



**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 (3<sup>rd</sup> 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.

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

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**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        | Commerce (Professional Accounting) |
| Basic Labour Laws                    | 23UCPN21    | II       |                                    |

|   |          |    |  |
|---|----------|----|--|
| 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 |  |

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

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**ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)**

1. Value Education
1. Environmental Studies

**GENERIC ELECTIVE COURSES -1**

1. Human Rights
2. Women Studies

## **GENERIC ELECTIVE COURSES -2**

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.

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

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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 Biotechnology**

To educate rural women students in the field of research and academics with excellent state-of-art Biotechnological skills to serve for the benefit of mankind

### Mission of the Department of Biotechnology

- To impart quality education in Biotechnology to the students with sound disciplinary knowledge
- To become competent Biotechnologists who will be able to apply the basic principles and techniques of life sciences to solve a wide array of problems to facilitate human welfare in various fields such as health, agriculture and industry with socio-ethical consideration

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

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

#### Programme Educational Objectives (PEOs) of B.Sc. Biotechnology Programme

##### The students will be able to

- To acquire knowledge and sound understanding of concepts in various branches of Biotechnology and exhibit their abilities and skills leading to become competent professionals
- To employ their knowledge and technical skills in their profession for problem solving
- To sustain the standards of the profession concerned with ethical consideration

| Key Components of the Mission Statement | PEO1 | PEO2 | PEO3 |
|---|------|------|------|
| conceptual knowledge                    | √    | √    | -    |
| Problem solving                         | √    | √    | -    |
| socio-ethical consideration             | -    | √    | √    |

#### 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. Biotechnology Programme, the students will be able to**

**PO1: Disciplinary knowledge**

**PSO1a:** Apply the knowledge on fundamental concepts of life sciences such as Biochemistry, Microbiology, Genetics and Molecular biology and its related courses in higher studies.

**PSO1b:** Understand the principles and handling of various instruments used in Biochemistry, Microbiology and chemistry laboratory and to equip the practical skills in Biotechnology

**PO2: Communication Skills.**

**PSO2:** Explain various concepts and processes of Biological sciences both in verbal and written form and illustrate the techniques related to Biotechnology.

**PO3: Scientific Reasoning and Problem Solving**

**PSO3a:** apply their theoretical knowledge and transferable skills to identify and solve problems in day today life

**PSO3b:** Employ interdisciplinary knowledge to provide better solutions and new ideas in various branches of Biotechnology innovatively to work in a biotechnology laboratory or in an industry.

**PO4: Critical thinking and Analytical Reasoning**

**PSO4a:** critically think and apply the concepts in life sciences in identifying the problems which can be addressed through Biotechnology to become an entrepreneur

**PSO4b:** Analyse the organization of plant, animal and microbes from cellular level upto genome level and their inter relationship to carry out various research and development activities

**PO5: Digital Literacy, Self - directed and Lifelong learning**

**PSO5:** Make use of modern ICT tools and to adapt to the technological advancements in the emerging areas of Biotechnology.

**PO6: Cooperation / Team Work and Multi-Cultural Competence**

**PSO6:** Work effectively as a member or leader of a team in institution, industry, society through the acquired skills from paper presentation, Industrial visit and Internship programme.

