO4:** Assess the yield of different organic preparations and identify with using chromatography  
TLC/Paper

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO / PSO                                                 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 12   | 12   | 12   | 12   | 12   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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| <b>Title of the Paper</b>       | <b>GENERAL CHEMISTRY - III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Semester - III</b>           | <b>Core Chemistry-Major Paper III</b> <b>Paper Code:26UCH03</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Objectives of the course</b> | <p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none"> <li>• The physical properties of gases, liquids, solids and X-ray diffraction of solids.</li> <li>• Fundamentals of nuclear chemistry and nuclear waste management.</li> <li>• Applications of nuclear energy</li> <li>• Basic chemistry of halo - organic compounds, phenol and other aromatic alcohols.</li> <li>• Preparation and properties of phenols and alcohols.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Course Outline</b>           | <p><b>UNIT-I Gaseous state</b><br/> Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell - Boltzmann distribution of speed of molecules – Definition of average, root mean square (RMS) and most probable velocity (MPV) and average kinetic energy, degrees of freedom and molecular basis of heat capacities. Definition of Collision frequency; collision diameter; mean free path.<br/> <b>Real gases:</b> Deviations from ideal gas behavior, compressibility factor, Z, and its variation with pressure for different gases-VanderWaal's equation.</p> <p><b>UNIT-II Liquid and Solid State</b><br/> Properties of Liquids and solids - Surface tension, viscosity and their applications. Crystalline and amorphous - differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Liquid crystals - classification and applications.<br/> Symmetry elements - plane, center and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X - ray diffraction - Bragg's equation Packing in atomic solids - simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO<sub>2</sub>; comparison of structure and properties of diamond and graphite;. numerical problems involving core concepts<br/> Defects in solids - stoichiometric and nonstoichiometric defects.</p> <p><b>UNIT-III Nuclear Chemistry</b><br/> Nuclear forces- atomic mass unit- packing fraction – mass defect and binding energy of the nucleus Stability of nuclei. Nuclear models- the liquid drop model. Nuclear reactions- nuclear fission- fission of uranium- nuclear reactors- types- importance of thorium in India's nuclear energy production. Nuclear fusion Radio activity- natural radio activity- rate of radio activity disintegration – half life period- transmutation of elements- group displacement law- radio active decay series. Isotopes, isobars, isotones - uses - Isotopes-separation of isotopes - applications of isotopes in analytical chemistry, medicine, and in reaction mechanism - Carbon dating - Neutron activation analysis. Major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measure</p> |

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|                                                                                                                                      | <p><b>UNIT-IV Halogenated Hydrocarbons :</b> Nomenclature , Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent; nucleophilic substitution vs. elimination.</p> <p>Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; S<sub>N</sub>Ar, Benzyne mechanism.</p> <p>Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.</p>                                                                                                                                                                            |
|                                                                                                                                      | <p><b>UNIT-V Alcohols</b><br/>Nomenclature, classification, preparation, properties and uses.</p> <p><b>Phenols :</b> Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raschig- process; properties - acidic character and effect of substitution on acidity. Reactions - Fries, Claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimenn, Kolbe, Schmidt, Gattermann synthesis</p> <p><b>Benzyl alcohol :</b> Nomenclature, - methods of preparation - hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis (RMgX), physical properties - Reactions with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride and hydrogen iodide</p>                    |
| Extended Professional Component (is apart of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved<br/>(To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Skills acquired from this course                                                                                                     | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Recommended Text</b>                                                                                                              | <ol style="list-style-type: none"> <li>1. B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i>, 46<sup>th</sup> edition, Vishal Publishing, 2020.</li> <li>2. B.R. Puri, L.R. Sharma and K.C. Kalia, <i>Principles of Inorganic Chemistry</i>, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.</li> <li>3. 4. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand &amp; amp; Sons, twentieth edition, 2006.</li> <li>4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003.</li> <li>5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.</li> </ol> |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1. T. W. Graham Solomons, <i>Organic Chemistry</i> , John Wiley & Sons, fifth edition, 1992.<br>2. A. Carey Francis, <i>Organic Chemistry</i> , Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.<br>3. I. L. Finar, <i>Organic Chemistry</i> , Wesley Longman Ltd, England, sixth edition, 1996.<br>4. P. L. Soni, and H. M. Chawla - <i>Text Book of Organic Chemistry</i> , New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.<br>5. J.D. Lee, <i>Concise Inorganic Chemistry</i> , Blackwell Science, fifth edition, 2005. |            |            |            |            |            |            |            |            |             |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>MOOC components</b><br><a href="https://nptel.ac.in/courses/104104101">https://nptel.ac.in/courses/104104101</a> Solid state chemistry<br><a href="https://nptel.ac.in/courses/103106071">https://nptel.ac.in/courses/103106071</a> Nuclear industries and safety<br><a href="https://nptel.ac.in/courses/104106119">https://nptel.ac.in/courses/104106119</a> s Introduction to organic chemistry                                                                                                                                                          |            |            |            |            |            |            |            |            |             |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> On completion of the course the students should be able to<br><b>CO1:</b> explain the kinetic properties of gases by using mathematical concepts.<br><b>CO2:</b> describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.<br><b>CO3:</b> investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.<br><b>CO4:</b> write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.<br><b>CO5:</b> investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |            |            |            |            |            |            |            |             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>PO1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | S          | S          | S          | S          | S          | S          | M          | S          | M           |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | S          | S          | S          | M          | S          | S          | M          | M          | M           |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | S          | S          | M          | S          | S          | S          | M          | S          | M           |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | S          | S          | S          | S          | S          | S          | M          | M          | M           |
| <b>CO5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | M          | S          | S          | S          | S          | S          | M          | M          | S           |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PO                                                   | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>POLYMER CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Semester - III</b>           | <b>Skill Enhancement Course-I</b> <b>Paper Code:26UCHS01</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Objectives of the course</b> | <p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• Classification of polymers, preparation of polymers</li> <li>• Kinetics of polymerization and characterization of polymers</li> <li>• Analytical techniques used to characterize polymers</li> <li>• Reactions of polymers</li> <li>• Speciality polymers like PVC, PMMA</li> </ul>                                                                                                                                                                                                                                                |
| <b>Course Outline</b>           | <p><b>UNIT-I Basic concepts</b><br/> <b>Introduction:</b> Classification - synthetic and natural, organic and inorganic, polymer tacticity, thermoplastic and thermosetting. Plastics, elastomers, fibers and liquid resins. Degree of polymerization and functionality of polymers- rubber - synthetic and natural, vulcanization of rubber.<br/> <b>Techniques of polymerization</b><br/> Bulk, solution, emulsion and suspension polymerization techniques</p>                                                                                                                                                                  |
|                                 | <p><b>UNIT-II Kinetics of polymerization</b><br/> Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation - reactivity ratios - block and graft copolymers.<br/> <b>Characterization of polymers</b><br/> Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state</p>                                                                                                                      |
|                                 | <p><b>UNIT-III Molecular Weight and Properties of Polymers</b><br/> Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index - membrane and vapour phase osmometry, light scattering - Zimm plot, End group analysis, ultracentrifuge - sedimentation velocity and sedimentation equilibrium - viscometry - gel permeation chromatography Thermal properties of polymers - Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature and its importance.</p> |
|                                 | <p><b>UNIT-IV</b><br/> <b>Reactions of Polymers</b>-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional groups in the Polymer.<br/> <b>Polymer technology</b><br/> Processing of polymers - casting, thermoforming, moulding- extrusion, compression, blow moulding - foaming, lamination, reinforcing - processing of fibers - melt, wet and dry spinning</p>                                                                                                                                                              |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                       | <p><b>UNIT-V Polymer Degradation and Speciality Polymers</b></p> <p><b>Polymer Degradation</b> :Types of Degradation-Thermal, Mechanical, Ultrasound, photodegradation and chemical Degradation. Rubber-Natural and Synthetic-Structure- Biodegradable and Non-Biodegradable Polymers.</p> <p><b>Speciality polymers</b> : Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers - two examples of each of these polymers. Preparation, properties and uses of Polyethylene, PVC, PMMA, polyester, polycarbonate and polyurethane.</p>                    |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/>(To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science.</li> <li>2. New Delhi: New Age International, 2015</li> <li>3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.</li> <li>4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005</li> <li>5. Ahluwalia, V.K. Anuradha Mishra, <i>Polymer Science A Text Book</i>, Ane Books India: New Delhi, 2008.</li> <li>6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. <i>Organic Chemistry</i>, 7<sup>th</sup> ed.; Pearson: New Delhi, 2011.</li> </ol>                           |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007.</li> <li>2. Seymour, R. B.; Carraher Jr.C.E. <i>Polymer Chemistry: An Introduction</i>, Marcel Dckker Inc : New York, 1981.</li> <li>3. Sinha, R. <i>Outlines of Polymer Technology</i>, Prentice Hall of India: New Delhi, 2000.</li> <li>4. Joel R. Fried, <i>Polymer Science and Technology</i>, 3<sup>rd</sup> ed.; Prentice Hall of India: New Delhi, 2014.</li> </ol>                                                                                                                                                                                |
| <b>Website and e-learning source</b>                                                                                                  | <ol style="list-style-type: none"> <li>1. <a href="https://polymerdatabase.com">https://polymerdatabase.com</a></li> <li>2. <a href="http://amrita.vlab.co.in/?sub=2&amp;brch=190&amp;sim=603&amp;cnt=1">http://amrita.vlab.co.in/?sub=2&amp;brch=190&amp;sim=603&amp;cnt=1</a></li> <li>3. <a href="http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm">http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm</a></li> <li>4. <a href="http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf">http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf</a></li> </ol> |

