**V.V.VANNIAPERUMAL COLLEGE FOR WOMEN**
(Belonging to Virudhunagar Hindu Nadars)
An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
*Reaccredited with 'A++' Grade (4th Cycle) by NAAC*
**VIRUDHUNAGAR**
**Quality Education with Wisdom and Values**

# OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
## (with effect from Academic Year 2025 - 2026)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 13 UG Programmes (SF), 13 PG Programmes and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) & Tamil Nadu State Council for Higher Education (TANSCHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

The Departments of Commerce, English, History, Mathematics, Biochemistry and Tamil upgraded as Research Centres offer Ph.D. Programmes as per the norms and regulations of Madurai Kamaraj University, Madurai and do not come under the purview of CBCS.

## A. CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed Courses. The CBCS is followed as per the guidelines formulated by the UGC. The performance of students is evaluated based on the uniform grading system. Computation of the Cumulative Grade Point Average (CGPA) is made to ensure uniformity in evaluation system.

List of Programmes in which CBCS/Elective Course System is implemented

**UG PROGRAMMES**

| | | |
|---|---|---|
| Arts & Humanities | : | History (E.M. & T.M.), English, Tamil |
| Physical & Life Sciences | : | Mathematics, Zoology, Chemistry, Physics, Biochemistry, Home Science - Nutrition and Dietetics, Costume Design and Fashion, Microbiology, Biotechnology, Computer Science, Information Technology, Data Science, Computer Applications and Computer Applications - Graphic Design |
| Commerce & Management | : | Commerce, Commerce (Computer Applications), Commerce (Professional Accounting), Business Administration |

**PG PROGRAMMES**

| | | |
|---|---|---|
| Arts & Humanities | : | History, English, Tamil |
| Physical & Life Sciences | : | Mathematics, Physics, Chemistry, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science and Computer Applications (MCA) * |
| Commerce & Management | : | Commerce, Business Administration (MBA) * |

* AICTE approved Programmes

**OUTLINE OF CHOICE BASED CREDIT SYSTEM- PG**

1. Core Courses
2. Elective Courses
    - Discipline Specific Elective Courses (DSEC)
    - Generic Elective Courses
    - Non-Major Elective Courses (NMEC)
3. Skill Enhancement Courses
4. Self Study Course (Online)
5. Extension Activity
6. Extra Credit Courses (Optional)

**List of Non Major Elective Courses (NME)**
**(2024-2025 onwards)**

**PG PROGRAMMES**

| Name of the Course | Semester | Course Code | Department |
|---|---|---|---|
| Introduction to Epigraphy | II | 24PHIN21 | History |
| Communication Strategies for Leadership Success | III | 24PHIN31 | |
| Functional English | II | 24PENN21 | English |
| English for Careers | III | 24PENN31 | |
| ஆளுமை மேம்பாடு | II | 24PTAN21N | Tamil |
| தகவல் தொடர்பியல் | III | 24PTAN31 | |
| Accounting for Managers -1 | II | 24PCON21N | Commerce |
| Accounting for Managers -II | III | 24PCON31 | |
| Entrepreneurship Development | II | 24PBAN21 | Business Administration |
| Employability Skills | III | 24PBAN31 | |
| Mathematics for Life Sciences | II | 24PMTN21 | Mathematics |
| Statistics for Life and Social Sciences | III | 24PMTN31 | |
| Solid Waste Management | II | 24PPHN21 | Physics |
| Sewage and Waste Water Treatment and Reuse | III | 24PPHN31 | |
| Chemistry in Everyday Life | II | 24PCHN21 | Chemistry |
| Industrial Chemistry | III | 24PCHN31 | |
| Food Preservation | II | 24PHSN21 | Home Science - Nutrition and Dietetics |
| Nutrition and Health | III | 24PHSN31 | |

| | | | |
|---|---|---|---|
| Nutritional Biochemistry | II | 24PBCN21 | Biochemistry |
| Molecular Basis of Diseases and Therapeutic Strategies | III | 24PBCN31 | |
| Tissue engineering | II | 24PBON21 | Biotechnology |
| Gene manipulation Technology | III | 24PBON31 | |
| Web Programming | II | 24PCSN21 | Computer Science |
| Python Programming | III | 24PCSN31 | |
| Fundamentals of Web Design | II | 24PCAN21N | Computer Applications |
| Fundamentals of Cyber Security | III | 24PCAN31 | |

## B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

The core philosophy of Outcome Based Education rests in employing a student - centric learning approach to measure the performance of students based on a set of pre- determined outcomes. The significant advantage of OBE is that it enables a revamp of thecurriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching-learning process. Italso helps in bringing clarity among students as to what is expected of them after completion of the Programme in general and the Course in particular. The OBE directs the teachers to channelise their teaching methodologies and evaluation strategies to attain the Programme Educational Objectives (PEOs) and fulfill the Vision and Mission of the Institution.

**Vision of the Institution**

The founding vision of the Institution is to impart Quality Education to the rural women folk and to empower them with knowledge and leadership quality.

**Mission of the Institution**

The mission of the Institution is to impart liberal education committed to quality and excellence. Its quest is to mould learners into globally competent individuals instilling in them life-oriented skills, personal integrity, leadership qualities and service mindedness.

### B.1 Programme Educational Objectives, Programme Outcomes and Programme Specific Outcomes

It is imperative for the Institution to set the Programme Educational Objectives (PEOs), Programme Outcomes (POs) and Course Outcomes (COs), consistent with its Vision and Mission statements. The PEOs and the POs should be driven by the Mission of the Institution and should provide distinctive paths to achieve the stated goals. The PEOs for each Programme have to fulfill the Vision and Mission of the Department offering the Programme.

**Vision of the Department of M.Sc. CHEMISTRY**

To train our students as scientifically literate professionals with a sense of social responsibilities.

**Mission of the Department of M.Sc. CHEMISTRY**

- To provide advanced knowledge in chemistry.
- To develop in students employable skills for job opportunities in the field of education, R&D institutions and industries.
- Acquire knowledge, abilities and insight in well-defined area of research within Chemistry.
- Acquire the skills of planning and conducting advanced chemical experiments and applying structural-chemical characterization techniques.
- To impart moral, ethical and social responsibilities to students

### B.1.1 Programme Educational Objectives (PEOs)

PEOs are broad statements that describe the career and professional achievements that the Programme is preparing the graduates to achieve within the first few years after graduation. PEOs are framed for each Programme and should be consistent with the Mission of the Institution.

**Programme Educational Objectives (PEOs) of M.Sc. CHEMISTRY Programme**

**The Students will be able**

- To educate and guide the students in attaining significant opportunities in various service domains at national and international level, and can work as scientist, analyst, quality controller, academics, research organizations and set testing labs.
- To mould the overall personality of the students by providing training and opportunities to enhance their communication skills, team management, co-ordination skills and leadership qualities.
- To guide and create awareness among the students to learn and adopt new skills and techniques to overcome the problem related with new technologies and to formulate, investigate and analyze scientifically real life problems along with ethical attitude which works in multidisciplinary team.

| Key Components of the Mission Statement | PEO1 | PEO2 | PEO3 |
|---|---|---|---|
| advanced knowledge and practical experience | √ | - | √ |
| development of research activities among students | √ | √ | √ |
| employable skills for job opportunities | √ | √ | √ |
| Contributing innovation of new applications of research in chemistry. | √ | - | √ |

**B.1.2 Programme Outcomes (POs)**

POs shall be based on Graduate Attributes (GAs) of the Programme. The GAs are the attributes expected of a graduate from a Programme in terms of knowledge, skills, attitude and values. The Graduate Attributes include Disciplinary Knowledge,Communication Skills, Critical Thinking, Problem Solving, Analytical Reasoning, Research Related Skills, Co-operation/Team Work, Scientific Reasoning, Reflective Thinking, Information/Digital Literacy, Multicultural Competence, Moral and Ethical Awareness/Reasoning, Leadership Qualities and Lifelong Learning.

**On successful completion of the Programme, the students will be able to**

*1* apply their in-depth domain knowledge and practical skills in interdisciplinary fields for research-based endeavours, employment and entrepreneurship development. (*Disciplinary Knowledge)*

2 communicate proficiently and confidently with the ability to present complex ideas both in spoken and written forms in a concise manner to assorted groups. (*Communication Skills*)

3 identify, formulate and solve problems in a consistent and systematic way with updated skills using modern tools and techniques. (*Scientific Reasoning and Problem Solving*)

4 analyze the data, synthesis the findings and provide valid conclusion by critical evaluation of theories, policies and practices for the fulfillment of the local, national, regional and global developmental needs. (*Critical Thinking and Analytical Reasoning*)

5 explore and evaluate globally competent research methodologies to apply appropriately in interdisciplinary research; Develop and sustain the research capabilities to meet the emerging needs for the welfare of the society. (*Research Related Skills*)

6 use ICT to mould themselves for lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning*)

7 self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence*)

8 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

**B.1.2 Programme Specific Outcomes (PSOs)**

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each PG Programme**.** Programme Specific Outcomes denote what the students would be able to do at

the time of graduation. They are Programme-specific and it is mandatory that each PO should be mapped to the respective PSO.

**On Successful completion of M.Sc. Chemistry Programme, the students will be able to**

**PO 1:** *Disciplinary Knowledge*

**PSO 1.a:** Apply in - depth knowledge on advanced concepts in Organic, Inorganic, Physical, Analytical, Biological, Environmental, Medicinal, spectral, Qualitative & Quantitative techniques and Industrial applications of chemistry in research based endeavours.

**PSO 1.b:** contribute new scientific insights and innovative applications of chemical research to the next generation. Develop focused field knowledge and amalgamate knowledge across different disciplines.

**PO2:** *Communication Skills*

**PSO 2:** Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Students will develop various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.

**PO3:** *Scientific Reasoning and Problem Solving*

**PSO 3a:** Develops analytical, technical skills and problem solving skills requiring application of chemical principles.

**PSO 3b:** Use modern chemical tools, Models, Chemdraw, Charts and Advanced Equipments for the potential uses in all fields of R& D laboratories, analytical industrial chemistry, medicinal chemistry and green chemistry.

**PO4:** *Critical thinking and Analytical Reasoning*

**PSO 4:** Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions to create an awareness of the impact of chemistry on the environment and society.

**PO5:** *Research Related Skills*

**PSO 5:** Come out with clear idea of choosing original research problems, writing new projects and publishing research papers to open up new research methods to develop environmental protection, resource management, public health and safety.

**PO6:** *Digital Literacy, Self - directed and Lifelong learning*

**PSO 6 :** Use ICT tools for literature survey of the topic of research, manuscript

preparation and online submission for publication. Apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and equip the students to face the employment challenges and to get good placement and instill confidence to turn into entrepreneur.

**PO7:** *Cooperation/Team Work and Multicultural Competence*

**PSO 7:** Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues. To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

**PO8:** *Moral and Ethical awareness*

**PSO 8:** Explore the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development and to contribute to the development of the society by collaborating with stakeholders for mutual benefit.

