



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN
 (Belonging to Virudhunagar Hindu Nadars)
 An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
 Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

REGULATIONS AND SYLLABUS (with effect from Academic Year 2023 - 2024)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes(Aided), 14 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 (TANSCHHE) 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, 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, Zoology, Biochemistry, Home Science - Nutrition and Dietetics, Computer Science, and Computer Applications (MCA) *
- Commerce & Management : Commerce, Business Administration (MBA) *
- * AICTE approved Programmes

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

1. Core Courses
2. Discipline Specific Elective Courses (DSEC)
3. Elective Courses
4. Skill Enhancement Courses (SEC)
5. Non Major Elective Courses (NMEC)
6. Ability Enhancement Compulsory Courses (AECC)
7. Generic Elective Courses (GEC)
8. Self Study Courses
9. Extra Credit Courses (Self Study Courses) (Optional)

List of Non Major Elective Courses (NME)**(2023-2024 onwards)****UG PROGRAMMES**

| Name of the Course | Course Code | Semester | Department |
|--------------------------------------|-------------|----------|------------------|
| Introduction to Tourism | 23UHIN11 | I | History(EM) |
| Indian Constitution | 23UHIN21 | II | History(EM) |
| சுற்றுலா ஓர் அறிமுகம் | 23UHIN11 | I | History (TM) |
| இந்திய அரசியலமைப்பு | 23UHIN21 | II | History(TM) |
| Popular Literature and Culture | 23UENN11 | I | English |
| English for Professions | 23UENN21 | II | |
| பேச்சுக்கலைத்திறன் | 23UTAN11 | I | Tamil |
| பயன்முறைத் தமிழ் | 23UTAN21 | II | |
| Practical Banking | 23UCON11 | I | Commerce (Aided) |
| Basic Accounting Principles | 23UCON22 | II | |
| Financial Literacy-I | 23UCON12 | I | Commerce (SF) |
| Financial Literacy -II | 23UCON21 | II | |
| Self-Employment and Startup Business | 23UCCN11 | I | Commerce CA (SF) |
| Fundamentals of Marketing | 23UCCN21 | II | |
| Women Protection Laws | 23UCPN11 | I | |

| | | | |
|---|----------|----|--|
| Basic Labour Laws | 23UCPN21 | II | Commerce (Professional Accounting) |
| Basics of Event Management | 23UBAN11 | I | Business Administration |
| Business Management | 23UBAN21 | II | |
| Quantitative Aptitude I | 23UMTN11 | I | Mathematics |
| Quantitative Aptitude II | 23UMTN21 | II | |
| Physics for Everyday life -I | 23UPHN11 | I | Physics |
| Physics for Everyday life -II | 23UPHN21 | II | |
| Food Chemistry | 23UCHN11 | I | Chemistry |
| Drugs and Natural Products | 23UCHN21 | II | |
| Ornamental fish farming and Management | 23UZYN11 | I | Zoology |
| Biocomposting for Entrepreneurship | 23UZYN21 | II | |
| Foundations of Baking and Confectionery | 23UHSN11 | I | Home Science – Nutrition and Dietetics |
| Basic Nutrition and Dietetics | 23UHSN21 | II | |
| Nutrition and Health | 23UBCN11 | I | Biochemistry |
| Life Style Diseases | 23UBCN21 | II | |
| Social and Preventive Medicine | 23UMBN11 | I | Microbiology |
| Nutrition & Health Hygiene | 23UMBN21 | II | |
| Herbal Medicine | 23UBON11 | I | Biotechnology |
| Organic farming and Health Management | 23UBON21 | II | |
| Basics of Fashion | 23UCFN11 | I | Costume Design And Fashion |
| Interior Designing | 23UCFN21 | II | |
| Office Automation | 23UCSN11 | I | Computer Science |
| Introduction to Internet and HTML 5 | 23UCSN21 | II | |
| Office Automation | 23UITN11 | I | Information Technology |
| Introduction to HTML | 23UITN21 | II | |
| Introduction to HTML | 23UCAN11 | I | Computer Applications |
| Fundamentals of Computers | 23UCAN21 | II | |
| Introduction to HTML | 23UGDN11 | I | Computer Applications - Graphic Design |
| Fundamentals of Computers | 23UGDN21 | II | |
| Organic Farming | 23UBYN11 | I | Botany |
| Nursery and Landscaping | 23UBYN12 | | |
| Mushroom Cultivation | 23UBYN21 | II | |
| Medicinal Botany | 23UBYN22 | | |
| Cadet Corps for Career Development I | 23UNCN11 | I | National Cadet Corps |
| Cadet Corps for Career Development II | 23UNCN21 | II | |

**List of Ability Enhancement Compulsory Courses (AECC) &
Generic Elective Courses (GEC) Offered**

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

1. Value Education
2. Environmental Studies

GENERIC ELECTIVE COURSES 1

1. Human Rights
2. Women Studies

GENERIC ELECTIVE COURSES2

1. Constitution of India
2. Modern Economics
3. Adolescent Psychology
4. Disaster Management

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 the curriculum based on the learning outcomes, upgrade of academic resources, quality enhancement in research and integration of technology in the teaching –learning process. It also 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 channelize their teaching methodologies and evaluation strategies to attain the 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 womenfolk 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 Chemistry

To empower rural young women through quality education in the field of chemical sciences with both theoretical and technical knowledge to pursue higher education to fulfill the regional, national and global demands.

Mission of the Department of Chemistry

- Offering learners deep knowledge in the theoretical and practical chemistry for their profession development.
- Developing research aptitude and personality.
- Facilitating learners to recognize the applications of chemistry in everyday life to progress as entrepreneurs.
- Inculcating social awareness and responsibility.

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.

The Programme Educational Objectives of B.Sc., Chemistry programme

The students will be able to

- To pursue further studies and succeed in academic and research Careers.
- To have opportunities to get employment at local and national level and to work as a teacher, analyst, quality controller, research assistant and in government sector jobs.
- To provide solutions for social issues such as environmental protection, occupational health and safety resource management and appropriate business skills.

| Key components of the mission statement | PEO 1 | PEO 2 | PEO 3 |
|---|-------|-------|-------|
| Deep knowledge in theoretical and practical chemistry | ✓ | ✓ | ✓ |
| Profession development | ✓ | ✓ | ✓ |
| Research aptitude and personality | ✓ | ✓ | - |
| Applications of chemistry in everyday life to progress as entrepreneurs | - | ✓ | ✓ |
| Social awareness and responsibility | - | ✓ | ✓ |

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 effectively the acquired knowledge and skill in the field of Arts, Physical Science, Life Science, Computer Science, Commerce and Management for higher studies and employment. (*Disciplinary Knowledge*)
- 2 articulate innovative thoughts and ideas proficiently in both in spoken and written forms. (*Communication Skills*)
- 3 identify, formulate and solve problems in real life situations scientifically / systematically by adapting updated skills in using modern tools and techniques. (*Scientific Reasoning and Problem Solving*)
- 4 critically analyse, synthesize and evaluate data, theories and ideas to provide valid suggestions through assignments, case studies, Internship and projects for the fulfillment of the local, national and global developmental needs. (*Critical Thinking and Analytical Reasoning*)
- 5 use ICT in a variety of self-directed lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning*)
- 6 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*)
- 7 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

B.1.3 Programme Specific Outcomes (PSOs)

Based on the Programme Outcomes, Programme Specific Outcomes are framed for each UG Programme. Programme Specific Outcomes denote what the students would be able to do at the time of graduation. They are Programme specific. It is mandatory that each PO should be mapped to the respective PSO.

On completion of B.Sc. Chemistry Programme, the students will be able to**PO1-Disciplinary Knowledge**

PSO 1.a: Apply the gained advanced knowledge in inorganic, organic and physical chemistry and related courses to pursue higher studies and employment.

PSO 1.b: Apply the good laboratory practices in core and related courses by appropriate experimental methods and safety measures and thereby updating their knowledge and skills to become successful entrepreneurs.

PO2-Communication Skills

PSO 2.a: Develop the confidence to articulate the basic concepts in chemistry in a clear and concise manner to fetch employment.

PSO 2b: Develop competence to draw complex chemical structures and to execute and report the results of an experiment in a systematic way.