**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to**

**CO1:** explain classification of polymers, elastomers, fibers and liquid resins

**CO2:** explain addition and condensation polymerization, mechanical properties of polymers

**CO3:** determine the molecular weight of polymers, and explain the thermal properties of polymers

**CO4:** explain reactions of polymers and polymer processing

**CO5:** discuss Speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PSO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------|------|------|------|------|------|
| CO1                                                | 3    | 3    | 3    | 3    | 3    |
| CO2                                                | 3    | 3    | 3    | 3    | 3    |
| CO3                                                | 3    | 3    | 3    | 3    | 3    |
| CO4                                                | 3    | 3    | 3    | 3    | 3    |
| CO5                                                | 3    | 3    | 3    | 3    | 3    |
| Weightage                                          | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to PSOs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>GENERAL CHEMISTRY-IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Semester - IV</b>            | <b>Core Chemistry-Major Paper IV</b> <b>Paper Code:26UCH04</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Objectives of the course</b> | <p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none"> <li>• Thermodynamic concepts on chemical processes and applied aspects.</li> <li>• Thermo chemical calculations</li> <li>• Transition elements with reference to periodic properties and group study of transition metals.</li> <li>• The organic chemistry of ethers, aldehydes and ketones</li> <li>• The organic chemistry of carboxylic acids</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Course Outline</b>           | <p><b>UNIT-I Thermodynamics I</b></p> <p>Terminology - Intensive, extensive properties, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics - Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible expansion of ideal gases under isothermal conditions; relation between heat capacities (Cp &amp; Cv); Joule Thomson effect- inversion temperature.</p> <p>Thermochemistry-Kirchhoff's equations and pressure on enthalpy of reactions; Hess's law and its applications; Measurement of heat of reaction - Zeroth law of thermodynamics-Absolute Temperature scale.</p> <p><b>UNIT-II Thermodynamics II</b></p> <p>Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing.</p> <p>Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases.</p> <p><b>Third law of thermodynamics</b> - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.</p> <p><b>UNIT-III General Characteristics of d-block elements</b></p> <p><b>Transition Elements-</b> Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour of the compounds, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Iron, Nickel and Zinc groups</p> |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                       | <p><b>UNIT-IV Ethers and Epoxides</b></p> <p>Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.</p> <p>Reactions of epoxides with alcohols, ammonia derivatives and LiAlH<sub>4</sub></p> <p><b>Thioethers-</b> General methods of preparations and properties of Thio ethers and Thio epoxide</p> <p><b>Aldehydes and Ketones</b></p> <p>Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Reduction: Clemmensen reduction, Wolff-Kishner, Meerwein-Ponndorf-Verley (MPV), reduction with LiAlH<sub>4</sub> and NaBH<sub>4</sub>.</p> <p>Addition reactions of unsaturated carbonyl compounds: Michael addition.</p> <p><b>UNIT-V</b></p> <p><b>Carboxylic Acids:</b> Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault-Blanc reduction, decarboxylation and Formic acid-reducing property.</p> <p><b>Carboxylic acid Derivatives:</b> Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide and anhydride. Schotten - Baumann reaction, Claisen condensation, Dieckmann and Reformatsky reactions and Curtius rearrangement.</p> <p><b>Hydroxy acids</b> - Nomenclature; preparation from halo, aldehydic and ketonic acids, ethylene glycol - Action of heat on <math>\alpha</math>, <math>\beta</math> and <math>\gamma</math>- hydroxy acids</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper) | Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved<br>(To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Recommended Text</b>              | <ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.</li> <li>2. K. L. Kapoor, <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.</li> <li>3. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand &amp; Sons, twentieth edition, 2006.</li> <li>4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003.</li> <li>5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.</li> </ol>                          |
| <b>Reference Books</b>               | <ol style="list-style-type: none"> <li>1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4<sup>th</sup>ed.; The Macmillan Company: Newyork, 1972.</li> <li>2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4<sup>th</sup> ed.; ELBS William Heinemann: London, 1991.</li> <li>3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26<sup>th</sup>ed.; Goel Publishing House: Meerut, 2001.</li> <li>4. Atkins, P.W. &amp; Paula, J. <i>Physical Chemistry</i>, 10<sup>th</sup> ed.; Oxford University Press: New York, 2014.</li> <li>5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4<sup>th</sup> ed; Addison Wesley Publishing Company: India, 1993.</li> </ol> |
| <b>Website and e-learning source</b> | <b>MOOC components</b><br><a href="https://nptel.ac.in/courses/112102255">https://nptel.ac.in/courses/112102255</a><br>Thermodynamics<br><a href="https://nptel.ac.in/courses/104101136">https://nptel.ac.in/courses/104101136</a><br>Advanced transition metal chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>                                                                                                             | <b>CHEMISTRY IN AGRICULTURE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Semester-IV</b>                                                                                                                    | <b>Skill Enhancement Course-II</b> <b>Paper Code:26UCHS02</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Objectives of the course</b>                                                                                                       | <p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• Chemical and mineralogical composition of soil</li> <li>• Chemical Fertilizers and Nutrients</li> <li>• Pesticides, insecticides Fungicides and Herbicides topic understanding</li> <li>• Water and air Pollution and its control</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Outline</b>                                                                                                                 | <p><b>UNIT-I: Soils</b><br/> <b>Soils</b>-Composition of soil- organic and inorganic constituents-Classification-Properties of soils- physical and chemical-Important functions of water in plant growth-Biological system of the soil- Role of soil organisms.<br/> <b>Soil analysis</b> : pH, Electrical conductivity, Estimation of macronutrients and micronutrients.</p> <p><b>UNIT-II Fertilizers</b> : Classification of fertilizers - Requisites of a good fertilizers, Effect of Nitrogen, potassium and phosphorous on plant growth – commercial method of preparation of urea, triple superphosphate. Complex fertilizers and mixed fertilizers – their manufacture and composition. Secondary nutrients – micronutrients – their function in plants.<br/> <b>Manures</b> : Bulky organic manures – Farm yard manure – handling and storage-oil cakes- blood meal – fish manures.</p> <p><b>UNIT-III Fungicides and Herbicides</b><br/> <b>Fungicide</b> : Sulphur compounds, Copper compounds, Bordeaux mixture.<br/> <b>Herbicides</b> : Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.</p> <p><b>UNIT-IV Pesticides &amp; Insecticides</b><br/> Pesticides - classification of Insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity. Safety measures when using pesticides, Organic pesticides - D.D.T. and BHC- Pesticides in India - Adverse environmental effects of pesticides<br/> <b>Insecticides</b>: Insecticides : Plant products-Nicotine, pyrethrin - Inorganic pesticides - borates</p> <p><b>UNIT-V Pollution and its control :</b><br/> <b>Water pollution</b>: Water pollution and Water Quality Standards: Pollutants and their sources, Effluent treatment plants (primary, secondary and tertiary treatment). Water quality parameters for waste water, industrial water and domestic water<br/> <b>Air pollution</b>: Pollutants and their sources, pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul-smelling gases. Methods of estimation of CO, NO<sub>x</sub>, SO<sub>x</sub> and their control procedures. Green house effect and global warming - pollution prevention.</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the External Examination Question paper) | Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Recommended Text</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1. Brady.N.C, The Nature and properties of soils – Eruasia Publishing House (P) Ltd.,<br>2. Jones.V.S, Fertilizers and soil fertility – Prentice Hall of India, New Delhi.<br>3. Fracer.D.E.H, Chemistry of Pesticides – D.Van Nostrand Co.<br>4. Agricultural Chemistry Vol I & Vol II edited by B.A. Yagodin – New<br>5. Industrial Chemistry by B.K. Sharma. Goel Publishing House, Meeru<br>6. Text book of Soil Science - T.D. Biswas and S.K. Mukerjee - II Edition. |
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1. Plant Ecology and Soil Science, R.S. Shukla and P.S.Chandel.<br>2. Shreve's. Chemical Process Industries, G.T. Austin<br>3. Agricultural Chemistry, B.A.Yagodin.<br>4. Fundamental concept of Applied Chemistry by Jayashree Ghosh, S. Chand & Company Ltd.,                                                                                                                                                                                                            |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><b>On completion of the course the students should be able to</b><br><br><b>CO 1:</b> understand about general composition of Soils – constituents and its physical properties.<br><b>CO 2:</b> acquire knowledge about Fertilizers and . Manures<br><b>CO 3:</b> learn about Fungicides and Herbicides composition<br><b>CO 4:</b> explain about Pesticidesand Insectides<br><b>CO 5:</b> have an idea about - types of pollution and its control |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PO                                                   | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>               | <b>QUALITATIVE INORGANIC ANALYSIS AND INORGANIC PREPARATIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Semester-IV</b>                      | <b>Core Practical -II</b> <b>Paper Code: 26UCHP02</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Objectives of the course</b>         | <p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• Learn the classical macro and semi-micro analytical groups (Groups I to VI).</li> <li>• Separate complex mixtures of cations and anions step-by-step.</li> <li>• Apply concepts of solubility products to precipitate specific ions selectively</li> <li>• Inorganic preparations of coordination complexes and double salts</li> <li>• The identity of an unknown compound is confirmed by comparing its migration distance and retention factor (<math>R_f</math>) value directly against known, pure standard references run under identical experimental conditions</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Course Outline</b>                   | <p><b>Unit-I Principles of Qualitative analysis ((Not for Examination))</b><br/>Basic principles of Inorganic semi micro analysis-semi micro techniques-principles involved in <math>\text{Na}_2\text{CO}_3</math> extract preparation-common ion effect and solubility product and their applications in qualitative analysis</p> <p><b>Unit-II Semi - Micro Qualitative Analysis</b><br/>1. Analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.<br/>2. <b>Anions to be studied:</b> Carbonate, sulphate, nitrate, fluoride, chloride, bromide, borate, oxalate, phosphate.</p> <p><b>Cations to be studied:</b> lead, bismuth, copper, cadmium, iron, manganese, aluminium, cobalt, nickel, zinc, barium, strontium, calcium, magnesium and ammonium.</p> <p><b>UNIT-III INORGANIC PREPARATIONS:</b><br/>a) Ferrous ammonium sulphate<br/>b) Tetraammine copper (II) Sulphate<br/>c) Microcosmic salt<br/>d) Bis (acetyl acetonato) Nickel (II)<br/>e) Tris (Thiourea) copper (II) sulphate dihydrate<br/>f) Potassium tri (oxalato) chromate (III)</p> <p><b>Unit-IV Chromatography</b><br/>Thin-Layer Chromatography (TLC) or Paper Chromatography qualitatively identify and differentiate inorganic preparations by monitoring reactant disappearance and confirming product formation</p> |
| <b>Skills acquired from this course</b> | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Recommended Text</b>                 | V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Website and e-learning source</b>    | <a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On successful completion of the course the students should be able to

**CO 1:** acquire knowledge on the systematic analysis of Mixture of salts and inorganic preparation

**CO 2:** identify the cations and anions in the unknown substance.

**CO 3:** identify the cations and anions in the soil and water and to test the quality of water.

**CO4:** assess the role of common ion effect and solubility product and inorganic preparation using chromatography TLC/Paper

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PO                                            | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 12   | 12   | 12   | 12   | 12   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>ORGANIC CHEMISTRY - I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Semester - V</b>             | <b>Core Chemistry-Major Paper V</b> <b>Paper Code:26UCH05</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Objectives of the course</b> | <p>This course aims to provide an understanding of</p> <ul style="list-style-type: none"> <li>• Stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane</li> <li>• Preparation and properties of aromatic and aliphatic nitro compounds and amines</li> <li>• Preparation of different dyes, food colour and additives</li> <li>• Preparation and properties of five membered heterocycles like pyrrole, furan and thiophene</li> <li>• Preparation and properties of six membered heterocycles like Pyridine, quinoline and isoquinoline.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outline</b>           | <p><b>UNIT-I Stereochemistry</b></p> <p><b>Optical isomerism</b> Definition, optical activity, Optical and Specific rotations-conditions for optical activity-asymmetric centre-Chirality-achiral molecules-meaning of (+) and (-) and D and L notations- Elements of symmetry.</p> <p>Projection formulae-Fischer, and Newmann projection formulae-Notation of optical isomers- Cahn- Ingold –Prelog rules-R-S. notations for optical isomers with one and two asymmetric Carbon atoms- erythro and threo representations-Racemisation-methods of racemisation Resolution-methods of resolution. Optical activity of allenes, spiranes and biphenyls</p> <p><b>Geometrical isomerism-</b> Definition, cis-trans, syn-anti and E-Z notations Methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclisation and heat of hydrogenation.</p> <p>Conformational Analysis: Introduction of terms- conformational analysis of ethane, ethylene glycol and n-butane including energy diagrams-conformers of cyclohexane (chair, boat and skew boat forms-conformers of mono and disubstituted cyclohexane's – stereochemistry of decalins.</p> <p><b>UNIT-II Chemistry of Nitrogen Compounds</b></p> <p><b>Nitro compounds:</b> Nomenclature, isomerism, Preparation of nitroalkanes and nitroarenes. Reduction of nitrobenzene under various conditions, nitro-acinitro tautomerism.</p> <p><b>Amines (aliphatic and aromatic):</b> Nomenclature, Classification, preparation from alkyl halides, Gabriel-Phthalimide synthesis, Hofmann bromamide reaction. Hofmann and Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO<sub>2</sub>, Schotten-Baumann reaction, Electrophilic substitution in aniline: nitration, bromination and sulphonation. Physical properties, reactions - alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines</p> <p>Diazonium salts: Preparation from aromatic amines. Conversion to benzene, phenol and azodyes</p> |

|                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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|                                                                                                                                              | <p><b>UNIT-III Amino acids and proteins</b></p> <p><b>Amino acids</b>-classification-essential and non essential amino acids-preparation of alpha amino acids-glycine, alanine and tryptophan-General properties of amino acids-Zwitter ions, isoelectric point.<br/> <b>Peptides</b> - peptide bond - nomenclature - synthesis of simple peptides Bergmann method.<br/> <b>Proteins</b> - classification based on composition, functions and structure-structure of proteins - primary, secondary, tertiary and quaternary<br/> <b>Vitamins</b>-occurrence and biological importance of water soluble Vitamin and fat soluble Vitamin</p>                                                          |
|                                                                                                                                              | <p><b>UNIT-IV DYE</b></p> <p>Introduction, Definition- Dye, colour, chromophore, auxochrome, bathochromic effect and hypso chromic effect - Classification- acid, base, azo, vat and reactive dyes<br/> synthesis and applications of Alizarin, Malachite Green, Pararosaniline, Indigo, Phenolphthalein, Rhodamine B, Fluorescein, Acridine orange Procion Blue HB and methyl Orange</p>                                                                                                                                                                                                                                                                                                           |
|                                                                                                                                              | <p><b>UNIT-V Heterocyclic Compounds</b></p> <p>Molecular Orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with emphasis on the mechanism of electrophilic substitution reaction, mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.</p> <p>Introduction to condensed five-and six-membered heterocyclics. Preparation and reaction of indole, quinoline and isoquinoline with special reference to Bisler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.</p> |
| <p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p> | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/> (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>Skills acquired from this course</p>                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Recommended Text</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.<br>2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.<br>3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& CompanyPvt. Ltd., Multicolour edition, 2012.<br>4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.<br>5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009. |
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.<br>2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.<br>3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition, 2009.<br>4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006.<br>5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.                                                                  |
| <b>Website and e-learning sources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1. www.epgpathshala.nic.in<br>2. www.nptel.ac.in<br>3. http://swayam.gov.in<br>4. Virtual textbook of Organic Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br>On completion of the course the students should be able to<br><b>CO1:</b> assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.<br><b>CO2:</b> explain preparation and properties of aromatic and aliphatic nitro compounds and amines<br><b>CO3:</b> explain constitution of Amino acids and proteins dyes and color additives<br><b>CO4:</b> discuss preparation and properties of dyes and color additives<br><b>CO5:</b> discuss preparation and properties of five and six membered heterocycles like pyridine, piperidine, pyrrole pyridine, quinoline and isoquinoline |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                           | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>INORGANIC CHEMISTRY - I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Semester - V</b>             | <b>Core Chemistry-Major Paper VI</b> <b>Paper Code:26UCH06</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Objectives of the course</b> | <p>The course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• Nomenclature, isomerism and theory of coordination compounds, and chelate complexes</li> <li>• Crystal field theory, magnetic properties, stability of complexes and jahn teller effect</li> <li>• Preparation and properties of metal carbonyls</li> <li>• Lanthanoids and actinoids</li> <li>• Preparation and properties of inorganic polymers and silicates and their applications</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Outline</b>           | <p><b>UNIT-I Co-ordination Chemistry - I</b><br/> IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.<br/> Werner's coordination theory - effective atomic number -interpretation of geometry and magnetic properties by Pauling's theory - geometry of co- ordination compounds with co-ordination number 4 &amp;6.<br/> Chelates - types of ligands forming chelates - stability of chelates, applications of chelates in qualitative and quantitative analysis - application of DMG and oxime in gravimetric analysis</p> <p><b>UNIT-II Co-ordination Chemistry - II</b><br/> Crystal field theory - Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of <math>[\text{Ti}(\text{H}_2\text{O})_6]^{3+}</math>. Comparison of VBT and CFT.</p> <p><b>Unit III Reactions Mechanisms and Applications of Complexes</b><br/> Substitution reactions in square planar complexes-Trans Effect-Trans effect series-uses of Trans effect-Theories of Trans effect- polarisation theory and <math>\pi</math>- bonding theory.<br/> Application of coordination compounds in Qualitative and Quantitative analysis-separation of Copper and Cadmium ions, Cobalt and Nickel ions- Identification of Cu, Fe, and Ni.<br/> EDTA and its applications - estimation of metals, hardness of water</p> |