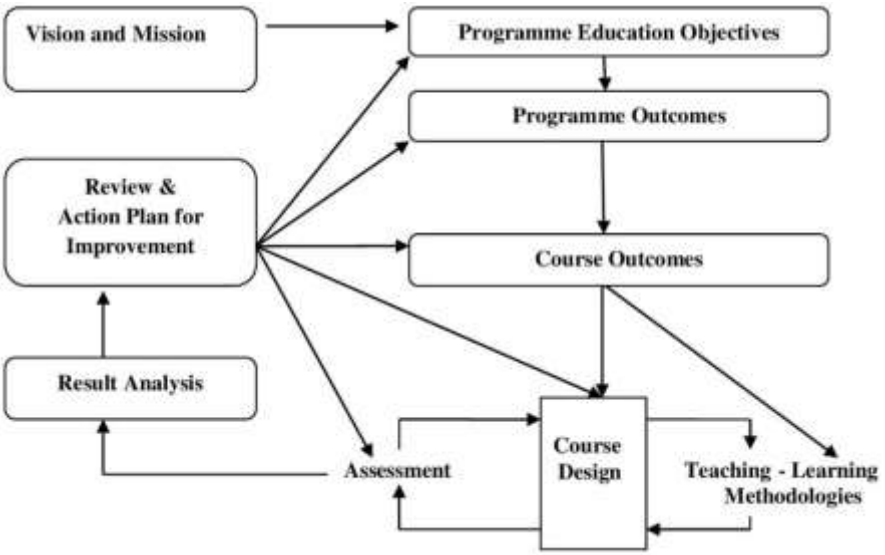
**PO-PEO Mapping Matrix**

Attainment of PEOs can be measured by a PO-PEO matrix. PEOs should evolve through constant feedback from alumnae, students, industry, management, *etc*. It is mandatory that each PEO should be mapped to at least one of the Pos.

| PEOs / POs/PSOs | PEO1 | PEO2 | PEO3 |
|---|---|---|---|
| **PO1/PSO1** | ✓ | ✓ | ✓ |
| **PO2/PSO2** | ✓ | ✓ | ✓ |
| **PO3/PSO3** | ✓ | ✓ | ✓ |
| **PO4/PSO4** | ✓ | ✓ | - |
| **PO5/PSO5** | - | ✓ | ✓ |
| **PO6/PSO6** | ✓ | ✓ | ✓ |
| **PO7/PSO7** | ✓ | ✓ | ✓ |
| **PO8/PSO8** | ✓ | ✓ | - |

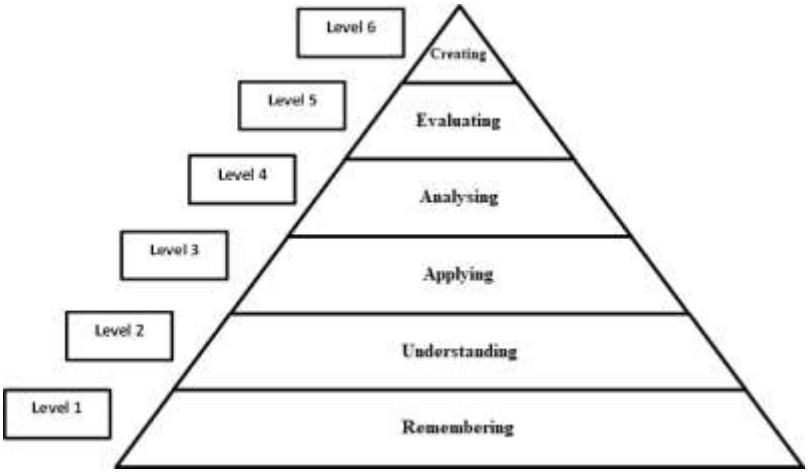
**B.1.4 Course Outcomes (COs)**

Course Outcomes are narrow statements restricted to the course contents given in five units. Course Outcomes describe what students would be capable of, after learningthe contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after learning of Course contents. COs are measurable, attainable and manageable in number. COs contribute to attain POs in such a way that each CO addresses at least one of the POs and also each PO is reasonably addressed by adequate number of CO




It is important to determine the methods of assessment. A comprehensive assessment strategy may be outlined using the revised Bloom's Taxonomy levels.

**BLOOM'S TAXONOMY**




**CO - PO Mapping of Courses**

After framing the CO statements, the COs framed for each course is mapped with POs based on the relationship that exists between them. The COs which are not related to any of the POs is indicated with (-), signifying Nil. Measurement Mapping is based on Four Points Scale [High (H), Medium (M), Low (L) and Nil (-)]. For calculating weighted percentage of contribution of each Course in the attainment of the respective POs, the weights assigned for H, M and L are 3, 2 and 1 respectively.

**CO-PO/PSO Mapping Table (Course Articulation Matrix)**

| PO/PSOs / COs | PO1/ PSO1 | PO2/ PSO2 | PO3/ PSO3 | PO4/ PSO4 | PO5/ PSO5 | PO6/ PSO6 | PO7/ PSO7 | PO8/ PSO8 |
|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | |
| **CO2** | | | | | | | | |
| **CO3** | | | | | | | | |
| **CO4** | | | | | | | | |
| **CO5** | | | | | | | | |

**ELIGIBILITY FOR ADMISSION**

The candidate should have passed in B.Sc. Degree in Chemistry from any recognized University.

**DURATION OF THE PROGRAMME**

The candidates shall undergo the prescribed Programme of study for a period oftwo academic years (four semesters).

**MEDIUM OF INSTRUCTION**

English

## B.2 EVALUATION SCHEME

| Components | Internal Assessment Marks | External Examination Marks | Total Marks |
|---|---|---|---|
| Theory | 25 | 75 | **100** |

### B.2.1 Core Courses, Elective Courses (Discipline Specific Elective Courses, Generic Elective Courses & Non Major Elective Courses

**INTERNAL ASSESSMENT**

**Distribution of Marks**

**Theory**

| Mode of Evaluation | | Marks |
|---|---|---|
| Periodic Test | : | 20 |
| Assignment | : | 5 |
| **Total** | **:** | **25** |

Three Periodic Tests - Average of the best two will be considered
Two Assignments - Better of the two will be considered

**Practical**

| Mode of Evaluation | | Marks |
|---|---|---|
| Practical Test | : | 30 |
| Record Performance | : | 10 |
| **Total** | **:** | **40** |

Practical Test - Average of the two Practical Tests will be considered
Performance - Attendance and Record

**Question Pattern for Periodic Test** **Duration: 2 Hours**

| Section | Q. No. | Types of Question | No. of Questions | No. of Questions to be answered | Marks for each Question | Total Marks |
|---|---|---|---|---|---|---|
| A | 1 - 5 | Multiple Choice Questions | 5 | 5 | 1 | 5 |
| B | 6-9 | Internal Choice – Either… or Type | 4 | 4 | 5 | 20 |
| C | 10 - 11 | Internal Choice – Either…. or Type | 2 | 2 | 10 | 20 |
| | | | | | **Total** | **45*** |

*The total marks obtained in the Periodic Test will be calculated for 20 marks

**Summative Examination**
**External Assessment**
Distribution of Marks

| Mode of Evaluation | | Marks |
|---|---|---|
| Summative Examination | : | 60 |
| Seminar Presentation | : | 15 |
| **Total** | : | **75** |

**Summative Examination**

**Question Pattern** **Duration: 3 Hours**

| Section | Q. No. | Types of Question | No. of Questions | No. of Questions to be answered | Marks for each Question | Total Marks |
|---|---|---|---|---|---|---|
| A | 1 - 5 | Multiple Choice Questions | 5 | 5 | 1 | 5 |
| B | 6 - 10 | Internal Choice - Either ….or Type | 5 | 5 | 5 | 25 |
| C | 11 - 13 | Internal Choice - Either …or Type | 3 | 3 | 10 | 30 |
| | | | | | **Total** | **60** |

**B.2.2 Project**

Individual Project is compulsory for II PG Students in IV Semester.

**Distribution of Marks**

| Mode of Evaluation | | Marks |
|---|---|---|
| Internal Assessment | : | 40 |
| External Assessment | : | 60 |
| **Total** | : | **100** |

**Internal Assessment:**

| | |
|---|---|
| Pre-submission Presentation | - 10 Marks |
| Review Report | - 20 Marks |
| One Open Online Course related to the Project | - 10 Marks |

**External Assessment:**

| | |
|---|---|
| Project Report | - 40 Marks |
| Viva Voce | - 20 Marks |

**B. 2.3 Skill Enhancement Course - Professional Competency Skill**

Types of Question – Multiple Choice Questions Only

**INTERNAL ASSESSMENT**

**Distribution of Marks**

| **Mode of Evaluation** | | **Marks** |
|---|---|---|
| Periodic Test | : | 20 |
| Assignment | : | 5 |
| **Total** | **:** | **25** |

Three Periodic Tests - Average of the best two will be considered

Two Assignments - Better of the two will be considered

**Question Pattern for Periodic Test** **Duration: 2 Hours**

| **Section** | **Q. No.** | **Types of Question** | **No. of Questions** | **No. of Questions to be answered** | **Marks for each Question** | **Total Marks** |
|---|---|---|---|---|---|---|
| A | 1 - 5 | Multiple Choice Questions | 5 | 5 | 1 | 5 |
| B | 6-9 | Internal Choice – Either… or Type | 4 | 4 | 5 | 20 |
| C | 10 - 11 | Internal Choice – Either…. or Type | 2 | 2 | 10 | 20 |
| | **Total** | | | | | **45*** |

*The total marks obtained in the Periodic Test will be calculated for 20 marks

**Summative Examination**

**External Assessment**

Distribution of Marks

| **Mode of Evaluation** | | **Marks** |
|---|---|---|
| Summative Examination | **:** | 60 |
| Seminar Presentation | **:** | 15 |
| **Total** | **:** | **75** |

**Summative Examination**

**Question Pattern** **Duration: 3 Hours**

| Section | Q. No. | Types of Question | No. of Questions | No. of Questions to be answered | Marks for each Question | Total Marks |
|---|---|---|---|---|---|---|
| A | 1 - 5 | Multiple Choice Questions | 5 | 5 | 1 | 5 |
| B | 6 - 10 | Internal Choice - Either ….or Type | 5 | 5 | 5 | 25 |
| C | 11 - 13 | Internal Choice - Either …or Type | 3 | 3 | 10 | 30 |
| | | | | | **Total** | **60** |

## B. 2.4 Internship / Industrial Training

Internship / Industrial Training is mandatory for all the Students

- **Internship:** Students have to involve in a designated activity, working in an organization for maximum of 30 days (not less than 20 days) under the guidance of an identified mentor.
- **Industrial Training:** Students have to undertake in-plant training in industries individually or in group for maximum of 30 days (not less than 20 days)
- Internship / Industrial Training must be done during the second semester holidays

**Distribution of Marks**

| Mode of Evaluation | | Marks |
|---|---|---|
| Internal Assessment | : | 75 |
| External Assessment | : | 25 |
| **Total** | : | **100** |

**Internal Assessment**

| Mode of Evaluation | | Marks |
|---|---|---|
| Onsite Learning/Survey | : | 50 |
| Report | : | 25 |
| **Total** | | **75** |

**External Assessment**

| Mode of Evaluation | | Marks |
|---|---|---|
| Viva-Voce | : | 25 |
| **Total** | | **25** |

## B.2.5. Self Study - Online Course

Practice for CSIR NET-General Paper –Online

Internal Examination only

- Two Periodic Tests ( Online) with Multiple Choice Questions will be conducted in III Semester.
- Model Examination will be conducted after two periodic tests.

**Distribution of Marks**

| Mode of Evaluation | | Marks |
|---|---|---|
| Periodic Test | : | 25 |
| Model Examination | : | 75 |
| **Total** | **:** | **100** |

Two Periodic Tests - Better of the two will be considered

**B.2.6. Extension Activities**

Assessment by Internal Examiner only

**Distribution of Marks**

| Mode of Evaluation | | Marks |
|---|---|---|
| Attendance | : | 5 |
| Performance | : | 10 |
| Report | : | 10 |
| **Total** | **:** | **25*** |

*The marks obtained will be calculated for 100 marks

**B.2.7 Transfer of credits earned through MOOC (UGC recognized Courses)**

- Students can opt for minimum of
  - 12 weeks Courses for Core Courses
  - 8 weeks Courses for Elective Courses
  - 4 weeks Courses for Skill Enhancement Course
- The Online Courses opted by the students will be verified and approved by the Head of the Department and forwarded to the Controller of Examinations through the Principal.
- Students are required to register for the equivalent Online Courses through the Institution's SWAYAM-NPTEL Local Chapter after submitting a Permission letter to the Head of the Department.
- The Course should be completed before the beginning of that particular Semester in which the selected Course is offered.
- The student should submit the Course Completion Certificate immediately after receiving it, to the Department.
- The Head of the Department has to send the list of the students and their Course Completion Certificates to the Controller of Examinations through the Principal.
- The students who have submitted the Completion Certificate are exempted from appearing the Periodic Tests and Summative Examinations of the respective course but without any exemption for class attendance.
- Credits allotted for the particular Course in the Curriculum will be transferred after the completion of the Online Course

- Students can earn up to 10 credits within the mandatory credits requirements of the Degree Programme by completing UGC recognised Online Courses.