PO3 -Scientific Reasoning and Problem Solving

PSO 3.a: Identify chemical formulae and analyse food, water and oil samples qualitatively and quantitatively by adapting updated skills in using modern tools and techniques for research activities..

PSO 3.b: Characterize the compounds extracted from natural sources by applying the basic principles of various chemical methods for recent research.

PO4 -Critical thinking and Analytical Reasoning

PSO 4.a: Critically analyze the concepts, theories and equations in various divisions of chemistry and perceive their significance in chemical industries and to conserve the environment in daily life.

PSO 4.b: Apply the integrated knowledge of different sections of chemistry and associated courses to create startup and thereby developing their research towards the development of new products.

PO5 -Digital Literacy, Self - directed and Lifelong learning

PSO 5.a: Acquire the ability to engage in independent and life-long learning trained at personal/career development concerning to their area of interest using contemporary digital tools to face the alteration of personal and social circumstances.

PSO 5.b: Exhibit excellence in industrial pursuits that contribute towards the holistic development of self and community

PO6 -Cooperation/Team Work and Multi-Cultural Competence

PSO 6: Promote self management in efficient functioning of an individual as an exemplary in representing and solving the current issues in a multicultural society for good nation building through their internship, group practical, co-curricular, extra curricular and extension activities.

PO7- Moral and Ethical awareness

PSO 7: Adapt the universal ethics and morals of chemical acts and practice the imbibed moral principles in their career and humanity to accomplish a green environment.

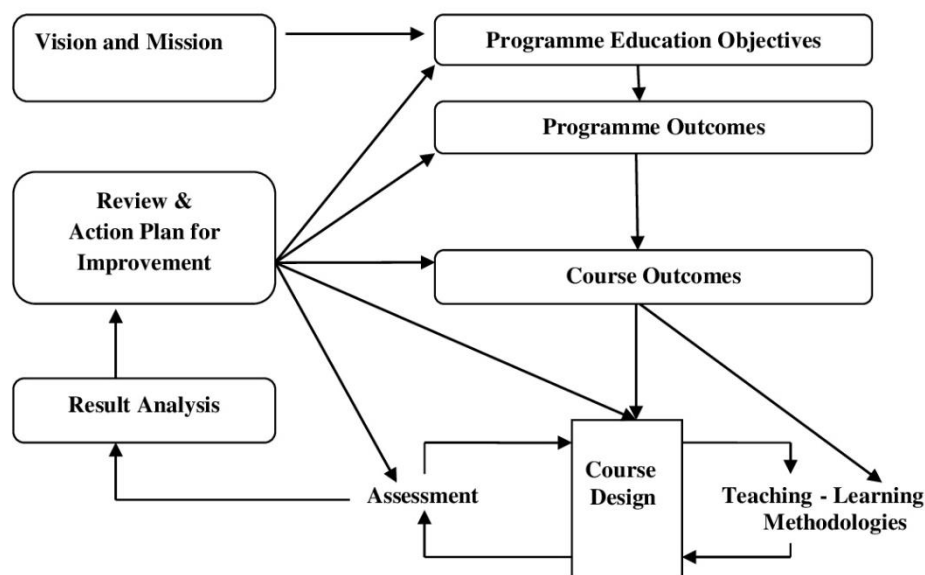
PO-PEO Mapping Matrix

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.a | - | ✓ | ✓ |
| PO1/PSO1.b | ✓ | ✓ | ✓ |
| PO2/PSO2.a | ✓ | ✓ | - |
| PO2/PSO2.b | ✓ | ✓ | - |
| PO3/PSO3 | - | ✓ | ✓ |
| PO4/PSO4.a | - | ✓ | ✓ |
| PO4/PSO4.b | ✓ | ✓ | - |
| PO5/PSO5 | ✓ | ✓ | - |
| PO6/PSO6 | - | ✓ | ✓ |
| PO7/PSO7 | - | - | ✓ |

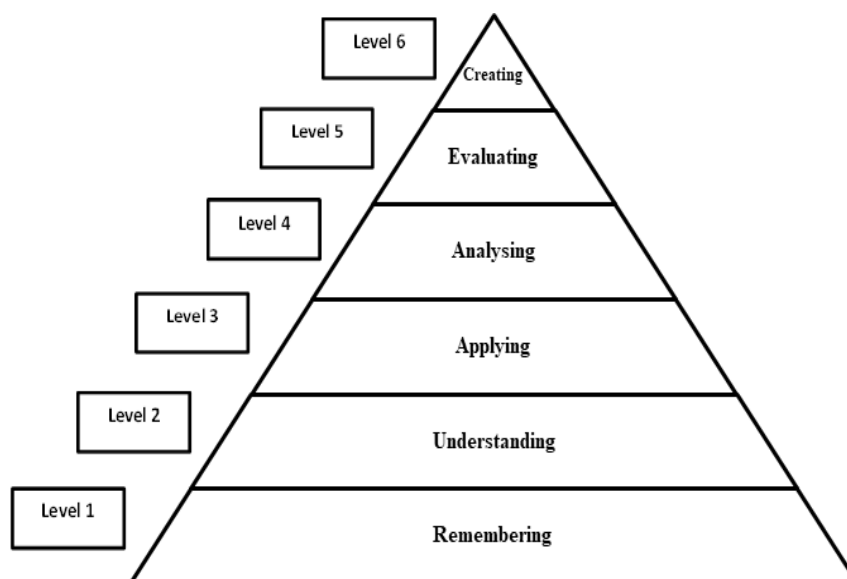
B.1.4 Course Outcomes (COs)

Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the 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 COs.



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 | PO1/ PSO1 | PO2/ PSO2 | PO3/ PSO3 | PO4/ PSO4 | PO5/ PSO5 | PO6/ PSO6 | PO7/ PSO7 |
|---------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| CO1 | | | | | | | |
| CO2 | | | | | | | |
| CO3 | | | | | | | |
| CO4 | | | | | | | |
| CO5 | | | | | | | |

ELIGIBILITY FOR ADMISSION

The candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Tamil Nadu or any other equivalent examination accepted by the Academic Council with Mathematics/Botany as one of the subjects in Higher Secondary Course.

DURATION OF THE PROGRAMME

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

MEDIUM OF INSTRUCTION

English

COURSES OFFERED

| | | |
|----------|---|--|
| Part I | : | Tamil/Hindi/Alternate Course |
| Part II | : | English |
| Part III | : | Core Courses |
| | : | Elective Courses |
| | : | Elective Courses: Discipline Specific Elective Courses |
| | : | Self Study Course |
| Part IV | : | Skill Enhancement Courses (SEC) |
| | : | Field Project/Internship |
| | : | Non-Major Elective Courses (NMEC) |
| | : | Ability Enhancement Compulsory Courses (AECC) |
| | : | Generic Elective Courses (GEC) |
| Part V | : | Self Study Course |
| | : | National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Club / Health and Fitness Club and National Cadet Corps/ Rotaract club |

B.2 EVALUATION SCHEME

B.2.1.PART II

| Components | Internal Assessment Marks | Summative Examination Marks | Total Marks |
|------------|---------------------------|-----------------------------|-------------|
| Theory | 15 | 75 | 100 |
| Practical | 5+5 | - | |

INTERNAL ASSESSMENT**Distribution of Marks**

| Mode of Evaluation | Marks |
|--------------------|-------------|
| Periodic Test | : 15 |
| Practical | : 5+5 |
| Total | : 25 |

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

B.2.2.Part I & PART III - Core Courses, Discipline Specific Elective Courses & Elective Courses

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

INTERNAL ASSESSMENT**Distribution of Marks****Theory**

| Mode of Evaluation | Marks |
|--------------------|--------------|
| Internal Test | : 15 |
| Assignment | K3 Level : 5 |
| Quiz | K2 Level : 5 |
| Total | : 25 |

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

| Mode of Evaluation | | Marks |
|----------------------|---|-----------|
| Internal Test | : | 30 |
| Record & Performance | : | 10 |
| Total | | 40 |

Internal Test - Average of the best two will be considered

Question Pattern for Internal Tests**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 - 4 | Multiple Choice | 4 | 4 | 1 | 4 |
| B | 5 -6 | Internal Choice - Either ... or Type | 3 | 3 | 7 | 21 |
| C | 8 -9 | Internal Choice - Either... or Type | 2 | 2 | 10 | 20 |
| | | | | | Total | 45* |