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|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                       | <p><b>UNIT-IV Inner transition elements (Lanthanoids and Actinoids)</b></p> <p>General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium- Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.</p>                                                                                                                                                                                                                                                                               |
|                                                                                                                                       | <p><b>UNIT-V Inorganic polymers</b></p> <p>General properties - classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazenes and polyphosphonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) - industrial applications of inorganic polymers.</p> <p><b>Silicates</b> :Introduction - general properties of silicates, structure – types of silicates - ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates (pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Skills acquired from this course                                                                                                      | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31<sup>th</sup> Edition, Milestone Publishers &amp; Distributors, Delhi.</li> <li>2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18<sup>th</sup> Edition, S. Chand &amp; Co., New Delhi</li> <li>3. Lee J D, (1991), Concise Inorganic Chemistry, 4<sup>th</sup> Edition, ELBS William Heinemann, London.</li> <li>4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.</li> <li>5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.</li> </ol>                                                                                                                                      |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup> ed., S.Chand and Company, New Delhi.</li> <li>2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, 1st Edition, University Press (India) Private Limited, Hyderabad</li> <li>3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>, 1st Edition, Pearson, Chennai</li> <li>4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3<sup>rd</sup> Edition, Addition-Wesley, England</li> <li>5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.</li> </ol>                                                                                                                                                                      |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a><br>2. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a><br>3. <a href="http://swayam.gov.in">http://swayam.gov.in</a> |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><br><b>On completion of the course the students should be able to</b><br><b>CO1:</b> explain isomerism, Werner's Theory and stability of chelate complexes<br><b>CO2:</b> discuss crystal field theory, magnetic properties and spectral properties of complexes.<br><b>CO3:</b> explain preparation and properties of metal carbonyls<br><b>CO4:</b> give a comparative account of the characteristics of lanthanoids and actinoids<br><b>CO5:</b> explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous |                                                                                                                                                                                                  |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>Title of the Paper</b>       | <b>PHYSICAL CHEMISTRY - I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Semester - V</b>             | <b>Core Chemistry-Major Paper VII</b> <b>Paper Code:26UCH07</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Objectives of the Course</b> | <p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties</li> <li>• Chemical kinetics and different types of chemical reactions</li> <li>• Adsorption, homogeneous and heterogeneous catalysis</li> <li>• Colloids and macromolecules</li> <li>• Photochemistry, fluorescence and phosphorescence</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Outline</b>           | <p><b>UNIT-I Thermodynamics - III</b></p> <p>Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation - derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases.</p> <p><b>Partial molar properties</b> - chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature and pressure, Duhem-Margules equation.</p> <p><b>UNIT-II Chemical Kinetics</b></p> <p><b>Rate of reaction</b> - order of reaction. order and molecularity of simple reactions, Rate laws - Rate constants - derivation of rate constants for zero, first order, second (Same and different concentration) and and third order (equal initial concentration) - Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.</p> <p>Effect of temperature on reaction rate - temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates - Collision theory - derivation of rate constant of bimolecular gaseous reaction - Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates - Derivation of rate constant for a bimolecular reaction - significance of entropy and free energy of activation. Comparison of collision theory and ARRT.</p> <p><b>UNIT-III</b></p> <p>Adsorption - Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms - Freundlich and Langmuir. Adsorption isotherms and their limitations - BET theory (derivation not required).Catalysis - general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst - theories of homogenous and heterogeneous catalysis - Kinetics of Acid - base and enzyme catalysis.</p> |

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|                                                                                                                                       | <p><b>UNIT-IV Colloids and Surface Chemistry</b><br/> <b>Colloids:</b> Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols),<br/> Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, Emulsions, Gels - preparation of Gels, Applications of colloids.</p>                                                                                                                                                                               |
|                                                                                                                                       | <p><b>UNIT-V Photochemistry</b><br/> Laws of photo chemistry - Lambert - Beer, Grothaus - Draper and Stark - Einstein. Quantum efficiency. Photochemical reactions - rate law - Kinetics of <math>\text{H}_2\text{-Cl}_2</math>, <math>\text{H}_2\text{-Br}_2</math> and decomposition of HI reactions, comparison between thermal and photochemical reactions. Fluorescence - applications including fluorimetry - sensitised fluorescence, phosphorescence - applications - chemiluminescence and photo sensitisation – examples Chemistry of Vision - 11 cis retinal - colour perception of vision.</p>                                                                         |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/> (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.</li> <li>2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.</li> <li>3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28<sup>th</sup> edition 2019, S, Chand &amp; Co.</li> <li>4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.</li> <li>5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.</li> </ol> |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1<sup>st</sup> edition, 2013.</li> <li>2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003.</li> <li>3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.</li> <li>4. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.</li> <li>5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001</li> </ol>                                                                |

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| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1. <a href="https://nptel.ac.in">https://nptel.ac.in</a><br>2. <a href="https://swayam.gov.in">https://swayam.gov.in</a><br>3. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a> |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><br><b>On completion of the course the students should be able to</b><br><b>CO1:</b> explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams<br><b>CO2:</b> apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.<br><b>CO3:</b> compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.<br><b>CO4:</b> demonstrate the types and characteristics of colloids, preparation of sols and emulsions.<br><b>CO5:</b> utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision. |                                                                                                                                                                                                     |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO / PSO                                                 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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| <b>Title of the Paper</b>       | <b>ANALYTICAL CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Semester - V</b>             | <b>Core Chemistry-Major Paper VIII</b> <b>Paper Code:26UCH08</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Objectives of the Course</b> | <p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• Understand the principles of various analytical techniques and their applications</li> <li>• Analyze errors and perform various tests for analytical data</li> <li>• Outline the concepts of gravimetric methods in quantitative analysis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Outline</b>           | <p><b>UNIT - I Analytical Techniques</b></p> <p><b>Data analysis-</b> Idea of significant figures- its importance- Accuracy- Methods of expressing accuracy- Error analysis- Types of Errors- Minimizing Errors, Precision-Methods of expressing precision- Mean, Median, Mean deviation, Standard deviation and Confidence limits</p> <p><b>Separation techniques-</b> Precipitation, Solvent extraction, Extraction by chemically active solvents, Continuous extraction- Soxhlet extraction.</p> <p><b>Purification techniques-</b> Purification of solids-Crystallisation, Fractional crystallization and Sublimation. Purification of liquids-Distillation, Fractional Distillation, Vacuum distillation and Steam distillation.</p> <p><b>UNIT II Chromatographic Techniques</b></p> <p><b>Column Chromatography-</b> principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications.</p> <p><b>TLC-</b> principle, choice of adsorbent and solvent, preparation of chromatoplates, R<sub>f</sub> -values, factors affecting the R<sub>f</sub>-values. Significance of R<sub>f</sub>-values.</p> <p><b>Paper Chromatography-</b> principle, and applications of paper chromatography.</p> <p><b>Ion-exchange chromatography-</b> principle- types of resins- requirements of a good resin-action of resins- experimental techniques-separation of Na-K, Ca-Mg, Co-Ni, and Chloride-bromide</p> <p><b>Gas Chromatography (GC)-</b>principle- experimental techniques-instrumentation and applications.</p> <p>High Pressure Liquid Chromatography (HPLC)- principle- experimental techniques- instrumentation and advantages.</p> <p><b>UNIT-III- Electro Analytical Methods</b></p> <p><b>Polarography-</b> principle, concentration polarization, dropping mercury electrode (DME)-advantages and disadvantages- migration, residual, limiting and diffusion currents- Use of supporting electrolytes-Ilkovic equation (derivation not required) and significance- experimental assembly- current voltage curve- oxygen wave-influence of temperature and agitation on diffusion layer. Half wave potential (<math>E_{1/2}</math>)- Polarography as an analytical tool in quantitative and qualitative analysis.</p> <p><b>Amperometric titrations</b> Basic principle – titrations- advantages, disadvantages – applications</p> |

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|                                                                                                                                       | <p><b>UNIT-IV Thermoanalytical Methods</b><br/> Principle - thermogravimetric analysis and differential thermal analysis- discussion of various components with block diagram- TGA &amp; DTA curves of <math>\text{CuSO}_4 \cdot 5\text{H}_2\text{O}</math>, <math>\text{MgC}_2\text{O}_4 \cdot \text{H}_2\text{O}</math> and <math>\text{Ca}(\text{OOCCH}_3)_2 \cdot \text{H}_2\text{O}</math>- Simultaneous DTA-TGA curves of <math>\text{SrCO}_3</math> in air and <math>\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}</math> in air and in <math>\text{CO}_2</math>- factors affecting TGA &amp; DTA curves.<br/> <b>Thermometric titrations</b>-principle- apparatus- applications.</p> <p><b>UNIT V Gravimetric Analysis &amp; Flame Spectrometry</b><br/> <b>Principle</b>- Theories of precipitation- Solubility product and precipitation- Factors affecting solubility. Conditions of precipitation – Co- precipitation &amp; Post precipitation, Reduction of errors. Precipitation from homogeneous solution- Washing and Drying of precipitate.<br/> <b>Choice of the precipitant</b>- Specific and Selective precipitants- Anthranilic acid, Cupferon, Dimethyl glyoxime, Ethylene diamine, 8-hydroxyquinoline, Salicylaldehyde-Use of Masking agent- use of sequestering agents<br/> <b>Crucibles</b>- Types, Care and uses. Calculation in gravimetric analysis- Use of Gravimetric factor.<br/> <b>Atomic Absorption Spectroscopy</b>: Basic principles – instrumentation - Techniques of atomization and sample introduction - Techniques for the quantitative estimation of trace level of lead ions from water samples.<br/> <b>Flame Emission Spectroscopy</b> - Principle – Instrumentation – interferences – analytical techniques for Flame Photometry- Applications and advantages of FES - Differences between AAS and FES</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br>(To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Douglas A, Skoog and Donal M. West Hort, Fundamentals of analytical Chemistry Rinechan and Winston Inc., New York.</li> <li>2. Janarthnam.P.B, Physico – Chemical Techniques of Analysis Vol I &amp; II – Asian Publishing House Bombay.</li> <li>3. Venkateswaran.V, Veerasamy.R, and Kulandaivelu.R, Basic Principles of Practical Chemistry.</li> <li>4. Sharma.Y.R, Elementary Organic Spectroscopy, Principles and applications- S. Chand &amp; Co.,</li> <li>5. Gopalan.R, Subramaniam.P.S, and Rengarajan.K, Elements of Analytical Chemistry – Sultan Chand &amp; Sons.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1. Ramachandra Sastry.A, Analytical Chemistry – K.C.S. Desikan & Co.<br>2. Brgron Kratochvil-An introduction to Chemical Analysis.<br>3. Bassett.J, Denney.R.C, Jaffery.G.H and Mendhan.J, Vogel's Hand Book of Quantitative Inorganic Analysis ELBS – Longman                                                                                                                           |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <a href="https://www.mobt3ath.com/uplode/book/book-19965.pdf">https://www.mobt3ath.com/uplode/book/book-19965.pdf</a> 2<br><a href="https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_105/Chapters/5._Errors_in_chemical_analysis">https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_105/Chapters/5._Errors_in_chemical_analysis</a> |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><br><b>On completion of the course the students should be able to</b><br><b>CO1:</b> Evaluate different types of errors and correct them. To understand the principle of separation and purification techniques<br><b>CO2:</b> Determine an analyte quantitatively using gravimetric methods<br><b>CO3:</b> Techniques of Chromatography differentiate between homogenous and heterogeneous<br><b>CO4:</b> Demonstrate the types and characteristics of Polarography as an analytical tool in quantitative and qualitative analysis.<br><b>CO5:</b> Thermogravimetric analysis and differential thermal analysis-discussion of various components. |                                                                                                                                                                                                                                                                                                                                                                                          |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| <b>Title of the Paper</b>       | <b>INDUSTRIAL CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Semester - V</b>             | <b>Elective-I -Major</b> <b>Paper Code:26UCHE01</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Objectives of the course</b> | <p>This course is designed to provide knowledge on</p> <ul style="list-style-type: none"> <li>• Classifications and characteristics of fuels</li> <li>• Preparation of cosmetics</li> <li>• Manufacture of sugar, paper, cement and leather and food processing</li> <li>• Applications of abrasives, lubricants and other industrial products</li> <li>• Intellectual property rights</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Outline</b>           | <p><b>UNIT-I</b><br/> <b>Survey of Indian Industries and mineral resources in India</b><br/> <b>Fuels:</b> Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination.<br/> <b>Liquid fuels:</b> Petroleum - characteristics; Gasoline aviation petrol-knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.<br/> <b>Gaseous fuel:</b> advantages over solid and liquid fuels; water gas, producer gas, - preparations - uses.<br/> <b>Natural gas:</b> LPG-composition, advantages and application. Propellants-rocket fuels (basic idea)</p> <p><b>UNIT-II Cosmetics</b><br/> <b>Skin care:</b> powders, ingredients; creams and lotion-cleansing, moisturising, all-purpose shaving cream, sunscreen.<br/> <b>Dental care:</b> tooth pastes - ingredients.<br/> <b>Hair care:</b> shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents; animal origin- ambergris and musk; synthetic-classification - esters-amylsalicylate alcohols</p> <p><b>Soaps and Detergents</b><br/> Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap and liquid soap - ingredients.<br/> Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.</p> |

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|                                                                                                                                       | <p><b>UNIT-II</b><br/> <b>Sugar Industry</b><br/> Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.<br/> <b>Food Preservation and processing</b><br/> Food spoilage - causes; Food preservation - methods - high temperature, low temperature, drying, radiation; Food additives - preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards - Agmark and Codex alimentarius.</p> <p><b>UNIT-IV Abrasives</b><br/> Definition, characteristics, types-natural and synthetic; natural abrasives - diamond, emery and quartz – composition, uses; synthetic abrasives - carborundum, aluminium carbide, boron carbide, boronnitride, synthetic graphite - composition and uses.<br/> <b>Leather Industry</b><br/> Structure and composition of skin, hide; Manufacture of leather – pre-tanning process - curing, liming, beating, pickling; methods of tanning-vegetable, chrome - one bath, two bath process; finishing.<br/> <b>Paper Industry</b><br/> Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper - beating, refining, filling, sizing, colouring, calendaring; cardboard.</p> |
|                                                                                                                                       | <p><b>UNIT-V</b><br/> <b>Lubricants</b> Definition, classification - liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point drop point; greases-properties, types; cutting fluids.<br/> <b>Cement Industry</b><br/> Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.<br/> <b>Intellectual Property Rights</b><br/> Introduction to Intellectual Property Rights - Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India.</p> <p><b>(Note: Students May be permitted and encouraged to undergo industrial visits and internships at relevant chemical and agricultural industries to gain practical exposure)</b></p>                                                                                                                                                                                                                                                                                                                        |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/> (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Recommended Text                                                                                                                      | <ol style="list-style-type: none"> <li>1. Sharma, B.K. <i>Industrial Chemistry</i>, 9<sup>th</sup> ed.; Goel Publishing House: Meerut, 1998.</li> <li>2. Wilkinson, J.B.E. Moore, R.J. <i>Harry's Cosmeticology</i>, 7<sup>th</sup> ed.; Chemical Publishers : New York, 1982.</li> <li>3. Alex V. Ramani, <i>Food Chemistry</i>, MJP publishers: Chennai, 2009.</li> <li>4. Jayashree Ghosh, <i>Applied Chemistry</i>, S. Chand : New Delhi, 2006.</li> <li>5. Srilakshmi, B. <i>Food Science</i>, 4<sup>th</sup> ed.; New Age International Publication, 2005.</li> <li>6. Sharma, B.K. <i>Industrial Chemistry</i>, 9<sup>th</sup> ed.; Goel Publishing House: Meerut, 1998.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ol style="list-style-type: none"> <li>1. Jain, P.C.; Jain, M. <i>Engineering Chemistry</i>, 16<sup>th</sup> ed.; Dhanapet Rai: Delhi, 1992</li> <li>2. George Howard, <i>Principles and Practice of Perfumes and Cosmetics</i>, Stanley Theronos, Cheltenham: UK, 1987.</li> <li>3. Thankamma Jacob, <i>Foods, Drugs and Cosmetics - A Consumer Guide</i>, Macmillan : London, 1997.</li> <li>4. ShankuntalaManay, N.; Shadaksharaswamy, M. <i>Food Facts and Principles</i>, 3<sup>rd</sup> ed.; New Age Publication, 2008.</li> <li>5. Neeraj Pandey, KhushdeepDharni, <i>Intellectual Property Rights</i>, PHI Learning, 2014.</li> </ol> |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <ol style="list-style-type: none"> <li>1. <a href="http://www.sciencecases.org/irradiation/irradiation_notes.asp">http://www.sciencecases.org/irradiation/irradiation_notes.asp</a></li> <li>2. <a href="http://discovery.kcpc.usyd.edu.au/9.5.5/">http://discovery.kcpc.usyd.edu.au/9.5.5/</a></li> <li>3. <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a></li> <li>4. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a></li> <li>5. <a href="http://swayam.gov.in">http://swayam.gov.in</a></li> </ol>                                                                                                 |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to</b><br><b>CO1:</b> summarize the properties of fuels which include petroleum, water gas, natural gas and propellents<br><b>CO2:</b> evaluate cosmetic products, soaps, detergents.<br><b>CO3:</b> explain manufacture of sugar, food spoilages and food additives<br><b>CO4:</b> explain properties of abrasives, manufacture of leather and paper<br><b>CO5:</b> explain properties and manufacture of lubricants and cement, and intellectual property rights |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1 | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| CO2 | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| CO3 | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| CO4 | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| CO5 | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-O Mapping (Course Articulation Matrix)**