**PO7: Moral and Ethical awareness**

**PSO7:** Understand the IPR, ethics in life science and adapting ecofriendly techniques for sustainable development.

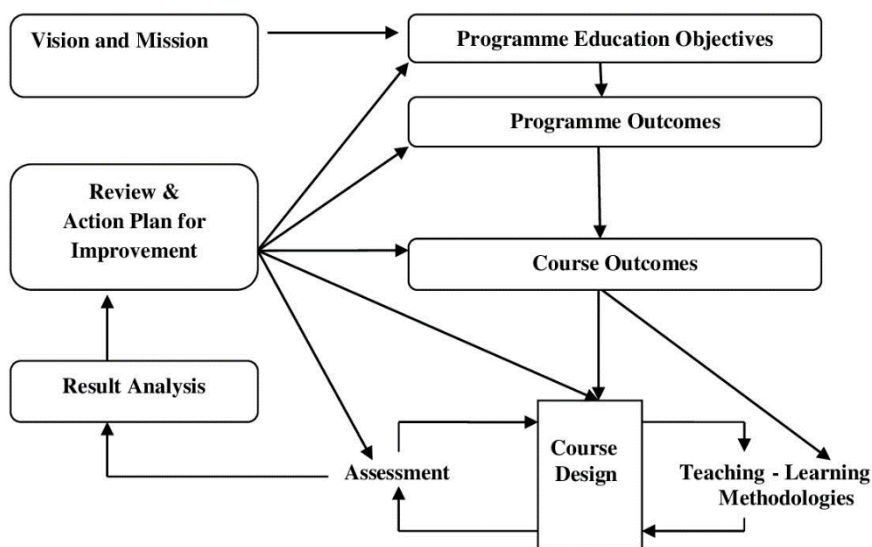
**PO-PEO Mapping Matrix**

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<br>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)

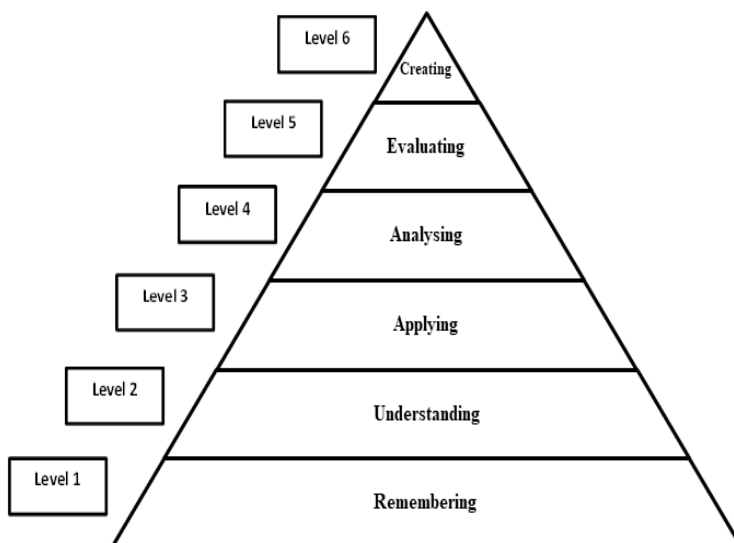
Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after 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/<br>PSO1 | PO2/<br>PSO2 | PO3/<br>PSO3 | PO4/<br>PSO4 | PO5/<br>PSO5 | PO6/<br>PSO6 | PO7/<br>PSO7 |
|---------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Cos     |              |              |              |              |              |              |              |
| CQ1     |              |              |              |              |              |              |              |
| 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 Biology 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  |
|          | : | Discipline Specific Elective Courses  |
|          | : | Elective Courses  |
|          | : | Self Study Course   |
| Part IV  | : | Skill Enhancement Courses (SEC)   |
|          | : | Internship/ Field Project   |
|          | : | 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       |
| <b>Total</b>       |   | <b>25</b> |

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

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


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| Components | Internal Assessment Marks | External Examination Marks | Total Marks |
|------------|---------------------------|----------------------------|-------------|
| Theory     | 25                        | 75                         | <b>100</b>  |

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

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

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        |
| <b>Total</b>         |   | <b>40</b> |

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          |
|         |        |                                      |                  |                                 | <b>Total</b>            | <b>45*</b>  |

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

**SUMMATIVE EXAMINATION****Question Pattern****Duration: 3 Hours**

| Section | Questions 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          |
|         |               |                                     |                  |                                 | <b>Total</b>            | <b>75</b>   |

**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         |
| <b>Total</b>       |          | <b>25</b> |

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 | Questions 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          |
|         |               |                                     |                  |                                 | <b>Total</b>            | <b>25</b>   |

**Summative Examination**

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

**Question Pattern****Duration: 2 Hours**

| Section | Questions 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          |
|         |               |                                     |                  |                                 | <b>Total</b>            | <b>50</b>   |

**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         |
| <b>Total</b>                             | <b>: 25*</b> |

\*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.
  - No Pass minimum for Internal Assessment.
  - Pass minimum for External Examination is 27 marks out of 75 marks for Core Courses, Discipline Specific Elective Courses and Allied Courses.
  - Pass minimum for External Examination is 21 marks out of 60 marks 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 Courses and Generic Elective Courses is 40 marks.
  - Pass minimum for Self Study Courses is 40 marks.