*The total marks obtained in the Internal Test will be calculated for 15 marks

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 -10 | Multiple Choice | 10 | 10 | 1 | 10 |
| B | 11 - 15 | Internal Choice – Either ...or Type | 5 | 5 | 7 | 35 |
| C | 16 - 18 | Internal Choice –Either... or Type | 3 | 3 | 10 | 30 |
| | | | | | Total | 75 |

B.2.3 PART IV - Skill Enhancement Courses, Non Major Elective Courses and Foundation Course

INTERNAL ASSESSMENT

Distribution of Marks

Theory

| Mode of Evaluation | | Marks |
|--------------------|------------|-----------|
| Internal Test | : | 15 |
| Assignment | K2 Level : | 5 |
| Quiz | K2 Level : | 5 |
| Total | | 25 |

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests

Duration: 1 Hour

| Section | Question No. | Types of Question | No. of Questions | No. of Questions to be answered | Marks for each Question | Total Marks |
|---------|--------------|-------------------------------------|------------------|---------------------------------|-------------------------|-------------|
| A | 1 - 3 | Internal Choice - Either... or Type | 3 | 3 | 5 | 15 |
| B | 4 | Internal Choice – Either ...or Type | 1 | 1 | 10 | 10 |
| | | | | | Total | 25 |

Summative Examination

| Mode of Evaluation | Marks |
|--------------------------------------|-------------|
| Summative Examination | : 50 |
| Multiple Choice Questions (K2 Level) | : 25 |
| Total | : 75 |

Question Pattern**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 | Internal Choice - Either... or Type | 5 | 5 | 6 | 30 |
| B | 6 - 7 | Internal Choice – Either... or Type | 2 | 2 | 10 | 20 |
| | | | | | Total | 50 |

B.2.6 Part V – Extension Activities

Assessment by Internal examiner only

Distribution of Marks

| Mode of Evaluation | Marks |
|--|--------------|
| Attendance | : 5 |
| Performance | : 10 |
| Report/Assignment/Project/Camp/Practical | : 10 |
| Total | : 25* |

*The marks obtained will be calculated for 100 marks

ELIGIBILITY FOR THE DEGREE

The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.

Attendance, progress and conduct certification from the Head of the Institution will be required for the students to write the examination.

- No Pass minimum for Internal Assessment.
- Pass minimum for External Examination is 27 marks out of 75 for Core Courses, Discipline Specific Elective Courses and Allied Courses.
- Pass minimum for External Examination is 21 marks out of 60 for Skill Enhancement Courses and Non Major Elective Courses.
- The aggregate minimum pass percentage is 40
- Pass minimum for External Practical Examination is 21 marks out of 60 marks.
- Pass minimum for Ability Enhancement Compulsory Course and Generic Elective Course is 40 marks.
- Pass minimum for Self Study Courses is 40.

ATTENDANCE

- For UG, PG Programmes,
 - (a) The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
 - (b) The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
 - (c) 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.
 - (d) 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.
- These rules are applicable to UG, PG and M.Phil. Programmes and come into effect from 2020-2021 onwards.
- 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 average mark 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 / Extracurricular activities 15% | For participation in Co-curricular / Extracurricular 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 and
Extracurricular Activities)**

Expected Level of Attainment for each of the Programme Outcomes

| POs | Level of Attainment |
|---------------------------------------|---------------------|
| Attainment Value $\geq 70\%$ | Excellent |
| $60\% \leq$ Attainment Value $< 70\%$ | Very Good |
| $50\% \leq$ Attainment Value $< 60\%$ | Good |
| $40\% \leq$ Attainment Value $< 50\%$ | Satisfactory |
| Attainment Value $< 40\%$ | Not Satisfactory |

Level of PO attainment

| Graduation Batch | Overall PO Attainment (in percentage) | Whether expected level of PO 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 5 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 $\geq 70\%$ | Excellent |
| $60\% \leq$ Attainment Value $< 70\%$ | Very Good |
| $50\% \leq$ Attainment Value $< 60\%$ | Good |
| $40\% \leq$ 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 PROGRAMME 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 analyzed 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 B.Sc. Chemistry Programme.



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VIRUDHUNAGAR - 626 001

BACHELOR OF SCIENCE CHEMISTRY (2017)

Outcome Based Education with Choice Based Credit System

Programme Structure - Allotment of Hours and Credits

For those who join in the Academic Year 2023-2024

| Components | Semester | | | | | | Total Number of Hours (Credits) |
|---|-------------------|-------------------|----------------|----------------|----------------|----------------|---------------------------------|
| | I | II | III | IV | V | VI | |
| Part I : Tamil /Hindi | 6 (3) | 6 (3) | 6 (3) | 6 (3) | - | - | 24 (12) |
| Part II : English | 6 (3) | 6(3) | 6 (3) | 6 (3) | - | - | 24 (12) |
| Part III : Core Courses, Discipline Specific Elective Courses, Allied Courses & Self Study Course | | | | | | | |
| Core Course | 5 (5) | 5(5) | 5 (5) | 4 (4) | 5 (5) | 5 (5) | 29 (29) |
| Core Course | - | - | - | - | 5 (4) | 5 (5) | 10 (9) |
| Core Course | - | - | - | - | 4 (4) | 5(4) | 9(8) |
| Core Course Practical | 3(2) | 3(2) | 3 (2) | 3 (2) | 3 (2) | 3 (2) | 18(12) |
| Core Course Project | - | - | - | - | 1 (1) | - | 1 (1) |
| DSEC | - | - | - | - | 5(4) | 5 (4) | 10 (8) |
| DSEC Practical | - | - | - | - | 3(2) | 3(2) | 6(4) |
| Elective Course I / | 6(4)/ | 3 (2) & 3 (2) / | - | - | - | - | 12(8) / |
| Elective Course I | 4 (4) | 4 (3) | - | - | - | - | 8(7) |
| Elective Course Practical I | 2 (0) | 2 (1) | - | - | - | - | 4(1) |
| Elective Course II | - | - | 4 (3) | 4 (3) | - | - | 8(6) |
| Elective Course II Practical II | - | - | 2 (1) | 2 (1) | - | - | 4(2) |
| Self Study Course | - | - | - | - | - | 0 (1) | 0 (1) |
| Part IV : Skill Enhancement Courses, Non Major Elective Courses, Ability Enhancement Compulsory Courses, Generic Elective Courses, Self Study Course & Internship/ Field Project | | | | | | | |
| SEC | 2 (2) | - | 1 (1) | - | - | - | 3 (3) |
| SEC | - | 2 (2) | 2 (2) | 2 (2) | 2 (2) | 2 (2) | 10 (10) |
| SEC | - | - | - | - | - | 2 (2) | 2 (2) |
| Non Major Elective Course | 2 (2) | 2 (2) | - | - | - | - | 4 (4) |
| AECC - Value Education | - | - | - | - | 2 (2) | - | 2 (2) |
| AECC - Environmental Studies | - | - | - | 2 (2) | - | - | 2 (2) |
| GEC -1 | - | - | 1 (1) | - | - | - | 1 (1) |
| GEC -2 | - | - | - | 1 (1) | - | - | 1 (1) |
| Self Study Course | - | - | - | - | 0 (1) | - | 0 (1) |
| Internship/ Field Project | - | - | - | 0 (1) | - | - | 0 (1) |
| Part V : Extension Activities | - | - | - | 0 (1) | - | - | 0 (1) |
| Total | 30 (21/21) | 30 (21/21) | 30 (21) | 30 (23) | 30 (27) | 30 (27) | 180 (140) |
| Extra Credit Course (Self Study Course) | - | - | - | - | 0(2) | - | 0(2) |

DSEC: Discipline Specific Elective Course; SEC- Skill Enhancement Course.