| CO /PSO                                           | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---------------------------------------------------|------|------|------|------|------|
| CO1                                               | 3    | 3    | 3    | 3    | 3    |
| CO2                                               | 3    | 3    | 3    | 3    | 3    |
| CO3                                               | 3    | 3    | 3    | 3    | 3    |
| CO4                                               | 3    | 3    | 3    | 3    | 3    |
| CO5                                               | 3    | 3    | 3    | 3    | 3    |
| Weightage                                         | 15   | 15   | 15   | 15   | 15   |
| Weighted percentage of Course Contribution to POs | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>CHEMISTRY IN NANO MATERIALS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Semester - V</b>             | <b>Skill Enhancement Course - III</b> <b>Paper Code:26UCHS03</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Objectives of the course</b> | <p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• Introduction to nanoparticles/clusters and nanocomposites</li> <li>• Properties of nanomaterials</li> <li>• Characterization of nanomaterials by different methods</li> <li>• Synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials</li> <li>• Applications of nanomaterials as sensors</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Course Outline</b>           | <p><b>UNIT-I</b><br/> Definition of terms -, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites-bulk material and nanomaterials. Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion - ball milling, methods based on evaporation of a precursor-inert gas condensation. Bottom-up approach (chemical methods) - solvothermal synthesis, sol-gel method. Nanomaterials via chemical routes- solvents reducing agents, capping agents - stabilization of nanoparticles - electrostatic and steric stabilization, common stabilizers.</p> <p><b>UNIT-II Properties of materials</b><br/> Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - <math>\text{Fe}_3\text{O}_4</math> particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.</p> <p><b>UNIT-III Techniques employed for characterization of materials</b><br/> Spectroscopy - UV-visible, Photoelectron spectroscopy - Electron microscopy - Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) - Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy - confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].</p> <p><b>UNIT-IV Special nanomaterials</b><br/> Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes.<br/> Other Important Carbon based materials: Preparation, properties and applications of Fullerene and Graphene.<br/> Semiconductor nanoparticles: Quantum dots, synthesis - chemical synthesis using clusters, properties, porous silicon - electrochemical etching, aerogel - types - silica aerogel, resorcinol formaldehyde (RF) aerogels - applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) - inorganic, organic molecules</p> |

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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|                                                                                                                                       | <p><b>UNIT-V Application of materials chemistry</b></p> <p>Biomedical Applications- drug, drug delivery, bio labelling, artificial implants, cancer treatment. Sensors - Natural nanoscale sensors, chemical sensors, biosensors, electronic noses.</p> <p>Optics &amp; Electronics - Nanomaterials in the next generation computer technology, high-definition TV, flat panel displays, quantum dot laser, single electron transistors [SET].</p> <p>Nanotechnology in agriculture - Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry.</p> <p>Impacts of Nanotechnology - human &amp; environmental safety risks.</p>                             |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/>(To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Sulabha K. Kulkarni, <i>Nanotechnology: Principles and Practices</i>, Capital Publishing Co., New Delhi.</li> <li>2. Pradeep. T, <i>Nano: The Essentials, Understanding Nanoscience and Nanotechnology</i>; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.</li> <li>3. Shah. M.A.; Tokeer Ahmad, <i>Principles of Nanoscience and Nanotechnology</i>; Narosa Publishing House, New Delhi, 2010.</li> <li>4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, <i>Textbook of Nanoscience and Nanotechnology</i>;Universities press, India Ltd ,Hyderabad. 2012.</li> </ol>                                                                                   |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Sharma. P.K., <i>Understanding Nanotechnology</i>; Vista International Publishing House, Delhi. 2008.</li> <li>2. Charles P. Poole Jr.; Frank J. Owens. <i>Introduction to Nanotechnology</i>; A John Wiley &amp; Sons, INC., Publication, 2003.</li> <li>3. Viswanathan B., <i>Nano Materials</i>;Narosa Publishing House, New Delhi, 2009.</li> <li>4. Edited by C.N.R. Rao; Mu"ller.A; Cheetham. A.K.<i>Nanomaterials Chemistry Recent Developments and New Directions</i>, WILEY-VCH Verlag GMBH &amp; Co.,KGaA, Darmstad.</li> <li>5. Jing Zhong Zhang, <i>Optical properties and spectroscopy of Nanomaterials</i>; World Scientific Publishing Pvt. Ltd., Singapore.</li> </ol> |

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| <b>Website and e-learning source</b>                                                                                                      | 1) <a href="http://www.nanotechnology.com/docs/wtd015798.pdf">http://www.nanotechnology.com/docs/wtd015798.pdf</a><br>2) <a href="http://nccr.iitm.ac.in/Nanomaterials.pdf">http://nccr.iitm.ac.in/Nanomaterials.pdf</a> |            |            |            |            |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to</b>                |                                                                                                                                                                                                                          |            |            |            |            |
| <b>CO1:</b> explain the general concepts and physical phenomena of relevance within the field of materials chemistry like nano materials. |                                                                                                                                                                                                                          |            |            |            |            |
| <b>CO2:</b> describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.                 |                                                                                                                                                                                                                          |            |            |            |            |
| <b>CO3:</b> examine the structure, properties, applicability and characterization of materials.                                           |                                                                                                                                                                                                                          |            |            |            |            |
| <b>CO4:</b> analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene                  |                                                                                                                                                                                                                          |            |            |            |            |
| <b>CO5:</b> discuss applications of chemistry of materials of sensors and in optics and electronics                                       |                                                                                                                                                                                                                          |            |            |            |            |
|                                                                                                                                           | <b>PO1</b>                                                                                                                                                                                                               | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> |
| <b>CO1</b>                                                                                                                                | S                                                                                                                                                                                                                        | S          | S          | S          | S          |
| <b>CO2</b>                                                                                                                                | M                                                                                                                                                                                                                        | S          | S          | S          | M          |
| <b>CO3</b>                                                                                                                                | S                                                                                                                                                                                                                        | S          | S          | M          | S          |
| <b>CO4</b>                                                                                                                                | S                                                                                                                                                                                                                        | S          | S          | S          | S          |
| <b>CO5</b>                                                                                                                                | S                                                                                                                                                                                                                        | M          | S          | S          | S          |

#### CO-PO Mapping (Course Articulation Matrix)

|                                                          |            |            |            |            |            |
|----------------------------------------------------------|------------|------------|------------|------------|------------|
| <b>CO /PO</b>                                            | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> |
| <b>CO1</b>                                               | 3          | 3          | 3          | 3          | 3          |
| <b>CO2</b>                                               | 3          | 3          | 3          | 3          | 3          |
| <b>CO3</b>                                               | 3          | 3          | 3          | 3          | 3          |
| <b>CO4</b>                                               | 3          | 3          | 3          | 3          | 3          |
| <b>CO5</b>                                               | 3          | 3          | 3          | 3          | 3          |
| <b>Weightage</b>                                         | 15         | 15         | 15         | 15         | 15         |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0        | 3.0        | 3.0        | 3.0        | 3.0        |

#### Level of Correlation between PO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>Title of the Paper</b>       | <b>ORGANIC CHEMISTRY - II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Semester - VI</b>            | <b>Core Chemistry-Major Paper IX</b> <b>Paper Code:26UCH09</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Objectives of the course</b> | <p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• Preparation and properties of saccharides</li> <li>• Biomolecules</li> <li>• Different molecular rearrangement</li> <li>• Classification, isolation and discussing the properties of alkaloids and terpenes</li> <li>• Application of green chemistry</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Course Outline</b>           | <p><b>UNIT-I Carbohydrates</b></p> <p>Classification, preparation, properties and structures of glucose, fructose, and sucrose (structural elucidation required), mutarotation, epimers and anomers. Polysaccharides, uses of starch and cellulose (structural elucidation not required). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. Interconversions of sugar series - ascending, descending, aldose to ketose and ketose to aldose. Hetero polysaccharides - hyaluronic acid, heparin.</p> <p><b>UNIT-II Molecular rearrangements:</b></p> <p>Molecular Rearrangement: Type of rearrangements, Mechanisms of pinacol-pinacolone, benzidine, Favorskii, Claisen, benzilic acid, Fries and Cope, Beckmann, Hofmann, Curtius, Lossen and Schmidt rearrangements.</p> <p><b>Special reagents in organic synthesis :</b> AIBN, 9BBN, BOC, DABCO, DCC</p> <p><b>UNIT-III Ureides and nucleic acids</b></p> <p>Ureides- Definition, classification- pyrimidines-thymine, uracil (Fischer and Roeder synthesis) and cytosine (Wheeler-Johnson method) -purines-adenine and guanine – Fischer's synthesis (structural elucidation not necessary)</p> <p>Nucleic acids-structures of ribose and 2-deoxyribose- DNA and RNA – their components – Biological functions of nucleic acids- Elementary ideas on replication and protein synthesis</p> |

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|                                                                                                                                       | <p><b>UNIT-IV Chemistry of natural products</b></p> <p><b>Alkaloids</b> :Classification, isolation, general properties - Hofmann Exhaustive Methylation; synthesis and structural elucidation of piperine, nicotine, Coniine and papaverine</p> <p><b>Terpenes:</b> Classification, Isoprene rule, isolation and structural elucidation of Citral, Geraniol, alpha terpineol, Menthol, alpha pinene and Camphor.</p> <p><b>UNIT-V Green Chemistry</b></p> <p>Green Chemistry- Principle &amp; Greener Reactions- Definition, need of green chemistry, twelve basic principles of green chemistry- Planning a green synthesis in a chemical laboratory-Solvent-less reactions, Selection of appropriate solvent.</p> <p>Use of microwaves- Fundamentals of closed-vessel heating and sonication- Water as green solvent- reactions in ionic-liquid, Solid support organic synthesis, Phase transfer catalyst (PTC) (Simple treatment only).</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4<sup>th</sup> reprint,2009.</li> <li>2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3<sup>rd</sup> edition,2009</li> <li>3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand&amp; Company Pvt. Ltd., Multicolour edition,2012.</li> <li>4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand &amp; Sons, New Delhi, 29<sup>th</sup> edition, 2007.</li> <li>5. C Bandyopadhyay; An Insight into Green Chemistry; Published on 2020</li> </ol>                                                                                                                                                                                                                                                                                    |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Books</b>               | 1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, 6 <sup>th</sup> edition, 2012.<br>2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, 11 <sup>th</sup> edition, 2012.<br>3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 7 <sup>th</sup> edition, 2009.<br>4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6 <sup>th</sup> edition, 2006.<br>5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5 <sup>th</sup> Edition, 2010. |
| <b>Website and e-learning source</b> | 1. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a><br>2. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a><br>3. <a href="http://swayam.gov.in">http://swayam.gov.in</a><br>4. Virtual Textbook of Organic Chemistry<br>5. <a href="https://vlab.amrita.edu/">https://vlab.amrita.edu/</a>                                                                                                                                                                                                                                        |

**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to**

**CO1:** explain isolation and properties of alkaloids and terpenes

**CO2:** explain preparation and reactions of mono and disachharides

**CO3:** classify biomolecules and natural products based on their structure, properties, reactions and uses.

**CO4:** explain molecular rearrangements like benzidine, Hoffmann etc.,

**CO5:** preparation and properties of organolithium compounds and uses of green chemistry

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| <b>Title of the Paper</b>       | <b>INORGANIC CHEMISTRY – II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Semester - VI</b>            | <b>Core Chemistry-Major Paper X</b> <b>Paper Code:26UCH10</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Objectives of the course</b> | <p>The course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• Organometallic compounds.</li> <li>• Organometallic catalysts</li> <li>• Bioinorganic Chemistry.</li> <li>• industrial applications of refractories, alloys, paints and pigments</li> <li>• Applications of Artificial intelligence in Chemistry</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Course Outline</b>           | <p><b>UNIT I - Organometallic compounds –I</b><br/> Definition- Nomenclature of organometallic compounds - classification- ionic, <math>\sigma</math> - bonded and <math>\Pi</math>- bonded organometallic compounds- examples- nature of carbon-metal bond.<br/> Organometallic compounds of Lithium &amp; Boron- preparation, properties, structure and uses.<br/> Olefin complexes –Zeise’s salt –synthesis and structure .<br/> Cyclopentadienyl complexes -Ferrocene- preparation, properties, structure and use</p> <p><b>UNIT II - Organometallic compounds – II</b><br/> <b>Metal carbonyls</b> - EAN rule, 18 electron rule. Structure &amp; bonding in 3d transition metal carbonyls; polynuclear carbonyls, bridging &amp; terminal carbonyls. Uses of IR absorption spectra for the determination of structure of metallic carbonyls.<br/> <b>Homogeneous catalysis</b>-Wilkinson’s catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Wacker process, Zeigler-Natta catalyst and polymerization of olefins (Reaction and Uses only)</p> <p><b>UNIT III - Bioinorganic Chemistry</b><br/> Essential and trace elements in Biological processes – Role of <math>\text{Na}^+</math>, <math>\text{K}^+</math>, <math>\text{Mg}^{2+}</math> &amp; <math>\text{Ca}^{2+}</math> ions in biological process-Sodium and Potassium pump. Toxic effects of some metals(<math>\text{Cu}</math>, <math>\text{Pb}</math>, <math>\text{As}</math>, <math>\text{Hg}</math>, <math>\text{Cd}</math>), Fixation of atmospheric nitrogen. Structure &amp; Biological functions of Haemoglobin, Myoglobin, Chlorophyll and Vitamin B12.</p> <p><b>UNIT-IV Industrial Applications of Inorganic Compounds</b><br/> Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints - pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.<br/> Nanocomposite Hydrogels: synthesis, characterization and uses.</p> <p><b>UNIT-V Applications of Artificial intelligence in Chemistry</b><br/> An overview of computationally readable and processible representation of simple inorganic molecules, e.g., SMILES, mol files. Chemical space and access to chemical databases. Statistical treatment of data: regression analysis and types of regression<br/> Basics of artificial intelligence and Machine Learning - AI Applications in inorganic chemistry - Tools and platforms (Python, RDKit, scikit-learn, TensorFlow, Chemprop and Deepchem)<br/> Fundamentals of generative models, graph neural networks, large language models. Neural networks in chemistry- Bias in chemical datasets -Future of AI in chemistry</p> |