## B.2.8. EXTRA CREDIT COURSES (OPTIONAL)

### 2.8.1 Extra Credit Course offered by the Department.

Assessment by Internal Examiner Only (To be conducted along with the III Periodic Test)

**Distribution of Marks**

| **Mode of Evaluation** | | **Marks** |
|---|---|---|
| Quiz (Multiple Choice Questions) | : | 25 |
| Model Examination | : | 75 |
| **Total** | **:** | **100** |

**Question Pattern for Model Examination**

| **Section** | **Types of Question** | **No. of Questions** | **No. of Questions to be answered** | **Marks for each Question** | **Total Marks** |
|---|---|---|---|---|---|
| A Q.No.(1-5) | Internal Choice-Either or Type | 5 | 5 | 7 | 35 |
| B Q.No.(6-9) | Internal Choice-Either or Type | 4 | 4 | 10 | 40 |
| | | | | **Total** | **75** |

### 2.8.2 Extra credit Course offered by MOOC (Massive Open Online Course)

- The Courses shall be completed within the first III Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 15 credits)**

4 weeks Course - 1 credit

8 weeks Course - 2 credits

12 weeks Course - 3 credits

## ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study and a minimum of 50% Pass marks in all the Courses.
  - No Pass minimum for Internal Assessment for all the Courses.
  - Pass minimum for External Examination is 27 marks out of 60 marks for Core Courses, Discipline Specific Elective Courses and Non-Major Elective Course.
  - Pass minimum for Practice for SET/NET - General Paper is 50 Marks.
- Attendance
  - The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.

- The students who have only 60-75days (66% -84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amountand fulfilling other conditions according to the respective cases.
- The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.
- The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.
- For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

## B.3 ASSESSMENT MANAGEMENT PLAN

An Assessment Management Plan that details the assessment strategy both at the Programme and the Course levels is prepared. The continuous assessment is implemented using an assessment rubric to interpret and grade students.

### B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

**Direct Assessment (Rubric based)** - Conventional assessment tools such as Term Test, Assignment, Quiz and End Semester Summative Examination are used.

**Indirect Assessment** - Done through Course Exit Survey.

**CO Assessment Rubrics**

For the evaluation and assessment of COs and POs, rubrics are used. Internal assessment contributes 40% and End Semester assessment contributes 60% to the total attainment of a CO for the theory courses. For the practical courses, internal assessment contributes 50% and Semester assessment contributes 50% to the total attainment of a CO. Once the Course Outcome is measured, the PO can be measured using a CO-PO matrix.

**CO Attainment**

**Direct CO Attainment**

Course Outcomes of all courses are assessed and the CO - wise marks obtained by all the students are recorded for all the assessment tools. The respective CO attainment level is evaluated based on set attainment rubrics.

**Target Setting for Assessment Method**

For setting up the target of internal assessment tools, 55% of the maximum mark is fixed as target. For setting up the target of End Semester Examination, the averagemark of the class shall be set as target.

**Formula for Attainment for each CO**

Attainment = Percentage of students who have scored more than the target marks

$$\text{Percentage of Attainment} = \frac{\text{Number of Students who Scored more than the Target}}{\text{Total Number of Students}} \times 100$$

**Attainment Levels of COs**

| **Assessment Methods** | **Attainment Levels** | |
|---|---|---|
| Internal Assessment | Level 1 | 50% of students scoring more than set target marks in Internal Assessment tools |
| | Level 2 | 55% of students scoring more than set target marks in Internal Assessment tools |
| | Level 3 | 60% of students scoring more than set target marks in internal Assessment tools |
| End Semester Summative Examination | Level 1 | 50% of students scoring more than average marks in End Semester Summative Examination |
| | Level 2 | 55% of students scoring more than average marks in End Semester Summative Examination |
| | Level 3 | 60% of students scoring more than average marks in End Semester Summative Examination |

**Indirect CO Attainment**

At the end of each Course, an exit survey is conducted to collect the opinion of the students on attainment of Course Outcomes. A questionnaire is designed to reflect the views of the students about the Course Outcomes.

**Overall CO Attainment=75% of Direct CO Attainment + 25 % of Indirect CO Attainment**

In each Course, the level of attainment of each CO is compared with the predefined targets. If the target is not reached, the Course teacher takes necessary steps for the improvement to reach the target.

For continuous improvement, if the target is reached, the Course teacher can set the target as a value greater than the CO attainment of the previous year.

### B.3.2 Assessment Process for Overall PO Attainment

With the help of CO - PO mapping, the PO attainment is calculated. PO assessment is done by giving 75% weightage to direct assessment and 25% weightage to indirect assessment. Direct assessment is based on CO attainment, where 75% weightage is given to attainment through End Semester Examination and 25 % weightage is given to attainment through Internal assessments. Indirect assessment is done through Graduate Exit Survey and participation of students in Co-curricular/Extra-curricular activities.

**PO Assessment Tools**

| Mode of Assessment | Assessment Tool | Description |
|---|---|---|
| Direct Attainment (Weightage -75%) | CO Assessment | This is computed from the calculated CO Attainment value for each Course. |
| Indirect Attainment (Weightage - 25%) | Graduate Exit Survey 10% | At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes. |
| | Co-curricular / Extra-curricular activities 15% | For participation in Co-curricular/Extra-curricular activities during the period of their study. |

**Programme Articulation Matrix (PAM)**

| Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| Average Direct PO Attainment | | | | | | | | | |
| Direct PO Attainment in percentage | | | | | | | | | |

**Indirect Attainment of POs for all Courses**

| POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|
| Graduate Exit Survey | | | | | | | | |
| Indirect PO Attainment | | | | | | | | |

**Attainments of POs for all Courses**

| POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|
| Direct Attainment(Weightage - 75%) | | | | | | | | |
| Indirect Attainment(Weightage - 25%) | | | | | | | | |
| Overall PO Attainment | | | | | | | | |

**Overall PO Attainment= 75% of Direct PO Attainment + 25% of Indirect PO Attainment (Graduate Exit Survey & Participation in Co- curricular andExtra-curricular Activities)**

**Expected Level of Attainment for each of the Programme Outcomes**

| POs | Level of Attainment |
|---|---|
| Attainment Value ≥70% | Excellent |
| 60% ≤ Attainment Value < 70% | Very Good |
| 50% ≤ Attainment Value < 60% | Good |
| 40% ≤ Attainment Value < 50% | Satisfactory |
| Attainment Value <40% | Not Satisfactory |

**Level of PO Attainment**

| Graduation Batch | Overall PO Attainment(in percentage) | Whether Expected Level ofPO is Achieved? (Yes/No) |
|---|---|---|
| | | |

**B.3.3 Assessment Process for PEOs**

The curriculum is designed so that all the courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 3 years of completion of the Programme only through Indirect methods.

**Target for PEO Attainment**

| Assessment Criteria | Target (UG) | Target (PG) |
|---|---|---|
| Record of Employment | 15% of the class strength | 30 % of the class strength |
| Progression to Higher Education | 50% of the class strength | 5 % of the class strength |
| Record of Entrepreneurship | 2 % of the class strength | 5 % of the class strength |

**Attainment of PEOs**

| Assessment Criteria & Tool | Weightage |
|---|---|
| Record of Employment | 10 |
| Progression to Higher Education | 20 |
| Record of Entrepreneurship | 10 |
| Feedback from Alumnae | 30 |
| Feedback from Parents | 10 |
| Feedback from Employers | 20 |
| **Total Attainment** | **100** |

$$\text{Percentage of PEO Attainment from Employment} = \frac{\text{Number of Students who have got Employment}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Higher Education} = \frac{\text{Number of Students who pursue Higher Education}}{\text{Target}} \times 100$$

$$\text{Percentage of PEO Attainment from Entrepreneurship} = \frac{\text{Number of Students who have become Entrepreneurs}}{\text{Target}} \times 100$$

**Expected Level of Attainment for each of the Programme Educational Objectives**

| POs | Level of Attainment |
|---|---|
| Attainment Value ≥70% | Excellent |
| 60% ≤ Attainment Value < 70% | Very Good |
| 50% ≤ Attainment Value < 60% | Good |
| 40% ≤ Attainment Value < 50% | Satisfactory |
| Attainment Value <40% | Not Satisfactory |

**Level of PEO Attainment**

| Graduation Batch | Overall PEO Attainment (in percentage) | Whether Expected Level of PEO is Achieved? (Yes/No) |
|---|---|---|
| | | |

## C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

The college has always been involving the key stakeholders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected, the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined earlier will be analysed and will identify the need for redefining PEOs. Based on identified changes in terms of curriculum, regulations and PEOs, the administrative system like Board of Studies, Academic Council and Governing Body may recommend appropriate actions. As per the Outcome Based Education Framework implemented from the Academic Year 2020 - 2021, the following are the Programme Structure, the Programme Contents and the Course Contents of M.Sc. Chemistry Programme.

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## MASTER OF CHEMISTRY

*Outcome Based Education with Choice Based Credit System*
Programme Structure - Allotment of Hours and Credits
For those who join in the Academic Year 2024-2025

| Components | Semester | | | | Total Number of Hours (Credits) |
|---|---|---|---|---|---|
| | I | II | III | IV | |
| Core Course | 6 (5) | 6 (5) | 6 (5) | 6 (5) | 24 (20) |
| Core Course | 6 (5) | 6 (5) | 6 (5) | 6 (5) | 24 (20) |
| Core Course Practical | - | - | 6 (4) | - | 6 (4) |
| Core Course Practical | 6 (4) | 6 (4) | 6 (5) | - | 18 (13) |
| Project | - | - | - | 6 (5) | 6(5) |
| Elective Course(DSEC) | 6 (3) | 4 (3) | 3 (3) | - | 13 (9) |
| Elective Course(Generic) | 6 (3) | 4 (3) | - | - | 10 (6) |
| Elective Course(NME) | - | 4 (2) | 3 (2) | - | 7 (4) |
| Elective Course-(Industry/ Entrepreneurship) | - | - | | 6 (3) | 6 (3) |
| Skill Enhancement Course/ Professional Competency Skill | - | - | - | 6 (3) | 6 (3) |
| Self Study Course | - | - | 0 (1) | - | 0 (1) |
| Internship/Industrial Activity | - | - | 0 (2) | - | 0 (2) |
| Extension Activity | - | - | - | 0 (1) | 0 (1) |
| **Total** | **30 (20)** | **30 (22)** | **30 (27)** | **30 (22)** | **120 (91)** |
| Extra Credit Course(Optional)- Offered by the Department | - | - | 0(2) | - | 0(2) |
| Extra Credit Course (Optional)- MOOC | - | - | - | - | Limited to a Maximum of 15 credits |

## SEMESTER III

| S.No. | Components | Title of the Course | Course Code | Hours per Week | Credits | Exam Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Int. | Ext. | Total |
| 1 | Core Course-7 | Organic Synthesis And Photochemistry | 24PCHC31 | 6 | 5 | 3 | 25 | 75 | 100 |
| 2 | Core Course-8 | Coordination Chemistry – I | 24PCHC32 | 6 | 5 | 3 | 25 | 75 | 100 |
| 3 | Core Course Practical -9 | Physical Chemistry Practical | 24PCHC31P | 6 | 4 | 6 | 40 | 60 | 100 |
| 4 | Core Course Practical – 10 | Analytical Instrumentation technique Practical | 24PCHC32P | 6 | 5 | 6 | 40 | 60 | 100 |
| 5 | Elective Course-6 (DSEC) | Biomolecules and Heterocyclic compounds | 24PCHE31 | 3 | 3 | 3 | 25 | 75 | 100 |
| 6 | Elective Course-7 (NME) | Industrial Chemistry | 24PCHN31 | 3 | 2 | 3 | 25 | 75 | 100 |
| 7 | Self Study Course | Practice for CSIR NET–General Paper | 24PGOL32 | - | 1 | - | 100 | - | 100 |
| 8 | Internship/ Industrial Activity | Internship | 24PCHI31 | - | 2 | - | 75 | 25 | 100 |
| **Total** | | | | **30** | **27** | | | | **800** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9. | Extra Credit Course | Chemistry in Ancient India | 24PCHO31 | - | 2 | 3 | 100 | - | 100 |