AECC- Ability Enhancement Compulsory Courses; GEC- Generic Elective Courses



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B.Sc. Chemistry-2017

Semester- I

2023-2024 onwards

| S. No. | Components | Title of the Course | Course Code | Hours Per Week | Credits | Exam . Hours | Marks | | | |
|--------------|-----------------|-------------------------------|---|--|----------------|----------------|------------|-------------|-------------|--------------|
| | | | | | | | Int . | Ext. | Total | |
| 1. | Part I | Tamil/Hindi | 23UTAG11/ 23UHDG11 | 6 | 3 | 3 | 25 | 75 | 100 | |
| 2. | Part II | English | 23UENG11 | 6 | 3 | 3 | 25 | 75 | 100 | |
| 3. | Part III | Core Course -1 | General Chemistry-I | 23UCHC11 | 5 | 5 | 3 | 25 | 75 | 100 |
| 4. | | Core Course -2 Practical I | Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations Practical | 23UCHC11P | 3 | 2 | 3 | 40 | 60 | 100 |
| 5. | | Elective Course -I | Allied Mathematics - I / Allied Botany I Allied Botany Practical-I | 23UMTA11/ 23UBYA11 23UBYA21P | 6 / 4 2 | 4 / 4 - | 3 - | 25 - | 75 - | 100 - |
| 6. | Part IV | NME-1 | Food Chemistry | 23UCHN11 | 2 | 2 | 3 | 25 | 75 | 100 |
| 7. | | SEC- 1 Foundation Course | Fundamental Concepts and Laboratory Practices in Chemistry | 23UCHF11 | 2 | 2 | 3 | 25 | 75 | 100 |
| Total | | | | 30 | 21 / 21 | | | | 700 | |

B. Sc. CHEMISTRY
(2023 -2024 Onwards)
Semester- II

| S. No | Components | Title of the Course | Course Code | Hours Per Week | Credits | Exam. Hours | Marks | | | |
|--------------|--------------------------------------|---|--|----------------|----------------|-------------|----------|----------|------------|-----|
| | | | | | | | Int. | Ext. | Total | |
| 1. | Part I | Tamil/Hindi | 23UTAG21/ 23UHDG21 | 6 | 3 | 3 | 25 | 75 | 100 | |
| 2. | Part II | English | 23UENG21 | 6 | 3 | 3 | 25 | 75 | 100 | |
| 3. | Part III | Core Course -3 | General Chemistry–II | 23UCHC21 | 5 | 5 | 3 | 25 | 75 | 100 |
| 4. | | Core Course -4 Practical II | Qualitative Organic Analysis and Preparation of Organic Compounds Practical | 23UCHC21P | 3 | 2 | 3 | 40 | 60 | 100 |
| 5. | | Elective Course -I | Mathematical Foundations | 23UMTA21 | 3 | 2 | 3 | 25 | 75 | 100 |
| | Statistics and Operations Research / | | 23UMTA22/ | 3 / | 2 / | 3 | 25 | 75 | 100/ | |
| 6. | | Allied Botany II Allied Botany Practical I | 23UBYA21 23UBYA21P | 4 2 | 3 1 | 3 3 | 25 40 | 75 60 | 100 100 | |
| 7. | Part IV | NME-2 | Drugs and Natural Products | 23UCHN21 | 2 | 2 | 3 | 25 | 75 | 100 |
| 8 | | SEC- 2 | Polymer Chemistry | 23UCHS21 | 2 | 2 | 3 | 25 | 75 | 100 |
| Total | | | | 30 | 21 / 21 | | | | 800 | |



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B.Sc. CHEMISTRY (2023 -2024 onwards)

| | | | |
|--------------------------------|----------------------------|----------------|----------------|
| Semester I | GENERAL CHEMISTRY-I | Hours/Week: 5 | |
| Core Course-1 | | Credits: 5 | |
| Course Code 23UCHC11 | | Internal 25 | External 75 |

COURSE OUTCOME

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

- CO1** : explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds. [K1]
- CO2** : classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents. [K2]
- CO3** : illustrate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects. [K2]
- CO4** : apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx , Δp electronegativity, bond order [K3]
- CO5** : construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms. [K3]

UNIT I

Atomic structure and Periodic trends

History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength- Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle; Numerical problems involving the core concepts. **(12 Hour)**

Unit II**Introduction to Quantum mechanics**

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2 .

Modern Periodic Table

Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity- electronegativity scales, applications of electronegativity.

(15 Hours)**UNIT-III: Covalent and Ionic bonding**

a) Covalent bond - VB approach – types of overlapping – sigma and pi bonds- principles of hybridization- sp, sp^2, sp^3, sp^3d and sp^3d^2 hybridisation with an example. VSEPR theory –simple Inorganic molecules [$BeCl_2, BF_3, CH_4, PCl_5, NH_3, \& H_2O$]. MO Theory – Bonding and Antibonding Orbitals – Application of MO Theory to H_2, He_2, N_2, CO – Comparison of VB and MO Theories.

b) Ionic bond : Lattice energy of NaCl – Born Haber Cycle **(15 Hours)**

UNIT-IV: Metallic bonding & Metallurgy

a) Metallic bond- nature -explanation of properties of metallic bond- conditions for the formation of the metallic bond – Hydrogen bond - types of hydrogen bond –effects of hydrogen bonding – van der Waals forces – types – factors affecting the strength of van der Waals forces –applications.

b) Metallurgy :

i) Occurrence of metals – concentration of ores – froth-floatation process, magnetic separation, calcination, roasting, smelting – flux - slag- purification of metals –Electrolytic refining- Zone refining –Van Arkel–de Boer process

ii) Important ores and extraction of the following metals – Ti, U and V

- iii) Preparation and uses of some important compounds - titanium oxide, uranium hexafluoride and vanadium pentoxide. **(15 Hours)**

UNIT-V:**Electronic effects , Reaction intermediates and aliphatic hydrocarbons**

- a) Electron displacement effects: Inductive effect, mesomeric and electromeric effect, resonance – steric inhibition of resonance and hyper conjugative effect.
- b) Cleavage of bonds : Homolytic and Heterolytic cleavage - reaction intermediates- carbocations, carbanions, free radicals – Formation, structure and their stability- Electrophilic and Nucleophilic reagents-types of organic reactions (elementary idea only).
- c) Alkanes: Cracking and pyrolysis.
- d) Alkenes: Preparation by dehydrohalogenation of alkyl bromides–
Electrophilic addition reactions– Markownikoff's rule–peroxide effect.
- e) Alkynes: Acidity of acetylene. **(18 Hours)**

Text Books

1. Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry*, 38thed.; Vishal Publishing Company: Jalandhar, 2002.
2. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi, 2016
3. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003
4. Arun Bahl & Bahl, B.S.(2009). *Advanced Organic Chemistry* .19th edition. New Delhi: S.Chand & Company Ltd.
5. Tewari, K.S. & Vishnoi, N.K.(2006). *A Text book of Organic Chemistry*. 2nd edition. New Delhi: Vikas Publishing House Pvt. Ltd.

Reference Book

1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*, 4thed.; The Macmillan Company: Newyork,1972.
2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS WilliamHeinemann: London,1991.
3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 26thed.; Goel PublishingHouse: Meerut, 2001.
4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford UniversityPress: New York, 2014.
5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed .; Addison, Wesley Publishing Company: India,1993.
6. Finar, I.L. Volume I.(2003).*Organic Chemistry*. 6thedition.Singapore: Pearson Education Pvt. Ltd.

| Course Code 23UCHC11 | PO1 | | PO2 | | PO3 | | PO4 | | PO5 | | PO6 | PO7 |
|-------------------------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO |
| | 1.a | 1. b | 2.a | 2.b | 3a | 3.b | 4a | 4b | 5.a | 5.b | 6 | 7 |
| CO1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | - | 1 |
| CO2 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | - | 1 |
| CO3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | - | 1 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | | 2 | 3 | - | 1 |
| CO5 | 2 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | - | 1 |

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Head of the Department

Mrs.A.Prasanna
Course Designer



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B.Sc. CHEMISTRY

(2023 -2024 onwards)

| | | | |
|--------------------------------|--|----------------|----------------|
| Semester I | QUANTITATIVE INORGANIC ESTIMATION (TITRIMETRY) AND INORGANIC PREPARATIONS PRACTICAL | Hours/Week: 3 | |
| Core Course-2 Practical I | | Credits: 2 | |
| CourseCode 23UCHC11P | | Internal 40 | External 60 |

COURSE OUTCOME

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

- CO1** : explain the basic principles involved in titrimetric analysis and inorganic preparations.[K2]
- CO2** : compare the methodologies of different titrimetric analysis.[K2]
- CO3** : calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.[K3]
- CO4** : determine the yield of different inorganic preparations and identify the end point of various titrations. [K3]
- CO5** : apply the principle and procedure involved in titrimetric analysis to estimate the amount of unknown compound in the given solution. [K3]

LIST OF EXPERIMENTS

I. ACIDIMETRY AND ALKALIMETRY

1. Estimation of Na_2CO_3
2. Estimation of NaOH / KOH
3. Estimation of oxalic acid.

II. REDOX TITRATIONS

a) Permanganometry

1. Estimation of ferrous ion

2. Estimation of oxalic acid

b)Dichrometry

Estimation of ferrous ion using external indicator

III. IODOMETRY AND IODIMETRY

1. Estimation of potassium dichromate
2. Estimation of potassium permanganate
3. Estimation of copper
4. Estimation of arsenious oxide.