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| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br>(To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31<sup>th</sup> ed., Milestone Publishers &amp; Distributors, Delhi.</li> <li>2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18<sup>th</sup> Edition, S. Chand &amp; Co., New Delhi</li> <li>3. Lee J D, (1991), Concise Inorganic Chemistry, 4<sup>th</sup> ed., ELBS William Heinemann, London.</li> <li>4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.</li> <li>5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992</li> <li>6. Cartwright C.; Kharma N., (2008), Using artificial intelligence in chemistry and biology, First Edition, CRC Press Taylor &amp; Francis Group</li> <li>7. Understanding Properties of Atoms, Molecules and Materials (Pranab. Sarkar, Sankar Prasad Bhattacharyya) (z-lib.org)</li> </ol>                                                                                                                                                           |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup> ed., S.Chand and Company, New Delhi.</li> <li>2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad</li> <li>3. Sivasankar B, (2013) Inorganic Chemistry. 1st Edition, Pearson, Chennai</li> <li>4. Alan G. Sharp (1992), Inorganic Chemistry, 3<sup>rd</sup> Edition, Addition- Wesley, England</li> <li>5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.</li> <li>6. Lewars, E. (2003), Computational Chemistry, Kluwer academic Publisher.</li> <li>7. Cramer, C.J. (2004), Essentials of Computational Chemistry, JohnWiley &amp; Sons.</li> <li>8. Hippe; Z., Artificial Intelligence in Chemistry: Structure Elucidation and Simulation of Organic Reactions, (1991) Academic Press, Elsevier</li> <li>9. Soft Computing in Chemical and Physical Sciences A Shift in Computing Paradigm (Kanchan Sarkar, Sankar Prasad Bhattacharyya) (z-lib.org)</li> </ol> |

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| <b>Website and e-learning source</b> | 1. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a><br>2. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a><br>3. <a href="http://swayam.gov.in">http://swayam.gov.in</a> .<br>4. <a href="https://gaussian.com/techsupport/">https://gaussian.com/techsupport/</a> 6. <a href="https://gaussian.com/man/">https://gaussian.com/man/</a><br>5. <a href="https://gaussian.com/wp-content/uploads/dl/gv6.pdf">https://gaussian.com/wp-content/uploads/dl/gv6.pdf</a><br>6. <a href="https://dasher.wustl.edu/chem478/software/spartan-manual.pdf">https://dasher.wustl.edu/chem478/software/spartan-manual.pdf</a><br>7. <a href="http://www.mdtutorials.com/gmx/">http://www.mdtutorials.com/gmx/</a><br>8. <a href="https://dasher.wustl.edu/chem430/software/avogadro/learning-avogadro.pdf">https://dasher.wustl.edu/chem430/software/avogadro/learning-avogadro.pdf</a> |
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**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to**

**CO1:** ability to explain the importance of tracer elements on biological system.

**CO2:** explain the metal ion transport, Bohr effect, Na, K, Ca pump.

**CO3:** explain the function of Vitamin B<sub>12</sub>, Zn-Cu enzyme, ferredoxin, cluster enzymes.

**CO4:** classification and the manufacture of refractories, explosives, paints and pigments

**CO5:** applications of artificial intelligence in chemistry

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

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| <b>Title of the Paper</b>       | <b>PHYSICAL CHEMISTRY- II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Semester - VI</b>            | <b>Core Chemistry-Major Paper XI      Paper Code: 26UCH11</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Objectives of the course</b> | <p>The course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• Phase diagram of one and two component systems</li> <li>• Chemical equilibrium,</li> <li>• Separation techniques for binary liquid mixtures.</li> <li>• Electrical conductance and transport number.</li> <li>• Galvanic cells, emf and significance of electrochemical series.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Outline</b>           | <p><b>UNIT-I Phase rule</b></p> <p>Definition of terms; derivation of phase rule ; application to one component systems - water and sulphur - super cooling, sublimation ; two component systems - solid liquid equilibria- simple eutectic (lead - silver), freezing mixtures (potassium iodide- water), compound formation with - congruent melting points (magnesium - zinc and ferric chloride - water system), peritectic change (sodium - potassium), copper sulphate - water system.</p> <p><b>UNIT-II Chemical equilibrium</b></p> <p>Law of mass action - thermodynamic derivation - relationship between <math>K_p</math> and <math>K_c</math> - application to the homogeneous equilibria - dissociation of <math>PCl_5</math> gas – equilibrium constant and degree of dissociation - formation of HI and <math>NH_3</math> - heterogeneous equilibrium - decomposition of solid calcium carbonate -Lechatelier principle - van't Hoff reaction isotherm - temperature dependence of equilibrium constant - van't Hoff reaction isochore - Clapeyron equation - Clausius Clapeyron equation and its applications.</p> <p><b>UNIT-III Binary liquid mixtures</b></p> <p>Ideal liquid mixtures - non ideal solutions - azeotropic mixtures - fractional distillation - partially miscible mixtures - phenol-water, triethylamine-water, nicotine-water - effect of impurities on critical solution temperature; immiscible liquids - steam distillation; Nernst distribution law - applications.</p> <p><b>UNIT-IV Electrical Conductance and Transference</b></p> <p>Arrhenius theory of electrolytic dissociation - Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – Debye Huckel theory - Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Transport number- determination - Hittorf's method, moving boundary method - factors affecting transport number.</p> <p>Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements - determination of – degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations - acid base titrations.</p> |

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|                                                                                                                                       | <p><b>UNIT-V</b></p> <p><b>Galvanic Cells and Applications</b></p> <p>Galvanic cell, representation, reversible and irreversible cells-Electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes - metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series - applications of electrochemical series.</p> <p><b>Applications of EMF measurements</b></p> <p>applications of EMF measurements - determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode and glass electrode, potentiometric titrations - acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis.</p> <p><b>Industrial component</b></p> <p>Galvanic cells- lead storage and Nickel-Cadmium batteries.</p> <p>Fuel cells - <math>H_2</math>-<math>O_2</math> cell - efficiency of fuel cells.</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved</p> <p>(To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.</li> <li>2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.</li> <li>3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28<sup>th</sup> edition 2019, S, Chand &amp; Co.</li> <li>4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.</li> <li>5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition, 2009.</li> <li>2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.</li> <li>3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.</li> <li>4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001</li> <li>5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&amp;Co., 2001</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1. <a href="https://nptel.ac.in">https://nptel.ac.in</a><br><a href="https://swayam.gov.in">https://swayam.gov.in</a><br>2. <a href="https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf">https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf</a><br>3. Thermodynamics - NPTEL<br><a href="https://www.youtube.com/watch?v=f0udxGcoztE">https://www.youtube.com/watch?v=f0udxGcoztE</a><br>4. Introduction to chemical equilibrium – MIT open course ware |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><b>On completion of the course the students should be able to</b><br><br><b>CO1:</b> construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.<br><b>CO2:</b> apply the concepts of chemical equilibrium in dissociation of $\text{PCl}_5$ , $\text{N}_2\text{O}_4$ and formation of $\text{HI}$ , $\text{NH}_3$ , $\text{SO}_3$ and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.<br><b>CO3:</b> Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.<br><b>CO4:</b> Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.<br><b>CO5:</b> Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

| Title of the Paper              | SPECTROSCOPY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
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| Semester - VI                   | Elective Course-II <span style="float: right;">Paper Code:26UCHE02</span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Objectives of the course</b> | <p>This course is designed to provide knowledge on</p> <ul style="list-style-type: none"> <li>• Electrical and magnetic properties of organic and inorganic compounds</li> <li>• Basic principles of microwave, uv-visible, infrared, raman, nmr , mass spectrometry, epr and mössbauer</li> <li>• Instrumentation of microwave, uv-visible, infrared, raman, nmr, mass spectrometry, epr and mössbauer</li> <li>• Applications of various spectral techniques in structural elucidation</li> <li>• Solving combined spectral problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Course Outline</b>           | <p><b>UNIT-I Electrical and Magnetic properties of molecules</b><br/> Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational and electronic) Born Oppenheimer approximation. Magnetic properties-diamagnetism, paramagnetism - determination of magnetic susceptibility using Guoy balance, ferromagnetism, Ferri and anti ferromagnetism<br/> Microwave spectroscopy, definition, selection rule instrumentation and applications. Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules - determination of bond length, effect of isotopic substitution - instrumentation and applications<br/> <b>U.V-VISIBLE Spectroscopy</b>-Types of electronic transitions. pre- dissociation spectra and dissociation energy. Applications-Beer's- Lambert's law, chromophore, auxochrome, bathochromic and hypsochromic shifts-Instrumentation and applications</p> <p><b>UNIT-II Infrared spectroscopy</b><br/> Vibrational spectra - principles - Instrumentation.-modes of vibrations - diatomic, triatomic linear (CO<sub>2</sub>) and non- linear triatomic (H<sub>2</sub>O) molecules - selection rules - stretching and bending vibrations - applications-determination of force constant, moment of inertia and inter nuclear distance - application of IR spectra to simple organic and inorganic molecules - (group frequencies).<br/> <b>Raman Spectroscopy</b><br/> principles - ,Rayleigh scattering and Raman scattering of light - Raman shift -Stokes and Anti stokes lines - selection rules - mutual exclusion principle - instrumentation (block diagram) - applications - differences. between IR and Raman spectroscopy.</p> <p><b>UNIT-III Nuclear magnetic resonance spectroscopy:</b><br/> PMR - theory of PMR - instrumentation - number of signals - chemical shift - peak areas and proton counting - spin-spin coupling - coupling constant - shielding and deshielding of protons, chemical shifts of protons in hydrocarbons and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems. Interpretation of NMR spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone</p> |

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|                                                                                                                                       | <p><b>UNIT-IV Mass Spectrometry</b><br/> Basic principles- instrumentation- molecular ion peak, base peak, metastable peak, isotopic peak- their uses. Nitrogen rule- ring rule- fragmentation and their types – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules.<br/> Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).</p> <p><b>UNIT-V Electron Paramagnetic Resonance Spectroscopy</b><br/> <b>Electron Paramagnetic Resonance Spectroscopy:</b> Principle and theory of EPR, g-factor, hyperfine interaction sand instrumentation<br/> <b>Mössbauer Spectroscopy:</b> Basic principle, concepts and applications - isomer shift, quadrupole splitting, hyperfine splitting, limitations and instrumentation.</p>                                                      |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br>(To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. <i>Elements of Analytical Chemistry</i>; S Chand: New Delhi, 2003.</li> <li>2. Usharani, S. <i>Analytical Chemistry</i>, 1<sup>st</sup>ed.; Macmillan: India, 2002.</li> <li>3. Banwell, C.N.; Mc Cash, E. M. <i>Fundamentals of Molecular Spectroscopy</i>, 4<sup>th</sup> ed.; Tata McGraw Hill, New Delhi, 2017.</li> <li>4. U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand &amp; Sons, 2<sup>nd</sup> Ed., 2005</li> <li>5. B.K.Sharma, Spectroscopy, 22<sup>nd</sup> ed., Goel Publishing House, 2011.</li> <li>6. Sharma.Y.R, Elementary applications- Organic Spectroscopy, Principles and applications- S. Chand &amp; Co.</li> </ol>                                                                                                                      |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Srivastava, A. K.; Jain, P. C. <i>Chemical Analysis an Instrumental Approach</i>, 3<sup>rd</sup>ed.; S.Chand, New Delhi, 1997.</li> <li>2. Robert D Braun. <i>Introduction to Instrumental Analysis</i>; Mc.Graw Hill: New York, 1987.</li> <li>3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. <i>Fundamentals of Analytical Chemistry</i>, 9<sup>th</sup>ed.; Harcourt college Publishers: USA, 2013.</li> <li>4. Madan, R. L.; Tuli, G. D. <i>Physical Chemistry</i>, 2<sup>nd</sup>ed.; S.Chand: New Delhi, 2005.</li> <li>5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. <i>Principles of Physical Chemistry</i>, 43<sup>rd</sup> ed.; Vishal Publishing: Delhi, 2008.</li> <li>6. William Kemp, Organic Spectroscopy – ELBS.</li> <li>7. R. S. Drago, Physical Methods for Chemists, 2nd Edition, Surfside</li> </ol> |