## SEMESTER IV

| S.No | Components | Title of the Course | Course Code | Hours per Week | Credits | Exam. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Int. | Ext. | Total |
| 1 | Core Course-11 | Coordination Chemistry-II | 24PCHC41 | 6 | 5 | 3 | 25 | 75 | 100 |
| 2 | Core Course-12 | Physical Chemistry-II | 24PCHC42 | 6 | 5 | 3 | 25 | 75 | 100 |
| 3 | Core Project | Project | 24PCHC43PR | 6 | 5 | - | 40 | 60 | 100 |
| 4 | ElectiveCourse-8 (Industry/ Entrepreneurship) | Chemistry of Natural products | 24PCHE41 | 6 | 3 | 3 | 25 | 75 | 100 |
| 5 | Skill Enhancement Course/ Professional Competency Skill | Chemistry for Competitive Examinations | 24PCHS41 | 6 | 3 | 3 | 25 | 75 | 100 |
| 6 | | Extension Activity | | - | 1 | - | 100 | - | 100 |
| **Total** | | | | **30** | **23** | | | | **600** |

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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **ORGANIC SYNTHESIS AND PHOTOCHEMISTRY** | **Hours/Week:6** | |
| **Core Course-7** | | **Credits:5** | |
| **Course Code 24PCHC31** | | **Internal 25** | **External 75** |

**Course Outcomes:**

On completion of the course, students will be able to

**CO1:** understand the molecular complexity of carbon skeletons and the presence of functional groups and their relative positions, Retro synthetic analysis, Pericyclic reactions, photochemical excitation and knowledge of photochemical organic reactions. [K2]

**CO2:** study various synthetically important reagents for any successful organic synthesis, Convergent and divergent synthesis, cyclo addition and Cheletropic reactions, Jablonskii diagrams and Photon energy transfer reactions, Photo cycloadditions, Photochemistry of aromatic compounds. [K3]

**CO3:** apply disconnection approach and identifying suitable synthons to effect successful organic Synthesis and implement the synthetic strategies in the preparation of various organic compounds. [K3]

**CO4:** predict the suitability of reaction conditions in the preparation of tailor-made organic compounds, Use of protective groups, activating groups and bridging elements, Regioselectivity, stereoselectivity and periselectivity in pericyclic reactions, Norrish type-I and type-II cleavage reactions and photochemical rearrangements. [K4]

**CO5:** analyze the photochemical organic reactions, design and synthesize novel organic compounds with the methodologies learnt during the course, Use of protective groups, activating groups, and bridging elements, stereoselectivity and periselectivity in pericyclic reactions, photo reductions; Paterno-Buchi reactions and Photochemistry of aromatic compounds. [K4]

**Unit I: Planning an Organic Synthesis and Control elements:**

Preliminary Planning – knowns and unknowns of the synthetic system studied, analysis of the complex and interrelated carbon framework into simple rational precursors, retro synthetic analysis, alternate synthetic routes, key intermediates that would be formed, available starting materials and resulting yield of alternative methods. Linear Vs convergent synthesis. synthesis based on Umpolung concepts of See back, region specific control elements. (18 Hours)

**UNIT-II: Organic Synthetic Methodology:**

Retrosynthetic analysis; Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach. Key intermediates, available starting materials and resulting yields of alternative methods. Convergent and divergent synthesis, Synthesis based on umpolung concepts of Seebach. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis. Control elements: Regio specific control elements. Use of protective groups, activating groups, and bridging elements. Stereo specific control elements. Functional group alterations and transposition. Examples on retro synthetic approach, calculation of yield, advantages of connvergent synthesis, synthesis of stereochemistry-controlled products. (18 Hours)

**UNIT-III: Pericyclic Reactions:**

Woodward Hoffmann rules; The Mobius and Huckel concept, FMO, PMO method and correlation diagrams. Cycloaddition and retrocycloaddition reactions; [2+2], [2+4], [4+4, Cationic, anionic, and 1,3-dipolar cycloadditions. Cheletropic reactions. ; Electrocyclization and ring opening reactions of conjugated dienes and trienes. Sigmatropic rearrangements: (1,3), (1,5), (3,3) and (5,5)-carbon migrations, degenerate rearrangements. Ionic sigmatropic rearrangements. Group transfer reactions. Regioselectivity, stereoselectivity and periselectivity in pericyclic reactions. (18 Hours)

**UNIT-IV: Organic Photochemistry-I:**

Photochemical excitation: Experimental techniques; electronic transitions; Jablonskii diagrams; intersystem crossings; energy transfer processes; Stern Volmer equation. Reactions of electronically excited ketones; $\pi \rightarrow \pi^*$ triplets; Norrish type-I and type-II cleavage reactions; photo reductions; Paterno-Buchi reactions; (18 Hours)

**UNIT-V:Organic Photochemistry-II:**

Photochemistry of α,β-unsaturated ketones; cis-trans isomerisation. Photon energy transfer reactions, Photo cycloadditions, Photochemistry of aromatic compounds; photochemical rearrangements; photo-stationery state; di-π-methane rearrangement; Reaction of conjugated cyclohexadienone to 3,4-diphenyl phenols; Barton's reactions.

(18 Hours)

**Text Books:**


1. F. A. Carey and Sundberg, (2003),Advanced Organic Chemistry, 5thed, Tata McGraw-Hill, New York.
2. J. March and M. Smith,( 2007) Advanced Organic Chemistry, 5th ed., John-Wiley and sons.
3. R. E. Ireland, (1990), Organic synthesis, Prentice Hall India, Goel publishing house.
4. Clayden, Greeves, Warren,( 2016), Organic Chemistry, Oxford University Press, Second Edition.
5. M. B. Smith, (2011), Organic Synthesis 3rd edn, McGraw Hill International Edition.


**References:**


1. Gill and Wills,( 1974), Pericyclic Reactions, Chapman Hall, London.
2. J.A. Joule, G.F. Smith, (2004), Heterocyclic Chemistry, Garden City Press, Great Britain.
3. W. Caruthers,( 2007), Some Modern Methods of Organic Synthesis 4thedn, Cambridge University Press, Cambridge.
4. H. O. House.( 1972), Modern Synthetic reactions, W.A. Benjamin Inc.
5. Jagdamba Singh and Jaya Singh,( 2012), Photochemistry and Pericyclic Reactions, New Age International Publishers, NewDelhi.


**Web Resources:**

1. **https://rushim.ru/books/praktikum/Monson.pdf**

| Course Code 24PCHC31 | PO1 | | PO2 | PO3 | | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | PSO 1.a | PSO 1..b | PSO 2 | PSO 3.a | PSO 3.b | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PSO 8 |
| CO 1 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO 4 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO 5 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

**Strong(3) Medium(2) Low(1)**

Dr. J. Kavitha
**Head of the Department**

Dr. V. Hemalatha
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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **COORDINATION CHEMISTRY – I** | **Hours/Week:6** | |
| **Core Course-8** | | **Credits:5** | |
| **Course Code 24PCHC32** | | **Internal 25** | **External 75** |

**COURSEOUTCOMES**

On completion of the course, the students shall be able to

**CO1**: understand the insights into the modern theories of bonding in coordination compounds, Spectral characteristics of complexes, Stability and Magnetic property of the complexes, Kinetics and mechanisms of substitution reactions of octahedral and square planar complexes and Electron Transfer reactions in octahedral complexes.[K2]

**CO2**: apply crystal field stabilization energy for high spin and low spin complexes, selection rules for electronic spectra, Stepwise and overall formation constants, SNCB mechanistic pathways for substitution reactions and Outer sphere electron transfer reactions and Marcus-Hush theory. [K3].

**CO3**: explain the stability of complexes and various experimental methods to determine the stability of complexes, Jahn Teller distortions and its consequences, Polorographic method and Continuous variation method, Crystal Field Activation Energy; Substitution reactions in square planar complexes, Trans effect, nature of the bridging ligand in inner sphere electron transfer reactions. [K3].

**CO4**: evaluate the reactions of octahedral and square planar complexes, Molecular Orbital Theory and energy level diagrams concept of Weak and strong fields, Sugano-Tanabe energy level diagrams , Spin-orbit coupling, effect of spin-orbit coupling on magnetic moments, quenching of orbital magnetic moments and Marcus-Hush theory. [K4].

**CO5**: analyze Molecular Orbital Theory and energy level diagrams concept of Weak and strong fields Racha parameter and calculation of inter-electronic repulsion parameter , Thermodynamic aspects of complex formation, Associative, Dissociative and SNCB mechanistic pathways for substitution reactions and nature of the bridging ligand in inner sphere electron transfer reactions [K4].

**UNIT-I: Modern theories of coordination compounds:**

Crystal field theory - splitting of d orbitals in octahedral, tetrahedral and square planar symmetries - measurement of 10Dq - factors affecting 10Dq - spectrochemical series - crystal field stabilisation energy for high spin and low spin complexes- evidences for crystal field splitting - site selections in spinels and antispinels - Jahn Teller distortions and its consequences. Molecular Orbital Theory and energy level diagrams concept of Weak and strong fields, Sigma and pi bonding in octahedral, square planar and tetrahedral complexes. (18 Hours)

**UNIT-II: Spectral characteristics of complexes:**

Term states for d ions - characteristics of d-d transitions - charge transfer spectra - selection rules for electronic spectra - Orgel correlation diagrams - Application of Orgel diagram to electronic spectra of transition metal complexes- octahedral ($d^3$, $d^6$, $d^7$, $d^8$) and tetrahedral complexes ($d^6$, $d^7$, $d^8$) configurations- Sugano-Tanabe energy level diagrams -Evaluation of 10 Dq and β for octahedral ($d^2$, $d^3$, $d^7$, $d^8$) and tetrahedral ($d^2$, $d^3$, $d^7$, $d^8$) configuration using Tanabe – Sugano diagram - nephelauxetic series - Racha parameter and calculation of inter-electronic repulsion parameter. (18 Hours)

**UNIT-III: Stability and Magnetic property of the complexes:**

Stability of complexes: Factors affecting stability of complexes, Thermodynamic aspects of complex formation, Stepwise and overall formation constants, Stability correlations, statistical factors and chelate effect, Determination of stability constant and composition of the complexes: Formation curves and Bjerrum's half method, Potentiometric method, Spectrophotometric method, Ion exchange method, Polorographic method and Continuous variation method (Job's method)Magnetic property of complexes: Spin-orbit coupling, effect of spin-orbit coupling on magnetic moments, quenching of orbital magnetic moments. (18 Hours)

**UNIT-IV: Kinetics and mechanisms of substitution reactions of octahedral and square planar complexes:**

Inert and Labile complexes; Associative, Dissociative and SNCB mechanistic pathways for substitution reactions; acid and base hydrolysis of octahedral complexes; Classification of metal ions based on the rate of water replacement reaction and their correlation to Crystal Field Activation Energy; Substitution reactions in square planar complexes: Trans effect, theories of trans effect and applications of trans effect in synthesis of square planar compounds; Kurnakov test. (18 Hours)

**UNIT-V: Electron Transfer reactions in octahedral complexes:**

Outer sphere electron transfer reactions and Marcus-Hush theory; inner sphere

electron transfer reactions; nature of the bridging ligand in inner sphere electron transfer reactions.Photo-redox, photo-substitution and photo-isomerisation reactions in complexes and their applications. (18 Hours)

**TEXT BOOKS**


1. J E Huheey, EA Keiter, RL Keiter and OK Medhi, (2006), Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc.,
2. G L Meissler and D ATarr,( 2008), Inorganic Chemistry, 3rd Edition, Pearson Education Inc.,
3. D. Bannerjea,( 1993), Co-ordination Chemistry, TATA Mcgraw Hill.
4. B. N. Figgis, (1976), Introduction to Ligand Fields, Wiley Eastern Ltd.
5. F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann, (1988), Advanced Inorganic Chemistry, 6thed.; Wiley Inter-science: New York.