IV. Preparation of Inorganic compounds (Group Practicals)

Tetraammine copper (II) sulphate, Mohr's Salt

Text Book

1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.
2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; An advanced course in Practical Chemistry, 3rd ed.; New Central Book Agency: Kolkata, 2007.

Reference Books

1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook of Quantitative Chemical Analysis, 6th ed.; Pearson Education Ltd: New Delhi, 2000.

| Course Code 23UCHC11P | PO1 | | PO2 | | P O 3 | | P O 4 | | PO5 | | PO 6 | PO 7 |
|--------------------------|------|------|-----|-----|-------------|------|-------------|------|-----|-----|---------|---------|
| | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO |
| | 1. a | 1. b | 2.a | 2.b | 3. a | 3. b | 4 .a | 4. b | 5.a | 5.b | 6 | 7 |
| CO1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 |
| CO2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO3 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 |

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B.Sc. CHEMISTRY

(2023-24 onwards)

| | | | |
|-------------------|-----------------------------|--------------|----------|
| Semester I | ALLIED MATHEMATICS-I | Hours/Week:6 | |
| Elective Course-I | | Credits:4 | |
| Course Code | | Internal | External |
| 23UMTA11 | | 25 | 75 |

COURSE OUTCOMES

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

CO1: retrieve the fundamental concepts, techniques in Calculus, Algebra and Numerical Methods.

[K1]

CO2: explain curvature of a curve, method of solving algebraic, transcendental and simultaneous equations. [K2]

CO3: find the eigen values and eigen vectors of a given matrix and evaluate double and triple integrals. [K2]

CO4: apply the knowledge gained in Calculus and Algebra to other fields. [K3]

CO5: use appropriate method to solve algebraic, transcendental and simultaneous equations. [K3]

UNIT I

The Solution of Numerical Algebraic and Transcendental Equations

The Bisection method - Iteration method – Regula Falsi method – Newton Raphson method – Horner's method (without proof) (Simple problems only) (18 hours)

UNIT II

Solution of Simultaneous Linear Algebraic Equations

Introduction - Gauss Elimination method – Gauss Jordan method – Gauss Jacobi method - Gauss Seidel method of iteration – (Restricted to three variables only) (Simple problems only) (18 hours)

UNIT III

Matrices

Eigen Values and Eigen Vectors – Diagonalization of Matrices – Cayley – Hamilton Theorem
– Inverse of a Matrix

(18 hours)

UNIT IV

Differential Calculus

n^{th} derivatives – Leibnitz theorem (without proof) – Jacobian – Curvature and radius of curvature

(18 hours)

UNIT V

Ordinary Differential Equations

Linear equations with Constant coefficients

Partial Differential Equations

Formation of Partial Differential Equations – Solution of a Partial Differential Equation – Standard Forms

(18 hours)

TEXT BOOKS

1. P.Kandasamy, K.Thilagavathy, K.Gunavathy, Numerical Methods (2016), S.Chand & Company Ltd., New Delhi-55.
2. P.Duraipandian and Dr.S.Udayabaskaran, Allied Mathematics Volume I (2014), S.Chand & Company Ltd., New Delhi-55.
3. P.Duraipandian and Dr.S.Udayabaskaran, Allied Mathematics Volume II (2014), S.Chand & Company Ltd., New Delhi-55.

| Unit | Chapter | Section |
|--------------------|---------|---------------------------|
| Text Book 1 | | |
| I | 3 | 3.1.1, 3.2, 3.3, 3.4, 3.5 |
| II | 4 | 4.1, 4.2, 4.8, 4.9 |
| Text Book 2 | | |
| III | 4 | 4.5, 4.5.1, 4.5.2, 4.5.3 |
| Text Book 3 | | |
| IV | 1 | 1.1.1, 1.1.2, 1.2, 1.4.3 |
| V | 5 | 5.2.1 |
| | 6 | 6.1, 6.2, 6.3 |

| Course Code 23UMTA11 | P O 1 | PO2 | P O 3 | PO4 | PO5 | PO6 | PO7 |
|-------------------------|-------------|-----|-------------|-----|-----|-----|-----|
| CO1 | 3 | 2 | 3 | 2 | 1 | 2 | - |
| CO2 | 3 | 2 | 3 | 2 | 1 | 2 | - |
| CO3 | 2 | 2 | 3 | 2 | 1 | 2 | - |
| CO4 | 3 | 3 | 3 | 3 | 1 | 2 | - |
| CO5 | 3 | 2 | 3 | 2 | 1 | 3 | - |

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B.Sc. CHEMISTRY
2023-2024 onwards

| | | | |
|--------------------------------|------------------------|----------------|----------------|
| Semester I | ALLIED BOTANY I | Hours/Week: 4 | |
| Elective Course- I | | Credits: 4 | |
| Course Code 23UBYA11 | | Internal 25 | External 75 |

Course Outcomes:

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

CO1: Increase the awareness and appreciation of human friendly algae and their economic Importance. [K1]

CO2: Develop an understanding of microbes and fungi and appreciate their adaptive Strategies [K2]

CO3: Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms. [K2]

CO4: Interpret the structure and function of cells and explain the development of cells.[K3]

CO5: Implement the core concepts and fundamentals of plant biotechnology and genetic engineering. [K3]

UNIT I : Algae: General characters of algae - Structure, reproduction and life cycle of *Sargassum* and economic importance of algae. (10 Hours)

UNIT II: Fungi: General characters of fungi, structure, reproduction and life cycle of *Agaricus* and economic importance of fungi. (10 Hours)

UNIT III : Bryophytes, Pteridophytes and Gymnosperms:

General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*. (14 Hours)

UNIT IV: Cell Biology:

Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division – mitosis. (12 Hours)

UNIT V :Genetics and Plant Biotechnology:

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods and its application in biotechnology. (14 Hours)

TEXT BOOKS

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.

REFERENCE BOOKS

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

| Course code 23UBYA11 | PO1 | PO2 | PO 3 | PO4 | PO 5 | PO 6 | PO 7 |
|--------------------------------|-----|-----|------|-----|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |

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

Dr. B. Karunai Selvi
Head of the Department

Dr. B. Karunai Selvi
Course Designer



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. CHEMISTRY

(2023 -2024 onwards)

| | | | |
|-----------------|-----------------------|---------------|----------|
| Semester I | FOOD CHEMISTRY | Hours/Week: 2 | |
| NME-1 | | Credits: 2 | |
| CourseCode | | Internal | External |
| 23UCHN11 | | 25 | 75 |

COURSE OUTCOME

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

- CO1** : get an awareness about food adulteration and food poisons [K1].
- CO2** : outline about various food additives, beverages and edible oils [K1]
- CO3** : understand the food adulteration methods and the types of food poisons[K2]
- CO4** : get an exposure on food additives, artificial sweeteners, types of beverages and quality parameters of edible oils.[K2]
- CO5** : apply their knowledge to identify food adulterants, food poisons, analyse the advantage and disadvantage of food additives, prevent liver and social problems due to beverages and to determine iodine value, RM value, saponification values in edible oils. [K3]

UNIT I

Food Adulteration

Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques **(6 Hours)**

UNIT-II

Food Poison

Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims

(6 Hours)

UNIT-III

Food Additives

Food additives -artificial sweeteners – Saccharin - Cyclamate a n d AspartateFood flavours -esters, aldehydes and heterocyclic compounds – Food colours– Emulsifying agents – preservatives -leavening agents. Baking powder – yeast – taste makers – MSG - vinegar.

(6 Hours)

UNIT-IV

Beverages

Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol– diseases of liver and social problems.

(6 Hours)

UNIT-V

Edible Oils

Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.

(6 Hours)

Text Books

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house,2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. ChandCo. Publishers, second edition, 2006.