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1. <a href="http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf">http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf</a><br>2. <a href="http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html">http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html</a><br>3. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a><br>4. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a><br>5. <a href="http://swayam.gov.in">http://swayam.gov.in</a> |
| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b><br><br><b>On completion of the course the students should be able to</b><br><b>CO1:</b> explain electrical and magnetic properties of materials and microwave spectroscopy<br><b>CO2:</b> explain theory, instrumentation and applications of Infrared and Raman spectroscopy<br><b>CO3:</b> apply selection rules to understand spectral transitions, explain Woodward – Fieser’s rule for the calculation of wavelength maximum of conjugated dienes<br><b>CO4:</b> explain theory, instrumentation and applications of NMR spectroscopy<br><b>CO5:</b> explain theory, instrumentation and applications of Mass spectrometry and electron paramagnetic resonance spectroscopy |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO / PSO                                                 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>PHARMACEUTICAL CHEMISTRY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Semester - VI</b>            | <b>Elective Course-III</b> <b>Paper Code: 26UCHE03</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Objectives of the course</b> | <p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• Drugs design and drug metabolism</li> <li>• Important indian medicinal plants, common diseases and antibiotics</li> <li>• Drugs for major diseases like cancer, diabetes and aids</li> <li>• Analgesics and antipyretic agents</li> <li>• Significance of clinical tests</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Outline</b>           | <p><b>UNIT-I Introduction</b><br/>           Important terminologies - drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index. Sources of drugs - dosage forms - bio availability - routes of administration - absorption, distribution and elimination of drugs - drug metabolism - prescription terms.<br/> <b>Structure and pharmacological activity</b><br/>           Effect of - unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite aldehydic, keto, hydroxyl and alkyl groups.</p> <p><b>UNIT-II Common diseases and their treatment</b><br/>           Causes, prevention and treatment of the following diseases:<br/>           Insect borne diseases - malaria, filariasis, plague; Water borne diseases - cholera, typhoid, dysentery. Digestive system - jaundice; Respiratory system – asthma; Nervous system - epilepsy.<br/> <b>Antibiotics</b><br/>           Definition - classification - structure and therapeutic uses of chloramphenicol, penicillins, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, Erythromycin.</p> <p><b>UNIT-III Drugs for major diseases</b><br/> <b>Cancer</b> - common causes - chemotherapy - anti neoplastic agents - classification - adverse effects of cytotoxic agents ; alkylating agents - chlorambucil ; anti metabolites - methotrexate, fluouracil ; Vinca alkaloids- vincristine, vinblastine. Diabetes - types - management of diabetes - insulin; oral hypoglycemic agents - sulphonyl ureas -chlorpropamide; biguanides -metformin -thiazolidinediones.<br/> <b>Cardiovascular drugs</b> - cardio glycosides; anti- hypertensive drugs - Aldomet, pentolinium tartarated; AIDS - causes, symptoms and prevention - anti HIV drugs - AZT, DDC</p> |

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|                                                                                                                                              | <p><b>UNIT-IV</b><br/> <b>Analgesics and antipyretic agents</b><br/> Classification - action of analgesics - narcotic analgesics - morphine; synthetic analgesics - pethidine, methadone; antipyretic analgesics - salicylic acid derivatives, indolyl derivatives.</p> <p><b>Anaesthetics</b><br/> Definition, characteristics, classification - general anaesthetics - volatile anaesthetics - nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene - storage, advantages and disadvantage ; non volatile anaesthetics - thiopental sodium ; local anaesthetics - requisites - advantages - esters - cocaine, benzocaine; amides.</p> <p><b>Blood and haematological agents</b><br/> Blood - composition, grouping - physiological functions of plasma proteins - mechanism of clotting; Coagulants - vitamin K, protamine sulphate, dry thrombin; Anti coagulants - coumarins, citric acid and heparin; antifibrinolytic agents, Anaemia - causes, types and control - anti anaemic drugs</p> <p><b>UNIT-V Clinical Chemistry</b><br/> Blood tests - blood count - complete haemogram - Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time – glucose tolerance test.<br/> <b>Significance of Clinical Tests</b><br/> Serum electrolytes - blood Glucose - orthotoluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile - cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination - pH, tests for glucose, albumin and bile pigment.<br/> <b>Indian medicinal plants</b><br/> Some important Indian medicinal plants - tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai - uses</p> <p><b>(Note: Students May be permitted and encouraged to undergo industrial visits and internships at relevant chemical and agricultural industries to gain practical exposure)</b></p> |
| <p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p> | <p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved<br/> (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>Skills acquired from this course</p>                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Recommended Text</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ol style="list-style-type: none"> <li>1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2<sup>nd</sup> ed., S.Chand&amp; company, New Delhi.</li> <li>2. Lakshmi S, (2004), Pharmaceutical chemistry, 3<sup>rd</sup> ed., Sultan chand&amp; sons, Delhi.</li> <li>3. Tripathi K D, (2018), Essentials of medical pharmacology, 8<sup>th</sup> ed., Jaypee brothers medical publishers ( P ) Limited, New Delhi.</li> <li>4. Ashutosh Kar, (2018), Medicinal chemistry, 7<sup>th</sup> ed.,New age international ( P ) Limited, Publishers, New Delhi.</li> </ol>     |
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic ( vol-I ) 6<sup>th</sup>ed ., Himalaya publishing house, Bombay.</li> <li>2. Chatwal G R, (1991),Pharmaceutical chemistry, organic(vol-II), Himalaya publishing house, Bombay.</li> <li>3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.</li> <li>4. Intellectual Property Rights, Neeraj Pandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.</li> </ol> |
| <b>Website and e-learning source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ol style="list-style-type: none"> <li>1. <a href="http://www.pharmacy.umaryland.edu/faculty/amackere/courses/pbar531_delete/lectures/qsar_1.pdf">http://www.pharmacy.umaryland.edu/faculty/amackere/courses/pbar531_delete/lectures/qsar_1.pdf</a></li> <li>2. <a href="http://www.indianmedicinalplants.info/">http://www.indianmedicinalplants.info/</a></li> <li>3. <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a></li> </ol>                                                                                                                     |
| <p><b>Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to</b></p> <p><b>CO1:</b> Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.</p> <p><b>CO2:</b> Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents,</p> <p><b>CO3:</b> Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.</p> <p><b>CO4:</b> explain classification of analgesics and anesthetics, and physiological functions of plasma proteins</p> <p><b>CO5:</b> explain the significance of clinical tests like blood urea, serum proteins and coronary risk index, significance of medicinal plants, clinical tests and factors for patentability.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>                                                                                                             | <b>GRAVIMETRIC ESTIMATION AND QUALITATIVE ORGANIC ANALYSIS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Semester VI</b>                                                                                                                    | <b>Core Practical-III</b> <b>Paper Code: 26UCHP03</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Objectives of the course</b>                                                                                                       | <p>This course aims at providing</p> <ul style="list-style-type: none"> <li>• Learn to form highly pure, insoluble precipitates from a solution of target ions.</li> <li>• Hands on experience in carrying out the experiments</li> <li>• Convert precipitates into stable, weighable chemical compositions using high-temperature burners or muffle furnaces</li> <li>• Identify functional groups using specific chemical color tests.</li> <li>• Confirm molecular structures by preparing solid crystalline derivatives</li> <li>• Compare the migration distance of an unknown compound against pure substance Confirm identity standard references</li> </ul> |
| <b>Course Outline</b>                                                                                                                 | <p><b>Unit- I GRAVIMETRIC ESTIMATIONS</b></p> <ol style="list-style-type: none"> <li>1. Estimations of Barium as Barium sulphate</li> <li>2. Estimation of Sulphate as Barium sulphate</li> <li>3. Estimation of Barium as Barium chromate</li> <li>4. Estimation of Lead as Lead chromate</li> <li>5. Estimation of Calcium as Calcium oxalate monohydrate</li> <li>6. Estimation of Nickel as Nickel DMG</li> </ol>                                                                                                                                                                                                                                               |
|                                                                                                                                       | <p><b>Unit- II Qualitative Organic Analysis</b></p> <p>Analysis of organic compounds-Preliminary examination, detection of special elements - Nitrogen, Sulphur and Halogens Aromatic and Aliphatic nature, Test for Saturation and Unsaturation, Identification of functional groups using solubility tests Confirmation of functional groups and preparation of derivative</p> <p><b>Carboxylic acids, Phenol, Aldehydes, Ketones, Monosaccharides, Aromatic ester, Aromatic primary amines, Amide, Diamide, Anilide and Nitro compounds - Chromatography Technique for derivative conformation</b></p>                                                           |
| Skills acquired from this course                                                                                                      | <p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills. Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>                                                                                                                                                                                                                                                                                                                                                                   |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Skills acquired from this course                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                                      |                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Book</b>                | 1.Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. <i>Basic Principles of Practical Chemistry</i> , 2 <sup>nd</sup> ed.; Sultan Chand & Sons: New Delhi, 1997.<br>2. <i>Vogel's Textbook of Practical Organic Chemistry</i> (5th Edition).<br>3. <i>Comprehensive Practical Organic Chemistry: Qualitative Analysis</i> , manual by V.K. Ahluwalia and Sunita Dhingra |
| <b>Website and e-learning source</b> | <a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>                                                                                                                                                                                                                                                     |

### Course Learning Outcomes (for Mapping with POs and PSOs)

**On completion of the course the students should be able to**

**CO1:** Describe the principles and methodology for the practical work.

**CO2:** Explain the procedure, data and methodology for the practical work

**CO3:** Apply the principles for carrying out the practical work, Demonstrate laboratory skills for safe handling of the equipment and chemicals

**CO4:** identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis

**CO5:** exhibit a solid derivative with respect to the identified functional group in TLC/Paper Chromatography

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

### CO-PO Mapping (Course Articulation Matrix)

| CO / PSO                                                 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

### Level of Correlation between PSO and CO

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>               | <b>PHYSICAL CHEMISTRY PRACTICALS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Semester VI</b>                      | <b>Core Practical – IV</b> <b>Paper Code: 26UCHP04</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Objectives of the course</b>         | <p>This course aims at providing</p> <ul style="list-style-type: none"> <li>• Basic principles of physical chemistry experiments</li> <li>• Hands on experience in carrying out the experiments</li> <li>• Determine the rate constants, order of reactions, and activation energy of chemical processes</li> <li>• Operate and calibrate instruments like conductometers and potentiometers</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Course Outline</b>                   | <p><b>UNIT-I Chemical Kinetics</b></p> <ol style="list-style-type: none"> <li>1. Determination of rate constant of acid catalyzed hydrolysis of an ester (methyl acetate (or) ethyl acetate).</li> <li>2. Determination of order of reaction between iodide and persulphate (initial rate method).</li> <li>3. Polarimetry: Determination of rate constant of acid catalyzed inversion of cane sugar (Demonstration only)</li> </ol> <p><b>Unit-II Phase Diagrams</b></p> <ol style="list-style-type: none"> <li>1. Simple eutectic - determination of eutectic temperature and composition of naphthalene - diphenyl amine or diphenyl system</li> <li>2. Determination of transition temperature of a salt hydrate.</li> <li>3. Effect of impurity on CST of phenol – water system and determination of unknown concentration of Sodium Chloride Colligative property</li> <li>4. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent</li> <li>5. Determination of molal depression constant K<sub>f</sub> of the given solvent.</li> </ol> <p><b>UNIT-III Distribution Law: (Demonstration only)</b><br/>Distribution co-efficient of iodine between benzene and water</p> <p><b>UNIT-IV Electro Chemistry</b></p> <p><b>Conductometry</b></p> <ol style="list-style-type: none"> <li>1. Determination of cell constant, Specific conductance and equivalent conductance of strong electrolyte</li> <li>2. Determination of dissociation constant of acetic acid</li> <li>3. Conductometric titration of hydrochloric acid against NaOH</li> <li>4. Conductometric titration of mixture of acids against NaOH</li> </ol> <p><b>Potentiometry</b></p> <ol style="list-style-type: none"> <li>1. Potentiometric titration of HCl against NaOH</li> <li>2. Potentiometric titration of ferrous ion against potassium dichromate</li> </ol> |
| <b>Skills acquired from this course</b> | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Reference Books</b>                  | <ol style="list-style-type: none"> <li>1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i>, Macmillan India : New Delhi, 2005.</li> <li>2. Gupta, Renu, <i>Practical Physical Chemistry</i>, 1<sup>st</sup> Ed.; New Age International New Delhi, 2017.</li> <li>3. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. <i>Basic Principles of Practical Chemistry</i>, 2<sup>nd</sup> ed.; Sultan Chand &amp; Sons: New Delhi, 1997</li> <li>Khosla, B. D. Garg, V. C.; Gulati, A. <i>Senior Practical Physical Chemistry</i>, R. Chand : New Delhi, 2011.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Website and e-learning source</b>    | <a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| <b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> On completion of the course the students should be able to<br><b>CO1:</b> Describe the principles and methodology for the practical work.<br><b>CO2:</b> Explain the procedure, data and methodology for the practical work<br><b>CO3:</b> Apply the principles of phase rule and electrochemistry for carrying out the practical work<br><b>CO4:</b> Demonstrate laboratory skills for safe handling of the equipment and chemicals |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

**ALLIED CHEMISTRY**

**(I or II Year / Semester - I or III and II or IV)**

| <b>Paper Code</b> |           | <b>Subject Title</b>                                                         | <b>Hours<br/>Week</b> | <b>Exam<br/>Hours</b> | <b>Internal<br/>Marks</b> | <b>External<br/>Marks</b> | <b>Total<br/>Marks</b> | <b>Credit</b> |
|-------------------|-----------|------------------------------------------------------------------------------|-----------------------|-----------------------|---------------------------|---------------------------|------------------------|---------------|
| 26UCHA01          | Theory    | Allied Chemistry -I                                                          | 4<br>(Odd Semester)   | 3                     | 25                        | 75                        | <b>100</b>             | <b>4</b>      |
| 26UCHAP01         | Practical | Practical-I<br>Volumetric Estimations<br>and Qualitative Organic<br>Analysis | 3<br>(Odd Semester)   | -                     | -                         | -                         | -                      | -             |
| 26UCHA02          | Theory    | Allied Chemistry -II                                                         | 4<br>(Even Semester)  | 3                     | 25                        | 75                        | <b>100</b>             | <b>4</b>      |
| 26UCHAP01         | Practical | Practical-I<br>Volumetric Estimations<br>and Qualitative Organic<br>Analysis | 3<br>(Even Semester)  | 3                     | 40                        | 60                        | <b>100</b>             | <b>3</b>      |

## ALLIED CHEMISTRY

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>ALLIED CHEMISTRY -I</b><br><b>(For Mathematics, Physics, Geology, Botany, Biochemistry &amp; Zoology etc)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Semester – I / III</b>       | <b>Allied Paper-I</b> <span style="float: right;"><b>Paper Code:26UCHA01</b></span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Objectives of the course</b> | <p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• Basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry</li> <li>• Nuclear chemistry and industrial chemistry</li> <li>• Importance of speciality drugs and</li> <li>• Separation and purification techniques.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Course Outline</b>           | <p><b>UNIT-I Chemical Bonding and Nuclear Chemistry</b><br/>           Chemical Bonding: Definition, Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen, oxygen, Fluorine and NO molecule; discussion of bond order and magnetic properties.<br/>           Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.</p> <p><b>UNIT-II Fundamental Concepts in Organic Chemistry</b><br/> <b>Hybridization:</b> Orbital overlap hybridization and geometry of CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub> and C<sub>6</sub>H<sub>6</sub>.<br/> <b>Electron displacement Effects:</b> Inductive, Resonance, Hyper conjugative &amp; steric effects. Their effect on the properties of compounds.<br/> <b>Reaction mechanisms:</b> Types of reactions- aromaticity-Electrophilic substitution in Benzene-Mechanism of Nitration, Halogenation- Craft's alkylation and acylation.<br/> <b>Heterocyclic compounds:</b> Preparation, properties and uses of Furan, Thiophene, Pyrrole and Pyridine</p> <p><b>UNIT-III Drugs and Speciality Chemicals</b><br/>           Definition, structure and uses: sulpha drugs-prontosil, sulphadiazine and sulphafurazole, Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate;<br/>           Organic Halogen compounds viz., Freon, Teflon<br/>           Cause and treatment of-diabetes, cancer and AIDS.</p> |