**REFERENCE BOOKS**


1. Keith F. Purcell and John C. Kotz, (1977),Inorganic Chemistry, Saunders Publications, USA.
2. Peter Atkins and Tina Overton, Shriver and Atkins'(2010), Inorganic Chemistry, 5th Edition, Oxford University Press.
3. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Guas, John Wiley, (2002), 3rd edn.
4. Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J. Alexander, John Wiley, 1994, 3rd edn.
5. Inorganic Chemistry, D. F. Shriver, P. W. Atkins, W. H. Freeman and Co, (2010), London.


**Web Resources:**

https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/pages/syllabus/

| Course Code 24PCHC32 | PO1 | | PO2 | PO3 | | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | PSO 1.a | PSO 1.b | PSO 2 | PSO 3.a | PSO 3.b | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PSO8 |
| CO 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO 5 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 |

**Strong(3) Medium(2) Low(1)**

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**Head of the Department**

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**Course Designers**

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| | | | |
|---|---|---|---|
| **Semester III** | **PHYSICAL CHEMISTRY PRACTICAL** | **Hours/Week:6** | |
| **CoreCourse-9 Practical** | | **Credits:4** | |
| **Course Code 24PCHC31P** | | **Internal 40** | **External 60** |

**COURSEOUTCOMES**

On completion of the course, students will be able to

**CO1:** understand the principles associated with various physical chemistry experiments and principle of conductivity experiments through conductometric titrations. [K2]

**CO2:** evaluate the order of the reaction, temperature coefficient, and activation energy of the reaction by following pseudo first order kinetics and scientifically plan and perform all the experiments. [K2]

**CO3:** observe and record systematically the readings in all the experiments and construct the phase diagram of two component system forming congruent melting solid and find its eutectic temperatures and compositions. [K3]

**CO4:** determine the kinetics of adsorption of oxalic acid on charcoal and calculate and process the experimentally measured values and compare with graphical data. [K3]

**CO5:** interpret the experimental data scientifically to improve students' efficiency for societal developments and develop the potential energy diagram of hydrogen ion, charge density distribution and Maxwell's speed distribution by computational calculation. [K4]

**UNIT-I: Conductivity Experiments**

1. Determination of equivalent conductance of a strong electrolyte & the verification of DHO equation.
2. Verification of Ostwald's Dilution Law & Determination of pKa of a weak acid.
3. Verification of Kohlrausch's Law for weak electrolytes.
4. Determination of solubility of a sparingly soluble salt.
5. Acid-base titration (strong acid and weak acid vsNaOH).
6. Precipitation titrations (mixture of halides only). (30 hours)

**UNIT-II: Kinetics**

1. Study the kinetics of acid hydrolysis of an ester, determine the temperature coefficient and also the activation energy of the reaction.
2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half-life method and determine the order with respect to iodine and acetone.

(30 hours)

**UNIT-III: Phase diagram**

Construction of phase diagram for a simple binary system

1. Naphthalene-phenanthrene
2. Benzophenone- diphenyl amine

**Adsorption**

Adsorption of oxalic acid on charcoal & determination of surface area (Freundlich isotherm only)

(30 hours)

**TEXT BOOKS**

1. B. Viswanathan and P.S.Raghavan,( 2009), Practical Physical Chemistry, Viva Books, New Delhi.
2. Sundaram, Krishnan, Raghavan, (1996), Practical Chemistry (Part II), S. Viswanathan Co. Pvt.
3. V.D. Athawale and ParulMathur, (2008), Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi.
4. E.G. Lewers, (2011), Computational Chemistry: Introduction to the Theory and Applications of Molecular and Quantum Mechanics, 2nd Ed., Springer, New York.

**REFERENCE BOOKS**

1. J. B. Yadav, (2001),Advanced Practical Physical Chemistry, Goel Publishing House.
2. G.W. Garland, J.W. Nibler, D.P. Shoemaker, (2009), Experiments in Physical Chemistry, 8th edition, McGraw Hill.
3. J. N. Gurthu and R. Kapoor, (1987), Advanced Experimental Chemistry, S. Chand and Co.
4. Shailendra K Sinha, (2014), Physical Chemistry: A laboratory Manual, Narosa Publishing House Pvt, Ltd., New Delhi.
5. F. Jensen, Introduction to Computational Chemistry, 3rd Ed., Wiley-Blackwell.

**Web Resources**

https://web.iitd.ac.in/~nkurur/2015-16/Isem/cmp511/lab_handout_new.pdf

| **Course Code** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| **24PCHC31P** | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO 2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Heads of the Department**

Dr.N. Ramila Devi
**Course Designer**

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| | | | |
|---|---|---|---|
| **Semester III** | **ANALYTICAL INSTRUMENTATION TECHNIQUE PRACTICAL** | **Hours/Week:6** | |
| **Core Course Practical –10** | | **Credits:5** | |
| **Course Code 24PCHC32P** | | **Internal 40** | **External 60** |

**Course Outcomes**

On completion of the course students will be able to

**CO1**: design chromatographic methods for identification of species and recall the principles associated with various inorganic organic and physical chemistry experiments [K2]

**CO2**: scientifically plan and perform all the experiments and explain different constituents through instrumental methods of analysis. [K2]

**CO3**: evaluate different contaminants in materials using turbidimetry and conductivity Measurements and observe and record systematically the readings in all the experiments**.** [K3]

**CO4**: calculate and process the experimentally measured values and compare with graphical data and design experiments for analysis of inorganic and organic materials. [K3]

**CO5**: analyze constituents in materials using emission and absorption techniques and interpret the experimental data scientifically to improve student efficiency for societal developments. [K4]

**UNIT-I:**

1. Determination of the equivalent conductance of a weak acid at different concentrations and verifying Ostwald dilution law. Calculation of the dissociation constant of the acid.
2. Determination of the equivalent conductance of a strong electrolyte at different concentrations and examining the validity of the Onsager's theory as limiting law at high dilutions.
3. Conductometric titration of a mixture of HCl and $CH_3COOH$ VsNaOH.
4. Conductometric titration of $NH_4Cl$ VsNaOH.
5. Conductometric titration of $CH_3COONa$ VsHCl.
6. Potentiometric titration of a mixture of HCl and $CH_3COOH$ VsNaOH

7. Determination of $pK_a$ of weak acid by EMF method.
8. Potentiometric titration of FAS Vs $K_2Cr_2O_7$
9. Potentiometric titration of KI Vs $KMnO_4$.
10. Potentiometric titration of a mixture of Chloride and Iodide Vs $AgNO_3$.
11. Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode.

(30 hours)

**UNIT-II:**

1. Estimation of Fe, Cu and Ni by colorimetric method.
2. Estimation of Na and K by flame photometric method.
3. Determination of spectrophotometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the complex formation.
4. Estimation of the amount of nitrate present in the given solution using spectrophotometric method.
5. Assay of Riboflavin and Iron in tablet formulations by spectrophotometry
6. Estimation of chromium in steel sample by spectrophotometry
7. Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography
8. Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry.
9. Estimation of Fe(II) by 1,10 phenonthroline using spectrophotometry.
10. Separation of coloured compounds using TLC and Column Chromatography (30 hours)

**UNIT-III:**

Interpretation and identification of the given spectra of various organic compounds arrived at from the following instruments

1. UV-Visible Spectroscopy
2. FT – IR
3. NMR Spectroscopy
4. Mass Spectroscopy

(30 hours)

**Recommended Text**

1. Vogel's (2003)Text book of Practical Organic Chemistry, 5th Ed, ELBS/Longman, England.
2. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, (1989)*Vogel's Textbook of Quantitative Chemical Analysis*; 6th ed., ELBS.
3. J. D. Woollins, (1995) ,*Inorganic Experiments*; VCH: Weinheim.
4. B. Viswanathan and P.S.Raghavan, (2009), Practical Physical Chemistry, Viva Books, New Delhi.
5.Sundaram, Krishnan, Raghavan,( 1996), Practical Chemistry (Part II), S.Viswanathan Co. Pvt.

**REFERENCE BOOKS**

1. N. S. Gnanapragasam and G. Ramamurthy, (2009) Organic Chemistry – Labmanual, S. Viswanathan Co. Pvt.Ltd.
2. J. N. Gurtu and R. Kapoor, (2011), Advanced Experimental Chemistry, S. Chand and Co.
3. J. B. Yadav, (2001), Advanced Practical Physical Chemistry, Goel Publishing House.
4. G.W. Garland, J.W. Nibler, D.P. Shoemaker,( 2009), Experiments in Physical Chemistry, 8th edition, McGraw Hill.
5. J. N. Gurthu and R. Kapoor, (1987), Advanced Experimental Chemistry, S. Chand and Co.

**Web Resources:**

1. https://bit.ly/3QESF7t
2. https://bit.ly/3QANOnX

| **Course Code** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| **24PCHC32P** | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 3** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO 4** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Head of the Department**

Dr.N.Ramila Devi
**Course Designer**

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**VIRUDHUNAGAR**
**Quality Education with Wisdom and Values**

**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **BIOMOLECULES AND HETEROCYCLIC COMPOUNDS** | **Hours/week: 3** | |
| **Elective Course-6 (DSEC)** | | **Credits:3** | |
| **24PCHE31** | | **Internal 25** | **External 75** |

Course Outcomes:

On completion of the course, students will be able to

**CO1:** learn the basic concepts and biological importance of biomolecules and natural products and understand the basic concepts of biomoleculesand natural products. [K2]

**CO2:** integrate and assess the different methods of preparation of structurally different biomolecules and natural products and explain various of functions of carbohydrates, proteins, nucleic acids, steroids and hormones. [K3]

**CO3:** understand the functions of alkaloids and terpenoids and illustrate the applications of biomolecules and their functions in the metabolism of living organisms. [K3]

**CO4:** analyse and rationalise the structure and synthesis of heterocyclic compounds and elucidate the structure determination of biomolecules and natural products. [K4]

**CO5:** extract and construct the structure of new alkaloids and terpenoids from different methods and develop the structure of biologically important heterocyclic compounds by different methods. [K4]

**UNIT-I: Chemistry and metabolism of carbohydrates:** Definition, classification and biological role of carbohydrates. Monosaccharides: Linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structure determination not required), physical and chemical properties of glucose and fructose. Disaccharides: Ring structures (Haworth formula) –occurrence, physical and chemical properties of maltose, lactose and sucrose. Polysaccharides: Starch, glycogen and cellulose – structure and properties, glycolysis of carbohydrates. (9 hours)

**UNIT-II: Steroids and Hormones:** Steroids-Introduction, occurrence, nomenclature, configuration of substituents. Diels' hydrocarbon, stereochemistry, classification, Diels' hydrocarbon, biological importance, colour reactions of sterols, cholesterol-occurrence, tests, physiological activity, biosynthesis of cholesterol from squalene. Hormones-Introduction, classification, functions of sex hormones- androgens and estrogens, adrenocortical hormones- cortisone and cortisol structure and functions of non-steroidal hormones- adrenaline and thyroxin. (9 hours)

**UNIT-III: Proteins and nucleic acids:** Separation and purification of proteins – dialysis, gel filtration and electrophoresis. Catabolism of amino acids - transamination, oxidative deamination and decarboxylation. Biosynthesis of proteins: Role of nucleic acids. Amino acid metabolism and urea cycle. Structure, methods for the synthesis of nucleosides - direct combination, formation of heterocyclic base and nucleoside modification, conversion of nucleoside to nucleotides. Primary and secondary structure of RNA and DNA, Watson-Crick model, solid phase synthesis of oligo nucleotides. (9 hours)

**UNIT-IV: Prostaglandins/ Pyrethroids and Rotenones**: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGE2α. Synthesis and reactions of Pyrethroids and Rotenones. (9 hours)

**UNIT-V: Fused Ring Heterocyclic Compounds:** Benzo fused five membered rings: Indole, isoindole, benzofuran and benzothiophene, Preparation and properties. Benzof used six membered rings: Quinoline and isoquinoline: Preparation by ring closure reactions, Reactions: Mechanism of electrophilic and nucleophilic substitutions, oxidation and reduction reactions. (9 hours)

**TEXT BOOKS**

1. T. K Lindhorst, (2007), Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH,North America.
2. I. L. Finar,( 1975), Organic Chemistry Vol-2, 5th edition,PearsonEducation Asia.
3. V. K. Ahluwalia and M. Goyal, (2000),Textbook of Heterocyclic compounds,Narosa Publishing, New Delhi.
4. M. K. Jain and S. C. Sharma, (2014), Modern Organic Chemistry, Vishal Publishing Co., Jalandhar, Delhi.
5. V. K. Ahluwalia, (2009),Steroids and Hormones, Ane books pub., New Delhi.