3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.

Reference Books

1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009.
2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.
3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.
4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.
5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

| Course Code | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-------------|-----|-----|-----|-----|-----|-----|-----|
| 23UCHN11 | | | | | | | |
| CO1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 |
| CO2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 |
| CO3 | 1 | 2 | 2 | 1 | 2 | 1 | 1 |
| CO4 | 1 | 1 | 1 | - | 1 | 1 | 1 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Dr.M.Dhanalakshmi
Heads of the Department

Dr.M.Amutha
Course Designer



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B.Sc. CHEMISTRY

(2023 -2024 onwards)

| | | | |
|-------------------------------|---|----------------|----------------|
| Semester I | Fundamental Concepts and Laboratory Practices in Chemistry | Hours/Week: 2 | |
| SEC- 1 Foundation Course | | Credits: 2 | |
| CourseCode 23UCHF11 | | Internal 25 | External 75 |

COURSE OUTCOME

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

- CO1** : know about fundamental concepts [K1]
CO2 : recall the first aid techniques [K1]
CO3 : explain the determination of empirical formula and molecular formula [K2]
CO4 : classify chemicals [K2]
CO5 : Understand appropriate purification techniques [K2]

UNIT I:

- i) Fundamental concepts- Symbol, Formula, Valency, equation-Laws of Chemical combination-kinds of chemical changes with examples. Equivalent weights of elements
 ii) Oxidation – reduction: Concepts of oxidation – reduction in terms of oxidation number – calculation of oxidation number – Balancing of redox equations by ion electron method (half reaction) – Reactions involving $\text{Cr}_2\text{O}_7^{2-} / \text{Fe}^{2+}$, $\text{MnO}_4^- / \text{Fe}^{2+}$ (in acid medium), $\text{CrO}_4^{2-} / \text{SO}_3^{2-}$ (in alkaline medium) **(6 Hours)**

UNIT II :

- i) Detection of elements-nitrogen, sulphur and halogens- Determination of molecular weight- Silver salt method, Platinichloride method – Determination of empirical formula and molecular formula.
 ii) Structural isomerism – Chain isomerism, position isomerism, functional isomerism and metamerism **(6 Hours)**

UNIT – III

Purification techniques of organic compounds – Crystallization- Sublimation – Distillation – Fractional Distillation – Distillation under reduced pressure- Steam distillation. Solvent Extraction

(6 Hours)

UNIT-IV

1. Laboratory chemicals and reagents- different grades- commercial, LR, GR, AR, Chromatographic pure and spectral pure.

2. Units of concentration of solution- Normality, molarity, molality, mole fraction, mass percentage and volume percentage- simple problems dealing with the preparation of reagents.

(6 Hours)

UNIT - V

General precautions for avoiding accidents - First –Aid techniques-Hazards in Laboratory- Poisoning- Treatment for specific poisons- Universal antidote- Laboratory safety measures.

(6 Hours)

Text Books

1. Satyaprakash, G.D.Tuli, Basu, Madan, Advanced Inorganic Chemistry, S.Chand Company Ltd, 1st Edition, 2011.
2. P.L.Soni & H.M.Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, 29th edition, 2007.
3. R.Gopalan, Elements of Analytical Chemistry, Sultan Chand & Sons, 3rd edition, 2003.
4. S.Balasubramanian and D.J.Sathianathan, Elements of Chemistry

Reference Books

1. Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2008. Addison-Wesley, Chemistry.
2. Raymond Chang, Chemistry, Tata McGraw.Mill Publishing Company Ltd, 2008

| Course Code 23UCHF11 | PO1 | | PO2 | | PO3 | | PO4 | | PO5 | | PO6 | PO7 |
|-------------------------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO |
| | 1.a | 1. b | 2a | 2b | 3a | 3.b | 4a | 4b | 5a | 5b | 6 | 7 |
| CO1 | 1 | 1 | 3 | 2 | 1 | 2 | L | M | 1 | 1 | - | 1 |
| CO2 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | - | 1 |
| CO3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | - | 1 |
| CO4 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 3 | 2 | 1 | - | 1 |
| CO5 | 2 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | - | 1 |

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B.Sc. CHEMISTRY (2023 -2024 Onwards)

| | | | |
|-----------------|-----------------------------|---------------|----------|
| Semester II | GENERAL CHEMISTRY-II | Hours/Week: 5 | |
| Core Course -3 | | Credits: 5 | |
| Course Code | | Internal | External |
| 23UCHC21 | | 25 | 75 |

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

- CO1** : explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons. [K1]
- CO2** : discuss the periodic properties of s and p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids. [K2]
- CO3** : classify hydrocarbons, types of reactions, acids and bases, examine the properties of s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons. [K2]
- CO4** : illustrate theories of acids, bases and indicators, buffer action and important compounds of s-block elements. [K3]
- CO5** : assess the application of hard and soft acids indicators, buffers, compounds of s and p- block elements and hydrocarbons. [K3]

UNIT-I

Acids, bases and Ionic equilibria

Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators;

Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-

Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts. **(15 Hours)**

Unit-II

Chemistry of s - block Elements

Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na₂CO₃, KBr, KClO₃ alkaline earth metals. Anomalous behaviour of Be.

Chemistry of p- block Elements (Group 13 & 14)

preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al.

comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates. **(15 Hours)**

UNIT-III

Chemistry of p- block Elements (Group 15-18)

General characteristics of elements of Group 15; chemistry of H₂N-NH₂, NH₂OH, HN₃ and HNO₃.

Chemistry of PH₃, PCl₃, PCl₅, POCl₃, P₂O₅ and oxy acids of phosphorous (H₃PO₃ and H₃PO₄).

General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO₄). Inter-halogen compounds (ICl, ClF₃, BrF₅ and IF₇), pseudo halogens [(CN)₂ and (SCN)₂] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of XeF₂, XeF₄, XeF₆ and XeOF₄; uses of noble gases – clathrate compounds. **(15 Hours)**

UNIT-IV**Hydrocarbon Chemistry-I**

Petroproducts: Fractional distillation of petroleum; isomerisation, alkylation, reforming and uses

Alkadienes

Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

Alkynes

Nomenclature; general methods of preparation, properties and reactions; polymerisation and isomerisation.

Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes. **(15 Hours)**

UNIT-V**Hydrocarbon Chemistry – II**

Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's $(4n+2)$ rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity.

Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at α/β - position – reduction, oxidation – uses.

Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.

(15 Hours)**Recommended Text**

1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded,

S.Chand and Company, New Delhi.

2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi.
3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi.
4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi.
5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.

Reference Books

1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork.
2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi.
3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS WilliamHeinemann, London.
4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure andReactivity, 4th ed., Addison Wesley Publishing Company, India.
5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed., Goel Publishing House, Meerut.
6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed., Goel Publishing House, Meerut

| Course Code | PO1 | | PO2 | | PO3 | | PO4 | | PO5 | | PO6 | PO7 |
|-------------|------------|------------|-------------|------------|------------|------------|------------|------------|------------|-------------|----------|----------|
| | PSO 1 a | PSO 1 b | PSO 2 a. | PSO 2b. | PSO 3 a | PSO 3 b | PSO 4 a | PSO 4 b | PSO 5.a | PSO 5.b. | PSO 6 | PSO 7 |
| 23UCHC21 | | | | | | | | | | | | |
| CO 1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| CO 3 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO 5 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |

Dr.M.Dhanalakshmi
Head of the Department

Dr.M.Amutha
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VIRUDHUNAGAR - 626 001

B.Sc. CHEMISTRY (2023 -2024 Onwards)

| | | | |
|---------------------------------|--|---------------|----------|
| Semester II | QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS PRACTICAL | Hours/Week: 3 | |
| Core Course-4 | | Credits: 2 | |
| Practical II | | Internal | External |
| Course Code 23UCHC21P | | 40 | 60 |

COURSE OUTCOME

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

- CO1** : observe the physical state, odour, colour and solubility of the given organic compound. [K2]
- CO2** : Classify the unknown organic compound by functional groups [K2]
- CO3** : identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis. [K3]
- CO4** : exhibit a solid derivative with respect to the identified functional group. [K3]
- CO5** : apply the techniques of the separation and isolation of organic compounds in their project and research work. [K3]

Qualitative Organic Analysis: Preliminary examination, detection of special elements - nitrogen, sulphur and halogens.

Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests.

Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ester

- carbohydrate (reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide

Preparation of derivatives for functional groups **(20 Hours)**

Preparation of Organic Compounds (15 Hours)

- i. Nitration : picric acid from Phenol
- ii. Halogenation : p-bromo acetanilide from acetanilide
- iii. Oxidation : benzoic acid from Benzaldehyde
- iv. Hydrolysis: benzamide to Benzoic Acid / Methyl benzoate to Benzoic acid
- v. Benzoylation: aniline to benzanilide / phenol to phenyl benzoate

Separation and Purification Techniques (Not for Examination) (10 Hours)

1. Purification of organic compounds by crystallization (from water /alcohol) and distillation
2. Determination of melting and boiling points of organic compounds.
3. Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves.
4. Chromatography (any one) (Group experiment)
 - (i) Separation of amino acids
 - (ii) Separation of KMnO_4 & $\text{K}_2\text{Cr}_2\text{O}_7$
 - (iii) Separation of lipids
 - (iv) Separation of carbohydrates

Recommended Text

1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012.
2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
3. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987.

4. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India, 1989.

| Course Code 23UCHC21P | PO1 | | PO2 | | PO3 | | PO4 | | PO5 | | PO6 | PO 7 |
|--------------------------|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|
| | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO | PSO |
| | 1.a | 1. b | 2.a | 2.b | 3a | 3.b | 4a | 4b | 5.a | 5.b | 6 | 7 |
| CO1 | 1 | 1 | 3 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | - | 3 |
| CO2 | 1 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | - | 3 |
| CO3 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | - | 3 |
| CO4 | 2 | 2 | 3 | 3 | 1 | 1 | 3 | 3 | 2 | 3 | - | 3 |
| CO5 | 2 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 3 | - | 3 |

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

Dr.M.Dhanalakshmi
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B.Sc. CHEMISTRY

(2023-24 onwards)

| | | | |
|--------------------------------|---------------------------------|----------------|----------------|
| Semester II | MATHEMATICAL FOUNDATIONS | Hours/Week:3 | |
| Elective Course-I | | Credits:2 | |
| Course Code 23UMTA21 | | Internal 25 | External 75 |

COURSE OUTCOMES

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

CO1: retrieve the basic concepts in differentiation, integration, algebraic equations and trigonometric functions. [K1]

CO2: explain the concepts in Algebra, Vector Calculus and Trigonometry. [K2]

CO3: find approximate solutions, establish the relation between roots and coefficients of an equation. [K2]

CO4: apply the concepts in Algebra and trigonometry in various fields. [K3]

CO5: apply the knowledge gained in Vector Calculus to solve problems in real life situations. [K3]

UNIT I

Vector Differentiation

Differentiation of Vectors – Gradient – Velocity and Acceleration – Divergence and Curl (Simple Theorems only) - Problems. (9 hours)

UNIT II

Vector Integration

Line integrals – Surface integrals – Theorems of Green, Gauss and Stoke's (Statements only) – Problems. (9 hours)

UNIT III

Algebra

Formation of Equations – Relation between roots and coefficients. (9 hours)

UNIT IV**Algebra Continued**

Transformation of Equations – Approximate solutions of numerical equations. (9 hours)

UNIT V**Trigonometry**Expansion of $\sin\theta$, $\cos\theta$, $\tan\theta$ in powers of θ –Hyperbolic Functions. (9 hours)**TEXTBOOKS**

1. Arumugam.S. and Thangapandi Isaac.A. (2004). *Ancillary Mathematics Paper II (Revised)*, New Gamma Publishing House.
2. Arumugam.S. and Thangapandi Isaac.A.(2014). *Allied Mathematics Paper I*, New Gamma Publishing House.

| Unit | Chapter | Section |
|-------------------|-----------------------------|-------------|
| Text Book1 | | |
| I | 1 | 1.2–1.5 |
| II | 2 | 2.1,2.2,2.3 |
| Text Book2 | | |
| III | Part1-Chapter1 | 1.1,1.2 |
| IV | Part1-Chapter1 | 1.4,1.5 |
| V | Part3- Chapter1 Chapter2 | 1.3 2.1 |

| Course Code 23UMTA21 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-------------------------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | 3 | 2 | 3 | 2 | 2 | - | - |
| CO2 | 3 | 1 | 3 | 2 | 2 | 1 | - |
| CO3 | 3 | 2 | 3 | 2 | 2 | 1 | - |
| CO4 | 2 | 2 | 1 | 2 | 2 | - | - |
| CO5 | 3 | 1 | 1 | 2 | 2 | 1 | - |

Dr. A.Uma Devi
Head of the Department

Dr. A.Uma Devi
Course Designer



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B.Sc. CHEMISTRY

(2023-24 onwards)

| | | | |
|--------------------------------|---|----------------|----------------|
| Semester II | STATISTICS AND OPERATIONS RESEARCH | Hours/Week:3 | |
| Elective Course -I | | Credits:2 | |
| Course Code 23UMTA22 | | Internal 25 | External 75 |

COURSE OUTCOMES

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

CO1: retrieve the basic concepts in Statistics and Operations Research. [K1]

CO2: explain the techniques used to solve the problems in Statistics and operations Research [K2]

CO3: find solutions to solve the problems in the society. [K2]

CO4: calculate some statistical constants to get statistical inference and use O.R techniques to solve real life problems. [K3]

CO5: apply Correlation and Regression to draw conclusion for a given data. [K3]

UNIT I

Statistics

Correlation

Correlation-Problems-Rank correlation

(9 hours)

UNIT II Regression

Regression –Properties of Regression coefficients–Problems.

(9 hours)

UNIT III**Operations Research**

Formulation of Linear Programming Problem – Mathematical formulation of a Linear Programming Problem- Graphical method.

(9 hours)

UNIT IV**Operations Research Continued:**

Mathematical formulation of Transportation Problems – Initial Basic Feasible Solutions (Method 1, Method 2, Method 3, Method 4).

(9 hours)

UNIT V**Operations Research Continued:**

Introduction- Mathematical formulation of an Assignment Problem – Solution to Assignment Problem – Hungarian Algorithm (balanced minimization problems only).

(9 hours)

TEXTBOOKS

1. Arumugam.S and Thangapandi Isaac. A. (2011). *Statistics*, New Gamma Publishing House.
2. Arumugam.S and Thangapandi Isaac. A.(2015). *Topics in Operations Research Linear Programming*, New Gamma Publishing house.

| Unit | Chapter | Section |
|--------------------|---------|---------------|
| Text Book 1 | | |
| I | 6 | 6.0, 6.1, 6.2 |
| II | 6 | 6.3 |
| Text Book 2 | | |
| III | 3 | 3.1, 3.2, 3.4 |
| IV | 4 | 4.1 |
| V | 5 | 5.0, 5.1, 5.2 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-------------------------|------------|------------|------------|------------|------------|------------|------------|
| Course Code 23UMTA22 | | | | | | | |
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 | - |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | - |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | - |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | - |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | - |

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Mrs.P.Getchial Pon Packiavathi
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VIRUDHUNAGAR - 626 001

B.Sc. CHEMISTRY (2023-2024 onwards)

| | | | |
|--------------------------------|-------------------------|----------------|----------------|
| Semester II | ALLIED BOTANY II | Hours/Week: 4 | |
| Elective Course - I | | Credits: 3 | |
| Allied Code 23UBYA21 | | Internal 25 | External 75 |

Course Outcomes:

CO1: Understand the fundamental concepts of plant anatomy and embryology. [K1]

CO2: Recognize the different organs of plants and secondary growth. [K2]

CO3: Explain the water relation of plants with respect to various physiological processes. [K2]

CO4: Demonstration of an aerobic and anaerobic respiration [K3]

CO5: Interpret the plant systematics and recognize the importance of herbarium and virtual herbarium. [K3]

UNIT I :

MORPHOLOGY OF FLOWERING PLANTS: Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description. (12 Hours)

UNIT II:

TAXONOMY: Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae (12 Hours)

UNIT III

ANATOMY: Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

(12 Hours)

UNIT IV:

EMBRYOLOGY: Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

(12 Hours)

UNIT V:

PLANT PHYSIOLOGY: Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.