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|                                                                                                                                       | <p><b>UNIT-IV Analytical Chemistry</b></p> <p><b>Safety Measures:</b> Handling reagents and solutions-acids, alkali, bromine water, phenol, inflammable substances etc.</p> <p>Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization.</p> <p><b>Chromatography:</b> Principle and application of column, paper and thin layer chromatography.</p> <p><b>UNIT-V Industrial Chemistry</b></p> <p><b>Chemical Explosives:</b> Preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, RDX, Dynamite, cordite, picric acid, gunpowder, introduction to rocket propellants.</p> <p><b>Fuels:</b> Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p><b>Silicones:</b> Synthesis, properties and uses of silicones.</p> <p><b>Fertilizers:</b> Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.</p> |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.</li> <li>2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.</li> <li>3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.</li> <li>4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</li> <li>2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</li> <li>3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan &amp; Chand, Edition 2006.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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| <p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p><b>CO1:</b> state the theories of chemical bonding, nuclear reactions and its applications</p> <p><b>CO 2:</b> evaluate the efficiencies and uses of various fuels and fertilizers.</p> <p><b>CO 3:</b> explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.</p> <p><b>CO 4:</b> demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.</p> <p><b>CO 5:</b> analyse various methods to identify an appropriate method for the separation of chemical components</p> |
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|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

#### CO-PO Mapping (Course Articulation Matrix)

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

#### Level of Correlation between PSO and CO

|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Title of the Paper</b>       | <b>ALLIED CHEMISTRY -II</b><br><b>(For Mathematics, Physics, Geology, Botany, Biochemistry &amp; Zoology etc)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Semester – II / IV</b>       | <b>Allied Paper-II</b> <b>Paper Code:26UCHA02</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Objectives of the course</b> | <p>This course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• Nomenclature of coordination compounds and carbohydrates.</li> <li>• Amino acids, vitamins and essential elements of biosystem</li> <li>• Understand the concepts of kinetics and catalysis</li> <li>• Provide fundamentals of electrochemistry, photochemistry and phase rule</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Course Outline</b>           | <p><b>UNIT-I</b><br/><b>Co-ordination Chemistry and Water Technology</b></p> <p><b>Co-ordination Chemistry:</b> Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to <math>[\text{Ni}(\text{CO})_4]</math>, <math>[\text{Ni}(\text{CN})_4]^{2-}</math>, <math>[\text{Co}(\text{CN})_6]^{3-}</math> Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</p> <p><b>Water Technology:</b> Hardness of water, determination of hardness of water using EDTA method, zeolite method- Purification techniques - BOD and COD.</p> <p><b>UNIT-II Carbohydrates</b></p> <p>Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose.</p> <p>Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.</p> <p><b>UNIT-III Amino Acids and Vitamins</b></p> <p>Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification - structure - Colour reactions - Biological functions - nucleosides - nucleotides - RNA and DNA - structure.</p> <p><b>Vitamins :</b> Sources , requirement deficiency diseases of A, B, C, D and K</p> <p><b>UNIT-IV Electrochemistry</b></p> <p>Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells -fuel cells-corrosion and its prevention.</p> |

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|                                                                                                                                       | <p><b>UNIT-V Photochemistry</b></p> <p>Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).</p> <p><b>Phase Rule:</b> Phase rule and the definition of terms in it. Application of phase rule to water system simple eutetic system (Pb-Ag) Freezing mixtures</p>                                                                                                                                                                                                                          |
| Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper) | Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Skills acquired from this course                                                                                                      | Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Recommended Text</b>                                                                                                               | <ol style="list-style-type: none"> <li>1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.</li> <li>2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.</li> <li>3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.</li> <li>4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li> </ol>                                                                                                                                                                  |
| <b>Reference Books</b>                                                                                                                | <ol style="list-style-type: none"> <li>1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.</li> <li>2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li> <li>3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007</li> <li>4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.</li> <li>5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</li> </ol> |

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to**

**CO 1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds water technology and enlighten the biological role of transition metals.

**CO 2:** explain the preparation and property of carbohydrate.

**CO 3:** amino acids , Vitamins and nucleic acids.

**CO 4:** apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

**CO 5:** outline the various type of photochemical process and Phase rule.

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| <b>CO1</b> | S   | S   | S   | S   | S   | S   | S   | M   | S   | M    |
| <b>CO2</b> | M   | S   | S   | S   | M   | S   | S   | M   | M   | M    |
| <b>CO3</b> | S   | S   | S   | M   | S   | S   | S   | M   | S   | M    |
| <b>CO4</b> | S   | S   | S   | S   | S   | S   | S   | M   | M   | M    |
| <b>CO5</b> | S   | M   | S   | S   | S   | S   | S   | M   | M   | S    |

**CO-PO Mapping (Course Articulation Matrix)**

| CO /PSO                                                  | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|----------------------------------------------------------|------|------|------|------|------|
| <b>CO1</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO2</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO3</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO4</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>CO5</b>                                               | 3    | 3    | 3    | 3    | 3    |
| <b>Weightage</b>                                         | 15   | 15   | 15   | 15   | 15   |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0  | 3.0  | 3.0  | 3.0  | 3.0  |

**Level of Correlation between PSO and CO**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <b>Title of the Paper</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p align="center"><b>ALLIED CHEMISTRY PRACTICAL -<br/>VOLUMETRIC ESTIMATIONS AND QUALITATIVE<br/>ORGANIC ANALYSIS</b></p> <p align="center"><b>(For Mathematics, Physics, Geology,<br/>Botany, Biochemistry and Zoology etc )</b></p> <p align="center"><b>(I or II Year / II or IV Semester)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Semester – II / IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b>Allied Practical Paper-I</b> <span style="float: right;"><b>Paper Code: 26UCHAP01</b></span></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Objectives of the course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>This course aims to provide knowledge on the</p> <ul style="list-style-type: none"> <li>• Basics of preparation of solutions.</li> <li>• Principles and practical experience of volumetric analysis</li> <li>• Analysis of organic compounds</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Course Outline</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>VOLUMETRIC ESTIMATIONS</b></p> <ol style="list-style-type: none"> <li>1. Estimation of sodium hydroxide using standard sodium carbonate.</li> <li>2. Estimation of hydrochloric acid using standard oxalic acid.</li> <li>3. Estimation of ferrous sulphate using standard Mohr's salt.</li> <li>4. Estimation of oxalic acid using standard ferrous sulphate.</li> <li>5. Estimation of potassium permanganate using standard potassium dichromate.</li> <li>6. Estimation of ferrous ion using diphenyl amine as indicator.</li> <li>7. Estimation of hardness of water.</li> </ol> <p><b>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</b></p> <p>The analysis must be carried out as follows:</p> <ol style="list-style-type: none"> <li>(a) Functional group tests [ Phenol, Acids (Mono &amp; Di) Aromatic Primary Amine, Amides (Mono &amp; Di), Aldehyde and carbohydrate].</li> <li>(b) Detection of elements (N, S, Halogens).</li> <li>(c) To distinguish between aliphatic and aromatic compounds.</li> <li>(d) To distinguish - Saturated and unsaturated compounds.</li> </ol> |
| <b>Reference Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>1.V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand &amp; sons, Second edition, 1997.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p>CO 1: Gain an understanding of the use of standard flask and volumetric pipettes, burette.</p> <p>CO 2: Design, carry out, record and interpret the results of volumetric titration and organic reaction</p> <p>CO 3: Apply their skill in the analysis of water/hardness/ chemical reaction</p> <p>CO4: Analyze the chemical constituents in allied chemical products.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|            | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|
| <b>CO1</b> | S          | S          | S          | S          | S          | S          | S          | M          | S          | M           |
| <b>CO2</b> | M          | S          | S          | S          | M          | S          | S          | M          | M          | M           |
| <b>CO3</b> | S          | S          | S          | M          | S          | S          | S          | M          | S          | M           |
| <b>CO4</b> | S          | S          | S          | S          | S          | S          | S          | M          | M          | M           |
| <b>CO5</b> | S          | M          | S          | S          | S          | S          | S          | M          | M          | S           |

**CO-PO Mapping (Course Articulation Matrix)**

| <b>CO /PSO</b>                                           | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> |
|----------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO1</b>                                               | 3           | 3           | 3           | 3           | 3           |
| <b>CO2</b>                                               | 3           | 3           | 3           | 3           | 3           |
| <b>CO3</b>                                               | 3           | 3           | 3           | 3           | 3           |
| <b>CO4</b>                                               | 3           | 3           | 3           | 3           | 3           |
| <b>CO5</b>                                               | 3           | 3           | 3           | 3           | 3           |
| <b>Weightage</b>                                         | 15          | 15          | 15          | 15          | 15          |
| <b>Weighted percentage of Course Contribution to POs</b> | 3.0         | 3.0         | 3.0         | 3.0         | 3.0         |

**Level of Correlation between PSO and CO**

**DEPARTMENT OF CHEMISTRY**  
**PROGRAMME SPECIFIC OUTCOMES**

**On successful completion of the programme the students will be able to**

**PSO1:** Acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.

**PSO2:** Disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.

**PSO3:** Uphold ethical values in personal life, research and career.

**PSO4:** Demonstrate laboratory skills, analytical acumen, creatively in academics and research.

**PSO5:** Apply digital tools to collect, analyze and interpret data and AI in chemistry presents scientific findings.

**PSO6:** Gain competence to pursue higher education and career opportunities in chemistry and allied fields.

**PSO7:** Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

**PSO8:** Apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

**PSO9:** Exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

**PSO10:** Display proactive approach towards sustainable environment through green laboratory practices.

**PO-PSO MAPPING MATRIX:**

| <b>PSOs</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> | <b>PSO6</b> | <b>PSO7</b> | <b>PSO8</b> | <b>PSO9</b> | <b>PSO10</b> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>POs</b>  |             |             |             |             |             |             |             |             |             |              |
| <b>PO1</b>  | <b>X</b>    |             |             |             |             |             |             |             |             |              |
| <b>PO2</b>  |             | <b>X</b>    |             |             |             |             |             |             |             |              |
| <b>PO3</b>  |             |             | <b>X</b>    |             |             |             |             |             |             |              |
| <b>PO4</b>  |             |             |             | <b>X</b>    |             |             |             |             |             |              |
| <b>PO5</b>  |             |             |             |             | <b>X</b>    |             |             |             |             |              |
| <b>PO6</b>  |             |             |             |             |             | <b>X</b>    |             |             |             |              |
| <b>PO7</b>  |             |             |             |             |             |             | <b>X</b>    |             |             |              |
| <b>PO8</b>  |             |             |             |             |             |             |             | <b>X</b>    |             |              |
| <b>PO9</b>  |             |             |             |             |             |             |             |             | <b>X</b>    |              |
| <b>PO10</b> |             |             |             |             |             |             |             |             |             | <b>X</b>     |

**PERIYAR UNIVERSITY, SALEM-11**  
**B.SC , DEGREE PRACTICAL EXAMINATIONS,**

**Model Question Paper Pattern**  
**CORE PRACTICAL – I**  
**VOLUMETRIC ESTIMATIONS AND ORGANIC PREPARATIONS**

**Time: 3 hours**

**Maximum Marks: 60**

**Mark Distribution**

|                               |           |
|-------------------------------|-----------|
| i) Volumetric Estimations     | :35 marks |
| ii) Organic Preparation       | :10 marks |
| iii) Chromatography Technique | :5 marks  |
| iv) Record                    | :10 marks |

1. Estimate volumetrically the amount of..... present in the whole of the given solution. You are provided with..... and a suitable link solution. Get the titre values attested by the examiners.
2. Prepare maximum quantity of..... from the given sample. Submit the dried sample for evaluation.
3. In an organic preparation, how does the simultaneous tracking of **reactant disappearance (spot)** and **product appearance (spot)** on a single chromatogram establish reaction completion.

(Scheme of valuation given by University question paper)

**PERIYAR UNIVERSITY, SALEM-11**  
**B.SC , DEGREE PRACTICAL EXAMINATIONS,**

**Model Question Paper Pattern**  
**CORE PRACTICAL – II**  
**QUALITATIVE INORGANIC ANALYSIS AND INORGANIC PREPARATIONS**

**Time: 3 hours**

**Maximum Marks :60**

**Mark Distribution**

|                               |           |
|-------------------------------|-----------|
| i) Qualitative Analysis       | :35 marks |
| ii) Inorganic Preparation     | :10 marks |
| iii) Chromatography Technique | :5 marks  |
| iii) Record                   | :10 marks |

1. Analyse systematically the given Inorganic mixture containing two acid radicals and two basic radicals, one acid radical being interfering one, record your observations and inferences then and there. Exhibit confirmative tests for each radical for evaluation.
2. Prepare maximum quantity of from the given simple salts. Submit the dried sample for evaluation.
3. In an inorganic preparation, how does the simultaneous tracking of **reactant disappearance (spot)** and **product appearance (spot)** on a single chromatogram establish reaction completion

(Scheme of valuation given by University question paper)

**PERIYAR UNIVERSITY, SALEM-11**  
**B.SC , DEGREE PRACTICAL EXAMINATIONS,**  
**Model Question Paper Pattern**  
**CORE PRACTICAL – III**  
**GRAVIMETRIC ESTIMATION AND QUALITATIVE ORGANIC ANALYSIS**

**Time: 6 Hour**

**Maximum Marks: 60**

- |                                      |                  |
|--------------------------------------|------------------|
| <b>i) Gravimetric estimation</b>     | <b>:20 marks</b> |
| <b>ii) Organic Analysis</b>          | <b>:25 marks</b> |
| <b>iii) Chromatography Technique</b> | <b>:5 marks</b>  |
| <b>iv) Record</b>                    | <b>:10 marks</b> |

1.Estimate Gravimetrically the amount of .....present in the whole of the given solution by converting it into..... . Get the weighing's attested by the examiners.