**REFERENCE BOOKS**

1. I. L. Finar, (2004), Organic Chemistry Vol-1, 6th edition, Pearson Education Asia.
2. Pelletier,( 2000),Chemistry of Alkaloids, Van NostrandReinhold Co,.
3. Shoppe, (1994), Chemistry of the steroids, Butterworthes.
4. I. A. Khan, and A. Khanum(2004), Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad.
5. M. P. Singh. and H. Panda,( 2005), Medicinal Herbs with their formulations, Daya Publishing House, Delhi.

**Web Resources:**

1. http://www.clutchprep.com/organic-chemistry

| **Course Code 24PCHE31** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 2** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Head of the Department**

Dr.C. Vidya Rani
**Course Designer**

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**M.Sc. CHEMISTRY**
**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **INDUSTRIAL CHEMISTRY** | **Hours/week: 3** | |
| **Elective Course–7 NME** | | **Credits:2** | |
| **24PCHN31** | | **Internal** 25 | **External** 75 |

Course Outcomes :

On completion of the course, students will be able to

**CO1:** understand the chemical concepts involved in small scale, leather and polymer products; chemistry involved in paint, pigments, energy resources and biofuels. [K1]

**CO2:** acquire knowledge about the manufacturing processes of small scale industrial products, leather, polymer, pigments and paints and biofuels. [K2]

**CO3:** analyse purity of industrial products. [K2]

**CO4:** apply the concept to harvest more energy from the natural resources and produce quality products. [K3]

**CO5:** prepare the novel industrial products such as leather, polymer, pigments and paints and biofuels. [K4]

**UNIT - I**

**Small scale Industries**

Preparation of Safety matches, agarbatties, naphthalene balls, wax candle, shoe polish, gum paste, writing/ fountain pen ink, chalk/crayons, plaster of paris, silicon carbide crucibles. (9 hours)

**UNIT - II**

**Leather Chemistry**

Introduction –structure of hide and skin –leather processing –process before tannage –flaying and curing –tanning process –methods of tanning –vegetable tanning –chrome tanning –aldehyde tanning –finishing processes after tanning –Tannery effluent and by –product problems –treatment of tanning wastes. (9 hours)

**UNIT- III**

**Polymer Chemistry**

History and significance of polymers- characteristics of polymers-Identification of polymers – polymers as adhesives, fillers, reinforcements-common plastic polymers used in packaging – PET,HDPE, PVC ,LDPE and PP- biodegradable polymers-composition of biodegradable plastics. starch –based plastics, bacteria –based plastic, Soy –based plastics –applications of biodegradable polymers–medical sutures,pins and dental implants. (9 hours)

**UNIT IV**

**Pigments and Paints**

(a) White pigments –white lead, Zinc oxide, lithopone, titanium dioxide – characteristics and uses.

Blue pigments: ultra marine blue , cobalt blue and iron blue – characteristics & uses

Red pigments: Red lead, synthetic iron oxide - characteristics & uses

Green pigments: Chrome green, Reinmann's green –uses.

(b) P**aints:** Requirements of a good paint –constituents of paint- manufacture of paints –emulsion paints –latex paints –varnishes –manufacture and uses –lacquers. (9 hours)

**UNIT V**

**Energy resources and Biofuels:-**

Energy resources- conventional and non –conventional energy resources.

Biofuels-introduction, types of bio fuels (bioethanol and biodiesel)- raw materials for the synthesis of bio fuels, properties of bio fuels standard specification of biofuel, uses of biofuels –modification of vegetable oils as biodiesel. (9 hours)

**TEXT BOOKS**

1. BK. Sharma, *Industrial Chemistry*, GOEL Publishing House, Meerut
2. K.Bagavathi Sundari, *Applied Chemistry*; MJP Publishers, Chennai,
3. Jayashree Ghosh, *Fundamental concepts of applied chemistry*, S.Chand &Company Ltd, Ram Nagar, New Delhi.

**REFERENCEBOOKS**

1. Dr. Vandana Meshram - Ingle, *A Textbook of Industrial Chemistry*, Educational Publisher and Distributors.
2. Raghunath B. Toche, Satish Kale, Eknath H. Gade, *A Textbook of Industrial Chemistry*, Vision Publications.

| **Course Code 24PCHN31** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 2** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |

**Strong (3) Medium(2) Low (1)**

Dr.J.Kavitha
**Head of the Department**

Dr.M.Vairalakshmi
**Course Designer**

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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **Practice for CSIR NET–General Paper** | **Hours/Week: -** | |
| **SELF STUDY COURSE** | | **Credits: 1** | |
| **Course Code 24PGOL32** | | **100** | **-** |

**COURSE OUTCOMES**

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

CO1 : explain various concepts related to numbers, quantitative comparison, monetary problems and logical reasoning. [K2]

CO2 : apply the analytical skills and logical reasoning in solving problems related to competitive examinations. [K3]

CO3 : solve typical problems, geometrical type problems, daily life problems in a effective manner. [K3]

CO4 : analyze the techniques used in solving complicated real life problems.[K4]

CO5 : interpret the data using logical reasoning and observational ability.[K5]

**UNIT I**

**Typical Problems-** Series formation

**Numerical Ability-** Numbers

**UNIT II**

**Geometrical Type Problems**

Mensuration and quantitative comparison

**UNIT III**

**Typical Problems-** Moving locomotive problem

**Numerical Ability-** Distance and Directions

**UNIT IV**

**Daily Life Problems**

Finding the X – Average - Monetary problems

**UNIT V**

**Logical Reasoning**

Data interpretation – Observational ability – Logical puzzles

**BOOKS FOR STUDY**:

Christy Varghese (2016).,*CSR – NET, General aptitude –A new outlook*, Lilly publishing house, Changanacherry, Kerala

**REFERENCE BOOKS**

1. Pradip Kumar Ray, General Aptitude Theory ,CSIR-NET, Previous question and answer with explanation and hint to solve, Notion Press, India
2. Ram Mohan Pandey (2021)., *CSIR-UGC-NET General Aptitude Theory and Practice*, Pathfinder Publication, a unit of Pathfinder Academy Pvt. Ltd., India.

| **Unit** | **Chapter** | **Section/Page Number** |
|---|---|---|
| 1 | 4 | 142-162 |
| | 5 | 163-192 |
| 2 | 12 | 272-294 |
| 3 | 3 | 132-141 |
| | 7 | 206-220 |
| 4 | 8 | 221-230 |
| | 9 | 231-239 |
| | 10 | 240-249 |
| 5 | 13 | 295-309 |
| | 14 | 310-323 |
| | 15 | 324-332 |

| **Course code 24PGOL32** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | - | 2 | - | - |
| **CO2** | 3 | 3 | 3 | 3 | - | 2 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | - | 3 | - | - |
| **CO4** | 3 | 2 | 3 | 3 | - | 3 | - | - |
| **CO5** | 3 | 2 | 3 | 3 | - | 3 | - | - |

**3 – Strong, 2 – Medium, 1 – Low**

Dr. M. C. Maheshwari
**Head of the Department**

Dr. T. Anitha
**Course Designer**

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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester III** | **INTERNSHIP** | **Hours/Week: -** | |
| **Internship** | | **Credits: 2** | |
| **Course Code 24PCHI31** | | **Internal 75** | **External 25** |

**COURSE OUTCOMES**

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

CO1: gain knowledge to select internship in the field of Organic, Inorganic, medicinal, nano and Physical chemistry. [K3]

CO2: apply skills in theoretical chemical knowledge to real-world problems within an industrial setting. [K3]

CO3: execute proficiency in using specialized equipment, data analysis, research methodologies, safety protocols. [K3]

CO4: explore effective communication skills through written reports, oral presentations, and collaboration with colleagues. [K4]

CO5: assess the problems like environmental issues, health and medicine in society and use chemical solutions adopting ethical behavior. [K5]

**Guidelines/ Regulations:**

- Each student must go for Internship training in a reputed Industry/Company/ Organization/ Educational Institution.
- Students should produce the Completion Certificate after the Completion of Internship period.
- A report of 15 – 20 pages must be submitted by each student after the completion of the Internship period.
- External Viva-voce examination will be conducted.

| **Course code 24PCHI31** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

**Strong (3) Medium(2) Low (1)**

Dr.J.Kavitha
**Heads of the Department**

Dr.J.Kavitha
**Course Designer**

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| | | | |
|---|---|---|---|
| **Semester III** | **CHEMISTRY IN ANCIENT INDIA** | **Hours/Week: -** | |
| **Extra Credit Course** | | **Credits: 2** | |
| **Course Code 24PCHO31** | | **Internal 100** | **External -** |

**Course Outcomes**

On completion of the course students will be able to:

**CO 1:** understand the ancient chemistry used in medicine, metallurgy, cosmetics, glass, dyes, inks. [K1]

**CO2:** explain the minerals used for medicinal preparations, plasters, and hair washes by the Indus Valley people. [K2]

**CO 3:** analyse the Chemistry in the field of Rasayana Sastra, Rasatantra, Rasakriyaa or Rasavidyaa. [K2]

**CO 4:** predict the Ayurveda used in variety of minerals. [K3]

**CO 5:** interpret ancient chemistry techniques to turn base metals into gold, Mercury and its elixirs used in these efforts and the Harappans knowledge in advanced metallurgical skills. [K4]

**UNIT –I: Chemistry in India: A Survey:** Define alchemy with regard to chemistry. Early Chemical Techniques - metallurgy in the emergence of civilization. Atomism in Vaiśeṣika. Chemistry in Early Literature.

**UNIT–II: Fundamental Concepts of Chemistry in Ancient India:** Glass making, Paints and Pigments,perfumes and cosmetics, paper and ink making, alcoholic liquors and nano particles.

**UNIT –III:** Rasashala: Ancient Indian Alchemical Lab: **Yaśodhara Bhaṭṭa (13th century), Rasaprakāśa**

**Sudhākara-**Laboratory and Apparatus in Alchemy. Knowledge about gold and silver coins, and jewels and gems.

**UNIT–IV: Nāgārjuna (7th or 8th century CE), Rasendramaṅgalam-** mercury and mercurials along with minerals and metals. **Rasārṇavakalpa-** mercury processing, its preparation for medicinal use.

**UNIT–V: Vāgbhaṭa (13th century), Rasaratnasamuccaya -** many processes for the purification and use of mercury and other metals. Metallurgy in India – Copper, iron, Zinc, Gold and Silver.

**Recommended Text**


1. Chittrabrata, Patil and Nupur Dasgupta. Eds. 2009. An Ancient Indian System of Rasayana Suvarnatantra: A Treatise on Alchemy, pp. 45–46, Kalpaz Publications, New Delhi.
2. Govind, V. 1970. Some Aspects of Glass Manufacturing in Ancient India. National Commission for the Compilation of History of Science in India, National Institute of Science of India, Vol. 5, No. 2. pp. 281–308.
3. Habashi, Fathi. 1998. The Age of Alchemy History of Chemistry, Metallurgy, and Civilisation, Interdisciplinary Science Reviews, Vol. 23, No. 4. pp. 348-361, doi: 10.1179/ isr.1998.23.4.348.
4. Hedge, K.T.M. 1981. Scientific Basis and Technology of Ancient Indian Copper and Iron Metallurgy. Indian Journal of History of Science, Vol. 16, No. 2. pp. 189–201.
5. Subbarayappa, B.V. 1999. Indian Alchemy: its Origin and Ramifications. In *Chemistry and Chemical Techniques in India* (Ed.) Subbarayappa, B.V., Delhi: Centre for Studies in Civilisations.
6. Deshpande, Vijaya Jayant. 1998. History of Chemistry and Alchemy in India from Pre-historic to Pre- Modern Times. In *History of Indian Science and Technology an Culture AD 1000-1800* (Ed) A. Rahman. Delhi: Oxford.
7. Habib, Irfan. 2000. Joseph Needham and The History of Indian Technology. *Indian Journal of History of Science* 35(3): 245-274.
8. Needham, Joseph. *Science and Civilisation in China*. Vols. IV (2), V(4). Cambridge: Cambridge University Press. (Especially pages 85-6,97, 104-7 and 131-2).
9. Ray, P.C. 1909. *History of Hindu Chemistry*. Vols. I & II. London: Williams and Norgate.