(12 Hours)

TEXT BOOKS

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

REFERENCE BOOKS

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.

| Course code 23UBYA21 | PO1 | PO2 | PO 3 | PO4 | PO 5 | PO 6 | PO 7 |
|-------------------------|-----|-----|------|-----|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |

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

Dr.B.Karunai Selvi
Head of the Department

Dr. R. Murugalakshmi Kumari
Course Designer



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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VIRUDHUNAGAR - 626 001

B.Sc. CHEMISTRY (2023-2024 onwards)

| | | | |
|------------------------------------|----------------------------------|----------------|----------------|
| Semester II | ALLIED BOTANY PRACTICAL I | Hours/Week: 2 | |
| Elective Course – I Practical I | | Credits: 1 | |
| Course Code 23UBYA21P | | Internal 40 | External 60 |

Course Outcomes:

CO1: Explain the internal organization of algae and fungi. [K2]

CO2: Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms. [K2]

CO3: Solve the classical taxonomy with reference to different parameters. [K3]

CO4: Sketch the fundamental concepts of plant anatomy and embryology. [K3]

CO5: Demonstrate the effect of various physical factors on photosynthesis. [K3]

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
5. To dissect a flower, construct floral diagram and write floral formula.
6. Demonstration experiments
 1. Ganong's Light screen

2. Ganong's respiroscope
7. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
8. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms and Angiosperm anatomy, Embryology, Cell biology and Biotechnology.

TEXT BOOKS

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5. Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

REFERENCE BOOKS

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

| Course code 23UBYA21P | PO1 | PO2 | PO 3 | PO4 | PO 5 | PO 6 | PO 7 |
|---------------------------------|-----|-----|------|-----|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |

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

Dr.B.Karunai Selvi
Head of the Department

Dr.B.Karunai Selvi
Course Designer



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VIRUDHUNAGAR - 626 001

B.Sc. CHEMISTRY (2023 -24 onwards)

| | | | |
|--------------------------------|---------------------------------------|----------------|----------------|
| Semester II | DRUGS AND NATURAL PRODUCTS | Hours/Week: 2 | |
| NME -2 | | Credits: 2 | |
| Course Code 23UCHN21 | | Internal 25 | External 75 |

COURSE OUTCOMES

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

CO1: define the various drug terminologies, antibiotics, chemotherapy agents, vitamins, hormones and natural products. [K1]

CO2: know the drugs studies, antibiotics, chemotherapeutic agents, vitamins, hormones and natural products. [K1]

CO3: understand the pharmaceutical terminologies, antibiotics drug action and effects, types of therapeutic agents, effects and uses of vitamins, hormones and natural products. [K2]

CO4: discuss the pharmaceutical terms, activity and effects of bacterial inflectional drugs, action of different therapeutic agents, biological importance and deficiency of vitamins and hormones, medicinal significance of terpenoids and alkaloids. [K2]

CO5: predict the drug terminologies, drug activity and effects of antibiotics nature and types of therapeutic agents, effects and importance of vitamins and steroids, medicinal uses of natural products. [K3]

UNIT I

Importance of Drugs –terminologies – Pharmacy – Pharmacology – Pharmacodynamics – Pharmacokinetics – Molecular Pharmacology – Pharmacophore – antimetabolites – actinomycetes - Bacteria, Virus, fungi –mutation. (6 Hours)

UNIT II

Antibiotics – Definition-classification-uses of Ampicillin, streptomycin, Erythromycin, tetracycline, rifomycin (structure not necessary) – drug action and side effects.

(6 Hours)

UNIT III

Chemotherapy-introduction-classification-Definition and examples of Antipyretics-Analgesics - Anti-inflammatory agents - Sulpha drugs-Antimalarials-Antiseptics(structure not necessary)

(6 Hours)

UNIT IV

Vitamin – Classification – Sources and deficiency of various vitamins.(structure not necessary)

Steroids – Classification- biological importance of Male sex hormone, Female sex hormone. (structure not necessary)

(6Hours)

UNIT V

Terpenoids: Definition – classification – occurrence – uses of citral, geraniol, limonene, menthol and zingiberene.(structure not necessary)

Alkaloids: Definition – classification - occurrence – medicinal uses of quinine, atropine, morphine,nicotine and papavarine.(structure not necessary)

(6 Hours)

TEXT BOOKS

1. Jayashree Ghosh, (2012). *A Text Book of Pharmaceutical Chemistry*, 1st Edition. New Delhi: S.Chand & Company Ltd.
2. Jain, M.K. & Sharma, S.C. (2016). *Modern Organic Chemistry*, 1st Edition. New Delhi: Vishal Publishing Co.

| Course Code | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|-------------|-------|-------|-------|-------|-------|-------|-------|
| 23UCHN21 | | | | | | | |
| CO 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 |
| CO 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 |
| CO 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 |
| CO 4 | 2 | 1 | 1 | 1 | - | 1 | 1 |
| CO 5 | 1 | 1 | 1 | - | 1 | 1 | 2 |

Dr.M.Dhanalakshmi
Head of the Department

Dr. C. Vidya Rani
Course Designer



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B.Sc. CHEMISTRY (2023 -24 onwards)

| | | | |
|-----------------|--------------------------|---------------|----------|
| Semester II | POLYMER CHEMISTRY | Hours/Week: 2 | |
| SEC-2 | | Credits: 2 | |
| Course Code | | Internal | External |
| 23UCHS21 | | 25 | 75 |

COURSE OUTCOMES

On successful completion of the course, the learners shall be able to

CO1: remember the classification of polymers[K1]

CO2: know the chemistry of polymer formation [K1]

CO3: explain the mode of preparation of vulcanized rubber, resins, plastics and biomedical polymers [K2]

CO4: understand the techniques of polymer preparation into a novel polymeric compound [K2]

CO5: apply the utility of different polymers [K3]

UNIT I :

Polymers - Introduction - definition - Classification of polymers- Types of polymerization reactions - Addition, condensation polymerization – examples-Polymerization techniques.

(6 Hours)

UNIT II :

Plastic - definition - Types - Thermosetting and thermoplastics – differences- examples – advantages and disadvantages of plastics - preparation and uses of cellulose acetate, celluloid, PVC, polyethylene,teflon, polycarbonates and polystyrene.

(6 Hours)

UNIT III :

Resins-Definition - Types – Examples - Phenolic resin, amino resin and polyurethanes – preparation and uses.

Fibres – Nylon-6,6, Nylon-6 and polyester - preparation and uses.

(6 Hours)

UNIT IV :

Inorganic polymers - Silicones - preparation and uses- Glass transition and melting temperatures – importance - conducting polymers - Different types - uses. Polymer alloy - biomedical polymers - examples and uses. (6 Hours)

UNIT V:

Rubber - Natural rubber - Vulcanization of rubber-synthetic rubber – Buna - S, Buna-N, Thiokol and Neoprene rubber- preparation and uses. (6 Hours)

TEXT BOOKS

- 1.Jain& Jain. (2013).*Engineering Chemistry*, 16th Edition. DhanpatRai Publishing Company (P) Ltd.
- 2.JayashreeGhosh.(2013).*Fundamental concepts of Applied Chemistry*, S.Chand& Company Ltd.

REFERENCE BOOKS

- 1.K.BagavathiSundari.(2006). *Applied Chemistry*, MJP Publishers.
- 2.B.K.Sharma.(2008).*Industrial Chemistry*, 13th Edition. GOEL Publishing House.

| Course Code | PO1 | | PO2 | | PO3 | | PO4 | | PO5 | | PO6 | PO7 |
|-------------|---------|---------|--------|--------|---------|---------|---------|---------|--------|---------|-------|-------|
| | PSO 1 a | PSO 1 b | PSO 2a | PSO 2a | PSO 3 a | PSO 3 b | PSO 4 a | PSO 4 b | PSO 5a | PSO 5.b | PSO 6 | PSO 7 |
| 23UCHS21 | | | | | | | | | | | | |
| CO 1 | 3 | 2 | 3 | | 3 | 1 | 1 | 2 | 2 | 2 | 1 | 2 |
| CO 2 | 3 | 3 | 3 | | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 |
| CO 3 | 3 | 3 | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO 4 | 3 | 3 | 2 | | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 |
| CO 5 | 3 | 3 | 3 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 |

Dr.M.Dhanalakshmi
Head of the Department

Mrs.R.Nagasathya
Course Designer