2.Analyses systematically the given organic compound and report the following:

- a) Whether Aliphatic or Aromatic
- b) Saturated or Unsaturated
- c) Special elements present and absent
- d) Functional group present
- e) Submit a colour reaction or derivative in support of functional group present and record your observation then and there

3. In an organic derivatives preparation, how does the simultaneous tracking of **reactant disappearance (spot)** and **product appearance (spot)** on a single chromatogram establish reaction completion

(Scheme of valuation given by University question paper)

**PERIYAR UNIVERSITY, SALEM-11**  
**B.SC , DEGREE PRACTICAL EXAMINATIONS**  
**Model Question Paper Pattern**  
**CORE PRACTICAL – IV**  
**PHYSICAL CHEMISTRY PRACTICALS**

**Time: 3 Hour**

**Maximum Marks: 60**

**Choose any one of the questions given below by lot**

1. Determine the rate constant of the acid catalyzed hydrolysis of the given ester at room temperature.
2. Determine the molecular weight of the given solute. You are provided with a suitable solvent.  
Whose,  $K_f$  value is.....
3. Determine the molal depression constant  $K_f$  of the given solute. You are provided with a suitable solvent, whose molecular weight is.....
4. Find out the concentration of the given sodium chloride solution. You are provided with pure phenol and 1 % solution of Sodium Chloride.
5. Determine the transition temperature of the hydrated salt by thermometric method.
6. Construct a simple eutectic system and determine of unknown percentage of given compound.
7. Find out the cell constant of the given conductivity cell using 0.1 N and 0.01 N potassium chloride solutions, whose specific conductivities are given. Determine the equivalent conductance of the two solutions of known concentration.
8. Determine the amount of the given Hydrochloric acid solution conductometrically using a standard Sodium Hydroxide solution.
9. Determine the amount of Acetic acid and Hydrochloric acid in the given mixture of acids conductometrically using a standard Sodium Hydroxide solution.
10. Determine the amount of the given Hydrochloric acid solution potentiometrically using a standard Sodium Hydroxide solution.

(Scheme of valuation given by University question paper)

**PERIYAR UNIVERSITY, SALEM-11**  
**B.SC , DEGREE PRACTICAL EXAMINATIONS,**  
**Model Question Paper Pattern**

**Name of Course: B.Sc Mathematics, Physics, Geology, Botany, Bio Chemistry and Zoology etc**

**Title of the Paper: Allied Chemistry Practical -I**

**VOLUMETRIC ESTIMATIONS AND QUALITATIVE ORGANIC ANALYSIS**

**Semester- I/III    Time: 3 hours**

**Maximum Marks: 60 Marks**

- |                                 |                  |
|---------------------------------|------------------|
| <b>i) Volumetric Estimation</b> | <b>:25 marks</b> |
| <b>ii) Organic Analysis</b>     | <b>:25 marks</b> |
| <b>iii) Record</b>              | <b>:10 marks</b> |

1. Estimate volumetrically the amount of -----present in the whole of the given solution. You are provided with ----- N solution of ----- (standard solution) and a suitable link solution. Get the titre values attested by the examiners.

2. Analyses systematically the given organic compound and report the following:

- A) Aliphatic or Aromatic
- B) Saturated or Unsaturated
- C) Special elements Present and absents in the compound
- D) Functional group present in the compound

Submit a colour reaction in support of functional group present and record your observation then and there

(Scheme of valuation given by University question paper)

**Naan Mudhalvan Paper - Arrear Students - Re-Exam - Skill Enhancement**  
**Course Title & Syllabus**  
**(Semesters – II, III, IV, V & VI)**

| <b>S.No</b> | <b>SEMESTER</b> | <b>TITLE OF THE PAPER</b>              |
|-------------|-----------------|----------------------------------------|
| 1           | II              | Food Chemistry                         |
| 2           | III             | Nutritional Chemistry and Pharmacology |
| 3           | IV              | Analytical and Manufacturing Chemistry |
| 4           | V               | Dye Chemistry                          |
| 5           | VI              | Medicinal Chemistry and Human Health   |

## **SEMESTER -II FOOD CHEMISTRY**

### **UNIT-I Food Adulteration**

Sources of foods, types, advantages and disadvantages, constituents of foods, carbohydrate, protein, fats and, oils, colours, flavours, natural toxicants.

### **UNIT-II Food Poisoning**

Sources, causes and remedy- Causes and remedies for acidity, gastritis, indigestion and constipation

### **UNIT-III Food Preservation and Processing**

Food spoilage, causes of food spoilage, types of Food spoilage, food preservation, preservation and processing by heating- sterilisation, pasteurization.

### **UNIT-IV Food Additives**

Food additives -artificial sweeteners - Saccharin - Cyclamate and Aspartate Food flavours -esters, aldehydes and heterocyclic compounds - Food colours - Emulsifying agents - preservatives - leavening agents. Baking powder - yeast - tastemakers - MSG - vinegar.

### **UNIT-V Vitamins & Minerals**

Sources, requirement deficiency diseases of A, C, K, E1 and B6

Mineral elements in food-Principal mineral elements-source. Function-Deficiency and daily requirements-Na, K, Mg, Fe, S and P

### **Reference Books:**

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.
3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.

## **SEMESTER -III**

### **NUTRITIONAL CHEMISTRY AND PHARMACOLOGY**

#### **UNIT-I Food & Food Poisoning**

Sources of food, types, advantages and disadvantages, constituents of food, carbohydrate, protein, fats and oils, vitamins and minerals, food additives, natural toxicants. Food Poisoning: Sources, causes and remedy – Causes and remedies for acidity, gastritis, indigestion and constipation.

#### **UNIT-II Food Preservation, Processing & Natural Food**

Food spoilage, courses of food spoilage, types of food spoilage, food preservation - Preservation and processing by heating- sterilization, pasteurization – Importance of Natural Food, Concept of “Food as medicine”.

#### **UNIT-III DRUGS**

Classification of drugs – biological & chemical (Structure not required) - Definition and two examples each (Structure not required): Anesthetics (General and local), Analgesics, Antipyretics and anti-inflammatory agents – Antibiotics – Penicillin, Streptomycin, Antivirals. AIDS – symptoms, prevention & treatment – Drug receptors and biological responses – factors affecting metabolism of drugs. (Basic concepts only)

#### **UNIT-IV Drugs for Some Clinical Conditions**

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Systolic & Diastolic Hypertensive drugs – Cardiovascular drugs – depressants and stimulants – Lipid profile – HDL, LDL cholesterol lipid lowering drugs. (Structure not required) - Pharmacologically active constituents in plants, Indian medicinal plants – Tulsi, Neem, Keezhanelli – their importance.

#### **UNIT -V Health Promoting Drugs**

Vitamins A,B, C, D, E and K, micronutrients – Na, K, Ca, Cu, Zn and I, Medicinally important inorganic compounds of Al, P, As, Hg and Fe, Examples and applications, Agents for kidney function (Aminohippuric acid) - Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases (Structure not required).

#### **References:**

1. Seema Yadav, Food Chemistry, Anmol publishing (P) Ltd., New Delhi.
2. Car H. Synder, The Extraordinary Chemistry for ordinary things, John Wiley & sons inc., New York, 1992.
3. Sivasankar, Food Processing and Preservation PHI. (Eastern Economy Editions)
4. V.K. Ahluwalia and Madhu Chopra, Medicinal Chemistry, Ane Books, New Delhi, 2008
5. P. Parimoo, A Text Book of Medicinal Chemistry, CBS publishers, New Delhi, 2006
6. S.Lakshmi Pharmaceutical Chemistry, S.Chand & Sons, New Delhi, 2004
7. Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Ltd., New Delhi, 1993
8. Romas Nogrady, Medicinal Chemistry, Oxford Univ. Press
9. David William and Thomas Lemke, Foyes, Principles of Medicinal Chemistry, BI Publishers

## SEMESTER -IV

### ANALYTICAL AND MANUFACTURING CHEMISTRY

#### UNIT I Chemistry Lab-General Awareness and First Aid Techniques

Safety in chemistry lab- introduction to laboratory glass wares-storage and handling of chemicals- carcinogenic chemicals - handling of ethers - toxic and poisonous chemicals. Burns and damages due to organic substances- acids, alkali's - burns in the eye inhalation of toxic vapours-hazardous chemicals-dealing with bromine, phenol and hot objects.

#### UNIT II Qualitative and Quantitative Aspects of Analysis

S.I Units, Distinction between Mass and Weight. Moles, Milli moles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Evaluation of analytical data - Errors - Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation

#### UNIT III

**Chemical Explosives :** Preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, RDX, Dynamite, cordite, picric acid, gunpowder, introduction to rocket propellants.

**Leather Industry :** Curing, preservation and tanning of hides and skins, process of dehairing and dyeing. Treatment of tannery effluents.

**Electrochemical Industries:** Production of materials like chlorine, austic soda ,sodium chlorate, secondary cells, solar cells, fuel cells.

#### UNIT IV

**Paints & Varnishes:** – primary and Paints & Varnishes: Primary constituents of paints, Dispersion medium (solvent), binder Pigments, formulation of paints and varnishes. Requirements of a good paint.

**Cleansing Agents:** Preparation of toilet and washing soaps, synthetic detergents-alkyl aryl sulphonate and cleansing action of soaps.

#### UNIT V

**Cement :** Manufacture – Wet Process and Dry process, types, analysis of major constituents, setting of cement, reinforced concrete. Cement industries in India.

**Glass:** Composition and manufacture of glass.Types of glasses- optical glass, coloured glasses and lead glass.

#### Reference :

- 1.Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry*, 2<sup>nd</sup> ed.; Sultan Chand & Sons: New Delhi, 1997
2. B.N.Chakrabarty, Industrial Chemistry, Oxford & IBH Publishing Co, New Delhi, 1981.
3. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut.
4. P.P.Singh, T.M.Joesph, R.G.Dhavale, College Industrial Chemistry, Himalaya Publishing House, Bombay, 4th Ed., 1983

## **SEMESTER -V**

### **DYE CHEMISTRY**

#### **UNIT-I**

- 1.1 Colour and constitutions, Definition - Dye, chromophore, auxochrome, bathochromic effect, hypochromic effect and Quinoid theory.
- 1.2 Classification- acid, base, azo, vat and reactive dyes.
- 1.3 Anthroquinone and Mordant Dyes- synthesis and applications of Alizarin.

#### **UNIT II**

- 2.1 Diphenylmethane Dyes- synthesis and application of Auramine -
- 2.2 Triphenylmethane Dyes -Malachite Green, Crystal Violet, Pararosaniline – Preparation and applications.
- 2.3 Indigo Dyes-Preparation and application of Indigo. Derivatives of Indigo-Synthesis and uses of Indigosol and tetrabromo indigo (Ciba blue)

#### **UNIT-III**

- 3.1 Phthalein Dyes – Phenolphthalein – preparation and applications.
- 3.2 Xanthein Dyes – Rhodamine B, Fluorescein – Preparation and applications.
- 3.3 Acridine dyes – synthesis and application of Acriflavin and proflavin.
- 3.4 Reactive dyes – synthesis and applications of Procion Blue HB.

#### **UNIT-IV**

- 4.1 Requirements of organic pigments- Types of pigments Applications. Fluorescent, Brightening agents.
- 4.2 Applications of dyes in other areas- medicine, chemical analysis, cosmetics, colouring agents.

#### **UNIT-V**

- 5.1 Textile Effluent-Characteristics, effect of untreated effluent, degradability of wastes
- 5.2 Effluent treatment plants-Aerated lagoon, photo oxidation process.

#### **References:**

- 1. B.K.Sharma, Industrial Chemistry ,Goel Publishing co,1997
- 2. R.Chatwal ,Synthetic Dyes -Himalayan Publishing House,1995
- 3. R.S.Prayag, Dyeing of wool, Silk and man made fibres.
- 4. V.A.Shenai, Chemistry of Dyes and Principles of Dyeing

## **SEMESTER -VI**

### **MEDICINAL CHEMISTRY AND HUMAN HEALTH**

#### **UNIT- I Introduction :**

Common diseases – infective diseases – insect – borne, air – borne and water-borne – hereditary diseases – Terminology – drug, pharmacology, antimetabolites, absorption of drugs – factors affecting absorption –therapeutic index (Basic concepts only)

#### **UNIT -II Drugs**

Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants – tulsi, neem, keezhanelli – their importance – Classification of drugs – biological chemical ( Structure not required) Drug receptors and biological responses – factors affecting metabolism of drugs. (Basic concepts only)

#### **UNIT III-Chemotherapy**

Drugs based on physiological action, definition and two examples each of anesthetics- General and local – analgesics – narcotic and synthetic – Antipyretics and anti inflammatory agents – antibiotics – Penicillin, Streptomycin, Antivirals, AIDS – symptoms, prevention, treatment – Cancer (Structure not required)

#### **UNIT IV-Common Body Ailments**

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Systolic & Diastolic Hypertensive drugs – Cardiovascular drugs – depressants and stimulants – Lipid profile – HDL, LDL cholesterol lipid lowering drugs. (Structure not required)

#### **UNIT V-Health Promoting Drugs**

Vitamins A,B, C, D, E and K micronutrients – Na, K, Ca, Cu, Zn and I, Medicinally important inorganic compounds of Al, P, As, Hg and Fe, Examples and applications, Agents for kidney function (Aminohippuric acid). Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases. (Structure not required)

#### **Reference :**

1. S.Lakshmi Pharmaceutical Chemistry, S.Chand & Sons, New Delhi, 2004
2. V.K. Ahluwalia and Madhu Chopra, -Medicinal Chemistry, Ane Books, New Delhi, 2008
3. P.Parimoo, - A Text Book of Medicinal Chemistry, CBS publishers, New Delhi, 2006
4. Ashutosh Kar, -Medicinal Chemistry, Wiley Eastern Ltd., New Delhi, 1993,
- 5.. David William and Thomas Lemke, Foyes Principles of Medicinal Chemistry, BI Publishers.
- 6.. Romas Nogrady, Medicinal Chemistry, Oxford Univ. Press

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**Salem – 636011, Tamil Nadu, India**  
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| <b>5.</b>   | <b>Dr. N. VIJAYAKUMARI</b><br>Associate Professor, Department of Chemistry<br>Government Arts College for Women<br>Salem – 8. Ph.No:9894519780                                                                                   | <b>Member</b>                   |
| <b>6.</b>   | <b>Dr.V.SUJATHA</b><br>Professor, Department of Chemistry<br>Periyar University, Salem – 636011<br>Ph.9444886804. e.mail: sujatha888@periyaruniversity.ac.in                                                                     | <b>University Nominee</b>       |
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