**Website and e-learning source**

1. http://www.chm.bris.ac.uk/webprojects2002/crabb/history.html
2. http://www.infinityfoundation.com/mandala/t_es_agraw_ chemistry_frameset.html
3. https://www.insa.nic.in/writereaddata/ UpLoadedFiles/IJHS/Vol05_2_7_VGovind.pdf)

| **Course Code 24PCHO31** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1a** | **PSO 1b** | **PSO2** | **PSO3 a** | **PSO3 b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| CO 1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO 4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO 5 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |

3 – Strong, 2 – Medium, 1 - Low

Dr.J.Kavitha
Head of the Department

Dr.J.Kavitha
Course Designer

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**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester IV** | **COORDINATION CHEMISTRY-II** | **Hours/Week:6** | |
| **Core Course-11** | | **Credits:5** | |
| **Course Code 24PCHC41** | | **Internal 25** | **External 75** |

**Course Outcomes:**

On completion of the course, students will be able to

**CO1:** recognize the fundamental concepts and structural aspects of inorganic spectroscopy and organometallic compounds. [K2]

**CO2:** Understand the structure and bonding in olefin, allyl, cyclopentadienyl and carbonyl containing organometallic compounds and Identify the structure of coordination complexes using spectroscopic tools such as IR, NMR, ESR, Mossbauer and optical rotatory dispersion studies to interpret the structure of molecules by various spectral techniques. [K3]

**CO3:** predict the structure of coordination compounds using spectroscopic tools [K3]

**CO4:** analyze the structure and bonding in coordination complexes and evaluate the spectral characteristics of selected complexes. [K4]

**CO5:** evaluate the reactions and catalysis of organometallic compounds and the concepts of IR, NMR, ESR, Mossbauer and photo electron spectroscopy. [K4]

**UNIT-I: Chemistry of organometallic compounds:** Classification of organometallic compounds based on M-C bond – 18 and 16 electron rule;Bonding in metal – olefin complexes (example: Ziese's salt), metal-acetylene and metal-allyl complexes; Metal-cyclopentadienyl complexes – Examples and MO approach to bonding in metallocenes; fluxional isomerism. Metal – carbonyl complexes: MO diagram of CO; Structure and bonding − bonding modes, MO approach of M-CO bonding, π-acceptor nature of carbonyl group, synergistic effect (stabilization of lower oxidation states of metals); Carbonyl clusters: Low nuclearity and high nuclearity carbonyl clusters – Structures based on polyhedral skeleton electron pair theory or Wade's rule. (18 hours)

**UNIT-II: Reactions and catalysis of organometallic compounds:** Reactions of organometallic compounds: Oxidative addition, reductive elimination (α and β eliminations), migratory insertion reaction and metathesis reaction.Organo-metallic catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (oxo process), oxidation of olefin (Wacker process), olefin isomerisation, water gas shift reaction, cyclo-oligomerisation of acetylenes using Reppe's catalysts, Monsonto process. (18 hours)

**UNIT-III: Inorganic spectroscopy -I:** IR spectroscopy: Effect of coordination on the stretching frequency-sulphato, carbonato, sulphito, aqua, nitro, thiocyanato, cyano, thiourea, DMSO complexes; IR spectroscopy of carbonyl compounds. NMR spectroscopy- Introduction, applications of 1H, 15N, 19F, 31P-NMR spectroscopy in structural identification of inorganic complexes, fluxional molecules, quadrupolar nuclei- effect in NMR spectroscopy. (18 hours)

**UNIT-IV: Inorganic spectroscopy-II:** Introductory terminologies: g and A parameters-definition, explanation and factors affecting g and A; Applications of ESR to coordination compounds with one and more than one unpaired electrons – hyperfine and secondary hyperfine splitting and Kramer's doublets; ESR spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II), Cu(II) complexes, bis(salicylaldimine)copper(II) and $[(NH_3)_5Co\text{-}O_2\text{-}Co(NH_3)_5]^{5+}$. Mossbauer spectroscopy – Mossbauer effect, Recoil energy, Mossbauer active nuclei, Doppler shift, Isomer shift, quadrupole splitting and magnetic interactions. Applications of Mössbauer spectra to Fe and Sn compounds. (18 hours)

**UNIT-V: Photo Electron Spectroscopy:** Theory, Types, origin of fine structures - shapes of vibrational fine structures – adiabatic and vertical transitions, PES of homonuclear diatomic molecules ( $N_2$, $O_2$) and heteronuclear diatomic molecules (CO, HCl) and polyatomic molecules ($H_2O$, $CO_2$, $CH_4$, $NH_3$) – evaluation of vibrational constants of the above molecules. Koopman's theorem- applications and limitations.Optical Rotatory Dispersion – Principle of CD and ORD; Δ and λ isomers in complexes, Assignment of absolute configuration using CD and ORD techniques.

(18 hours)

**Recommended Text**

1. J E Huheey, EA Keiter, RL Keiter and OK Medhi, (2006),Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc.,
2. G L Meissler and D ATarr, (2008), Inorganic Chemistry, 3rd Edition, Pearson Education Inc.,
3. D. Bannerjea,( 1993), Co-ordination Chemistry, TATA Mcgraw Hill.
4. B D Gupta and A K Elias,( 2013),Basic Organometallic Chemistry: Concepts, Syntheses and Applications, University Press.
5. F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann,( 1988), Advanced Inorganic Chemistry, 6thed.; Wiley Inter-science: New York.

**Reference Books**

1. Crabtree, Robert H. (2000),The Organometallic Chemistry of the Transition Metals. 3rd ed. New York, NY: John Wiley.
2. P Gütlich, E Bill, A X Trautwein, (2011),Mossbauer Spectroscopy and Transition Metal Chemistry: Fundamentals and Applications, 1st edition, Springer-Verlag Berlin Heidelberg.
3. Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J.Alexander, John Wiley, 1994, 3rd edn.
4. K. F. Purcell, J. C. Kotz, (1976) Inorganic Chemistry; Saunders: Philadelphia.
5. R. S. Drago,( 1977), PhysicaI Methods in Chemistry; Saunders: Philadelphia.

**Website and e-learning source**

1. https://archive.nptel.ac.in/courses/104/101/104101100/

| **Course Code 24PCHC41** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 2** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 3** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO 4** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Head of the Department**

Dr.M.Vairalakshmi
**Course Designer**

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**VIRUDHUNAGAR**
**Quality Education with Wisdom and Values**

**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester IV** | **PHYSICAL CHEMISTRY-II** | **Hours/Week:6** | |
| **Core Course-12** | | **Credits:5** | |
| **Course Code 24PCHC42** | | **Internal 25** | **External 75** |

**Course Outcomes:**

On completion of the course, students will be able to

**CO1:** understand the essential characteristics of wave functions and need for the quantum mechanics and group theory. [K2]

**CO2:** apply the quantum mechanics to hydrogen and poly electronic systems and applications of quantum and group theory. [K3]

**CO3:** apply the concept of quantum mechanics and group theory to predict the electronic structure and construct character table for various point groups. [K3]

**CO4:** specify the appropriate irreducible representations for theoretical applications and apply Huckel method to Ethylene butadiene, cyclopropenyl, cyclo butadiene and Benzene. [K4]

**CO5:** develop skills in evaluating the energies of molecular spectra and predict the vibrational modes, hybridization using he concepts of group theory. [K4]

**UNIT-I:** Wave particle duality, Uncertainty principle, Particle wave and Schrodinger wave equation, wave function, properties of wave function. Properties of wave function, Normalized, Orthogonal, orthonormal, Eigen values, Eigen functions, Hermitian properties of operators.Introduction to quantum mechanics-black body radiation, photoelectric effect, hydrogen spectrum.Need for quantum mechanics, Postulates of Quantum Mechanics, Schrodinger wave equation, Time independent and time dependent. (18 hours)

**UNIT-II: Quantum models:** Particle in a box-1D, two dimensional and three-dimensional, degeneracy,application to linear conjugated molecular system, free particles, ring systems.Harmonic Oscillator-wave equation and solution, anharmonicity, force constant and its significance.Rigid Rotor-wave equation and solution, calculation of rotational constants and bond length of diatomic molecules. (18 hours)

**UNIT-III: Applications to Hydrogen and Poly electron atoms:** Hydrogen atom and hydrogen like ions, Hamiltonian-wave equation and solutions, radial and angular functions, representation of radial distribution functions. Approximation methods –variation methods: Application to Hydrogen and Helium atom. Perturbation method - first order applications to hydrogen atom - Hatrefock self-consistent field method, HFSCF application to Helium atom-electron spin and paulis exclusion principle - Slater determination.

(18 hours)

**UNIT-IV: Group theory:** Groups, sub groups, symmetry elements, operations, classification-axial and non-axial. Dihedral point groups- $C_n$,$C_{nh}$, $D_n$, $D_{nh}$, $D_{nd}$, Td and Oh. Matrix representation and classes of symmetry operations, reducible irreducible and direct product representation. The Great orthogonality theorem – irreducible representation and reduction formula, construction of character table for $C_{2v}$, $C_{2h}$, $C_{3v}$ and $D_{2h}$ point groups.

(18 hours)

**UNIT-V: Applications of quantum and group theory:** Hydrogen Molecule-Molecular orbital theory and Heitler London (VB) treatment, Energy level diagram, Hydrogen molecule ion; Use of linear variation function and LCAO methods.Electronic conjugated system:Huckel method to Ethylene butadiene, cyclopropenyl, cyclo butadiene and Benzene. Applications of group theory to molecular vibrations, electronic spectra of ethylene.

(18 hours)

**Recommended Text**

1. R.K. Prasad, Quantum Chemistry, New Age International Publishers, New Delhi, 2010, 4th revised edition.
2. F. A. Cotton, Chemical Applications of Group Theory, John Wiley & Sons, 2003, 2nd edition.
3. A. Vincent, Molecular Symmetry and Group Theory. A Programmed Introduction to Chemical Applications, John and Willy & Sons Ltd., 2013, 2nd Edition.
4. T. Engel & Philip Reid, Quantum Chemistry and Spectroscopy, Pearson, New Delhi, 2018, 4th edition.
5. G. K. Vemulapalli, Physical Chemistry, Prentice Hall of India Pvt. Ltd. 2001. 6. D.A. McQuarrie, Quantum Chemistry, Viva Books PW. Ltd, 2013, 2nd edition.

**Reference Books**

1. N. Levine, Quantum Chemistry, Allyn& Bacon Inc, 1983, 4th edition.
2. D.A. McQuarrie and J. D. Simon,( 2012), Physical Chemistry, A Molecular Approach, Viva Books Pvt. Ltd, New Delhi.
3. R. P. Rastogi& V. K. Srivastava, (1999),An Introduction to Quantum Mechanics of Chemical

Systems, Oxford & IBH Publishing Co., New Delhi.

4. R.L. Flurry. Jr, (1980),Symmetry Group Theory and Chemical applications, Prentice Hall. Inc,.
5. J. M. Hollas, (2011),Symmetry in Molecules, Chapman and Hall, London, Reprint.

**Website and e-learning source**

1. https://nptel.ac.in/courses/104101124
2. https://ipc.iisc.ac.in/~kls/teaching.html

| **Course Code 24PCHC42** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 2** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 3** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO 4** | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO 5** | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Head of the Department**

Dr.N. Ramila Devi
**Course Designer**

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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester IV** | **PROJECT** | **Hours/Week:6** | |
| **Core Project** | | **Credits:5** | |
| **Course Code 24PCHC43PR** | | **Internal 40** | **External 60** |

## COURSE OUTCOMES

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

CO1: understand the fundamentals of research strategies and develop ability to choose methods appropriate to research projects aims and objectives [K2]

CO2: select and define appropriate research problem [K3]

CO3: apply various methods for collecting primary and secondary data along with literature Survey. [K3]

CO4: analyze research ethical issues related to Research and Publication. [K4]

CO5: evaluate new methodologies to develop novel materials through new synthetic routes. [K5]

**Project General Rules:**

1. Each learner can select her research project in any one of the areas of chemistry in consultation with her guide and the Head of the department.

2. The project can be either developing novel materials through new synthetic routes or review of literature paper.

3. Either individual project or team work (only two students in a team) shall be chosen.

4. The project report should be submitted to the Controller of Examination Office as per the rules prescribed by the college.

5. Each learner shall submit 2 copies of her project report for valuation.

6. The project report shall contain at least 25 pages excluding bibliography and appendices.

7. The project report shall be valued for a total of 100 marks out of which the external examiner and guide share 60 and 40 marks respectively.

| Evaluation Pattern (100 marks) | | | | |
|---|---|---|---|---|
| Internal Assessment (40marks) | | | External Assessment (60 marks) | |
| Review Report (20) | Pre-Submission Presentation (10) | One Open online Course related to the Project (10) | Project Presentation (40) | Viva Voce (20) |

| Course Code **24PCHC43PR** | PO1 | | PO2 | PO3 | | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | PSO 1.a | PSO 1.b | PSO 2 | PSO3 .a | PSO3 .b | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PSO 8 |
| CO 1 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 4 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 5 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**3 – Strong, 2 – Medium, 1 - Low**

Dr. J. Kavitha
Head of the Department

Dr. J. Kavitha
Course Designer

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**M.Sc. CHEMISTRY**

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| | | | |
|---|---|---|---|
| **Semester III** | **CHEMISTRY OF NATURAL PRODUCTS** | **Hours/week: 6** | |
| **Elective Course-8 (DSEC)** | | **Credits:3** | |
| **24PCHE41** | | **Internal 25** | **External 75** |

**Course Outcomes:**

On completion of the course, students will be able to

**CO1:** understand the basic concepts and biological importance of chemistry of biomolecules and natural Products. [K2]

**CO2:** scientifically plan and perform the isolation and characterization of synthesized natural products and explain various of functions of carbohydrates, proteins, nucleic acids, steroids and hormones. [K3]

**CO3:**elucidate the structure of alkaloids, terpenoids, carotenoids, falvanoids and anthocyanins, purines and natural dyes. [K3]

**CO4:**determine the structure of phytochemical constituents by chemical and physical methods and elucidate the structure determination of biomolecules and natural products. [K4]

**CO5:** extract and construct the structure and chemistry of new alkaloids, terpenoids, Anthocyanines and flavones, Purines and Steroids and natural dyes from different methods. [K4]

**UNIT-I:** A**lkaloids:** Introduction, occurrence, classification, isolation and functions of alkaloids. Classification, general methods of structural elucidation. Chemical methods of structure determination of Coniine, Piperine, Nicotine, Papaverine. Atropine, Quinine, Belladine, Cocaine, Heptaphylline, Papaverine and Morphine. (18 hours)

**UNIT-II: Terpenoids:** Introduction, occurrence, Isoprene rule,classification. General methods of determiningstructure..Structure determination of Camphor, Abietic acid, Cadinene, Squalene, Zingiberine.**Carotenoids:** Introduction, geometricalisomerism, Structure, functions and synthesis of β-carotene andvitamin-A. (18 hours)

**UNIT-III: Anthocyanines and flavones:** Anthocyanines: Introduction toanthocyanines. Structure and general methods of synthesis of anthocyanines. Cyanidine chloride: structure and determination. Flavones: Biological importance of flavones. Structure and determination of flavone and flavonoids. Quercetin: Structure determination and importance. (18 hours)

**UNIT-IV: Purines and Steroids:** Purines: Introduction, occurrence and isolation of purines. Classification and spectral properties of steroids.biological importance, Structure and synthesis of Uric acid and Caffeine. Steroids: Steroids-Introduction, occurrence, nomenclature, configuration of substituents, Diels' hydrocarbon, stereochemistry, classification, Diels' hydrocarbon, biological importance, colour reactions of sterols, cholesterol-occurrence, tests, physiological activity, biosynthesis of cholesterol from squalene. (18 hours)

**UNIT-V:Natural Dye**s: Occurrence, classification, isolation, purification, properties, colour andconstitution. Structural determination and synthesis of indigoitin and alizarin.

(18 hours)

**Recommended Text**

1. G. K. Chatwal, (2009),Organic Chemistry on Natural Products, Vol. 1, Himalaya Publishing House, Mumbai.
2. G. K. Chatwal,( 2009), Organic Chemistry on Natural Products, Vol. 2, Himalaya Publishing House, Mumbai.
3. O. P. Agarwal,( 1997), Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut.
4. O. P. Agarwal,( 1997), Chemistry of Organic Natural Products, Vol. 2, Goel Publishing House, Meerut.
5. I. L. Finar(1975), Organic Chemistry Vol-2, 5$^{th}$edition,PearsonEducation Asia.

**Reference Books**

1. I. L. Finar, (2004),Organic Chemistry Vol-1, 6$^{th}$edition, Pearson Education Asia.
2. Pelletier,( 2000),Chemistry of Alkaloids, Van NostrandReinhold Co.
3. Shoppe, (1994),Chemistry of the steroids, Butterworthes.
4. I. A. Khan, and A. Khanum(2004), Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad.

**Website and e-learning source**

https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic

| **Course Code 24PCHE41** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** |
|---|---|---|---|---|---|---|---|---|---|---|
| | **PSO 1.a** | **PSO 1.b** | **PSO 2** | **PSO 3.a** | **PSO 3.b** | **PSO 4** | **PSO 5** | **PSO 6** | **PSO 7** | **PSO 8** |
| **CO 1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 2** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO 5** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |

**Strong(3) Medium(2) Low(1)**

Dr.J.Kavitha
**Head of the Department**

Dr.C. Vidya Rani
**Course Designer**

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**M.Sc. CHEMISTRY**

**(2024-2025 onwards)**

| | | | |
|---|---|---|---|
| **Semester IV** | **CHEMISTRY FOR COMPETITIVE EXAMINATIONS** | **Hours/week: 6** | |
| **Professional Competency Course** | | **Credits:3** | |
| **24PCHS41** | | **Internal 25** | **External 75** |

**COURSE OUTCOMES**

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

CO1: know the fundamentals of chemistry. [K1]

CO2: understand the basics of chemistry to predict the periodicity, solid state, molecular spectroscopy, nuclear chemistry and medicinal chemistry. [K2]

CO3: identify the types of allotrophy, concepts of acids and bases, data analysis, aromaticity and supramolecular chemistry [K2]

CO4: apply Structure and bonding in homo- and hetero nuclear molecules and Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques . [K3]

CO5: interpret important concepts of acid base, Polymer chemistry, IUPAC nomenclature of organic molecules, Inner transition elements and Nuclear chemistry. [K4]

**UNIT I** - Chemical periodicity- Periodic table, Elements, Groups. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.

Structure and bonding in homo- and hetero nuclear molecules, including shapes of molecules (VSEPR Theory). Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents. (18 Hours)

**UNIT II** - Solid state: Crystal structures; Bragg's law and applications; band structure of solids. Polymer chemistry: Molar masses; kinetics of polymerization.

Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

Data analysis: Mean and standard deviation; absolute and relative errors; linear

regression; covariance and correlation coefficient. (18 Hours)

**UNIT III -** IUPAC nomenclature of organic molecules including regio- and stereoisomers.

Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions

Structure determination of organic compounds by IR, UV-Vis, 1H & 13C NMR and Mass spectroscopic techniques. (18 Hours)

**Unit IV** -Inner transition elements-Redox chemistry, Spectral and magnetic properties, Analytical applications. Supramolecular chemistry. (18 Hours)

**Unit V -** Nuclear chemistry Radio-analytical techniques-Activation analysis, Nuclear reactions, fission, and fusion. Cages and metal clusters. Medicinal chemistry-Therapeutic classes of drugs, Antimicrobial drugs, Antibiotics, Adrenergic and Cholinergic drugs, neurological and neuromuscular agents, Anti-hypertensive and Cardiovascular drugs, QSAR and drug design. (18 Hours)

**TEXT BOOKS**


1. 1. J. March and M. Smith, (2007),Advanced Organic Chemistry, 5th ed., John-Wiley and sons.
2. J E Huheey, EA Keiter, RL Keiter and OK Medhi, (2006),Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc.,
3. G L Meissler and D ATarr, (2008),Inorganic Chemistry, 3rd Edition, Pearson Education Inc.,
4. D. Bannerjea, (1993), Co-ordination Chemistry, TATA Mcgraw Hill.
5. F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann,( 1988), Advanced Inorganic Chemistry, 6thed.; Wiley Inter-science: New York.
6. I. L. Finar, (1975),Organic Chemistry Vol-2, 5thedition,PearsonEducation Asia.
7. V. K. Ahluwalia and M. Goyal,( 2000), Textbook of Heterocyclic compounds,Narosa Publishing, New Delhi.
8. M. K. Jain and S. C. Sharma, (2014),Modern Organic Chemistry, Vishal Publishing Co., Jalandhar, Delhi.
9. V. K. Ahluwalia,( 2009), Steroids and Hormones, Ane books pub., New Delhi.
10. Kalsi, P.S. (2014).*Spectroscopy of Organic Compounds.* New Delhi: New Age

International Publishers, 6th Edition.

11. William Kemp. (2009). *Organic Spectroscopy*. New York: Palgrave, 3rdEdition.
12. Aruldhas, G.(2001).*Molecular Structure and Spectroscopy*. New Delhi: Prentice – Hall of India Pvt. Ltd., 1st Edition.
13. G. K. Chatwal, (2009),Organic Chemistry on Natural Products, Vol. 1, Himalaya Publishing House, Mumbai.
14. G. K. Chatwal,( 2009), Organic Chemistry on Natural Products, Vol. 2, Himalaya Publishing House, Mumbai.
15. O. P. Agarwal,( 1997), Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut.
16. I. L. Finar, (1975),Organic Chemistry Vol-2, 5th edition, Pearson Education Asia.

**REFERENCE BOOKS**

1. R. E. Ireland, (1990),Organic synthesis, Prentice Hall India, Goel publishing house.
2. Clayden, Greeves, Warren, (2016),Organic Chemistry, Oxford University Press, Second Edition.
3. M. B. Smith, (2011),Organic Synthesis 3rd edn, McGraw Hill International Edition.
4. B. N. Figgis,( 1976), Introduction to Ligand Fields, Wiley Eastern Ltd.
5. T. K Lindhorst,( 2007), Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH,North America.
6. John Dyer, R. (2010).*Application of Absorption Spectroscopy of Organic Compounds.*New Delhi: PHI Learning Pvt. Ltd, 1stEdition .
7. Robert Silverstein, M. & Francis Webster, X. (2004). *Spectrometric Identification Organic Compounds.* New Jersey: John Wiley & Sons, Inc., 6th Edition.

**Website e Resources**

1. https://www.adda247.com/teaching-jobs-exam/csir-net-chemical-science-syllabus/?srsltid=AfmBOoqPnxRC3sbC2POxbxCaG5oXUCQS4zlcSwdD83AEdHyoSwzhh8Ib
2. https://www.adda247.com/teaching-jobs-exam/csir-net-chemical-science-syllabus/?srsltid=AfmBOoqPnxRC3sbC2POxbxCaG5oXUCQS4zlcSwdD83AEdHyoSwzhh8Ib
3. https://www.adda247.com/teaching-jobs-exam/csir-net-chemical-science-syllabus/?srsltid=AfmBOoqPnxRC3sbC2POxbxCaG5oXUCQS4zlcSwdD83AEdHyoSwzhh8Ib

| Course Code **24PCHS41** | PO1 | | PO2 | PO3 | | PO4 | PO5 | PO6 | PO7 | PO8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | PSO 1.a | PSO 1.b | PSO 2 | PSO 3.a | PSO 3.b | PSO 4 | PSO 5 | PSO 6 | PSO 7 | PSO 8 |
| CO 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO 5 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |

**3 – Strong, 2 – Medium, 1 – Low**

Dr.J.Kavitha

Dr. J. Kavitha
**Head of the Department**

Dr.N. Ramila Devi
**Course Designers**