- 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.
      - For Part V in UG Programmes, the students require 75 % of attendance to get a credit.
      - For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

These rules come into effect from 2020-2021 onwards

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### **B.3 ASSESSMENT MANAGEMENT PLAN**

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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<br>(Weightage -75%)    | CO Assessment  | This is computed from the calculated CO Attainment value for each Course  |
| Indirect Attainment<br>(Weightage - 25%) | Graduate Exit<br>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/<br>Extra-curricular<br>activities 15% | For participation in Co-curricular/Extra-curricular activities during the period of their study.  |

**Programme Articulation Matrix (PAM)**

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



**Indirect Attainment of POs for all Courses**

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

**Attainments of POs for all Courses**

| POs                                   | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|---------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| 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  
Extra curricular 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<br>(in percentage) | Whether Expected Level of<br>PO is Achieved?<br>(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         |
| <b>Total Attainment</b>         | <b>100</b> |

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

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

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

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

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

**Level of PEO Attainment**

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

**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. Biotechnology Programme.



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## BACHELOR OF SCIENCE BIOTECHNOLOGY (2026)

*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             |                                 |
| <b>Part I : Tamil /Hindi</b>  | 6 (3)          | 6 (3)          | 6 (3)          | 6 (3)          | -              | -              | 24 (12)                         |
| <b>Part II : English</b>  | 6 (3)          | 6(3)           | 6 (3)          | 6 (3)          | -              | -              | 24 (12)                         |
| <b>Part III : Core Courses, Discipline Specific Elective Courses, Allied Courses &amp; Self Study Course</b>  |                |                |                |                |                |                |                                 |
| 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   | 4 (3)          | 4 (3)          | -              | -              | -              | -              | 8(6)                            |
| Elective Course I Practical I   | 2 (1)          | 2 (1)          | -              | -              | -              | -              | 4(2)                            |
| 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)                           |
| <b>Part IV : Skill Enhancement Courses, Non Major Elective Courses, Ability Enhancement Compulsory Courses, Generic Elective Courses, Self Study Course &amp; Internship/ Field Project</b> |                |                |                |                |                |                |                                 |
| 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)                           |
| <b>Part V : Extension Activities</b>  | -              | -              | -              | 0 (1)          | -              | -              | 0 (1)                           |
| <b>Total</b>  | <b>30 (21)</b> | <b>30 (21)</b> | <b>30 (21)</b> | <b>30 (23)</b> | <b>30 (27)</b> | <b>30 (27)</b> | <b>180 (140)</b>                |
| Extra Credit Course (Self Study Course)   | -              | -              | -              | -              | 0(2)           | -              | 0(2)                            |

DSEC: Discipline Specific Elective Course  
AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course  
GEC: Generic Elective Course



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**B.Sc., BIOTECHNOLOGY– 2026**

**PROGRAMME CONTENT**

**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.           | <b>Part I</b>   | Tamil/Hindi                      | 23UTAG11/<br>23UHDG11                              | 6              | 3         | 3           | 25         | 75   | 100   |     |
| 2.           | <b>Part II</b>  | English                          | 23UENG11   | 6              | 3         | 3           | 25         | 75   | 100   |     |
| 3.           | <b>Part III</b> | Core Course -1                   | Cell and Molecular Developmental Biology           | 23UBOC11       | 5         | 5           | 3          | 25   | 75    | 100 |
| 4.           |                 | Core Course -2<br>Practical-I    | Cell and Molecular Developmental Biology Practical | 23UBOC11P      | 3         | 2           | 3          | 40   | 60    | 100 |
| 5.           |                 | Elective Course-I                | Biological Chemistry                               | 23UBOA11       | 4         | 3           | 3          | 25   | 75    | 100 |
| 6.           |                 | Elective Course-I<br>Practical I | Biological Chemistry Practical                     | 23UBOA11P      | 2         | 1           | 3          | 40   | 60    | 100 |
| 7.           | <b>Part IV</b>  | NME-1                            | Herbal Medicine                                    | 23UBON11       | 2         | 2           | 3          | 25   | 75    | 100 |
| 8.           |                 | SEC- 1<br>Foundation Course      | Basics of Biotechnology                            | 23UBOF11       | 2         | 2           | 3          | 25   | 75    | 100 |
| <b>Total</b> |                 |                                  |  | <b>30</b>      | <b>21</b> |             | <b>800</b> |      |       |     |

**B.Sc., BIOTECHNOLOGY - SEMESTER II**

| S.No.        | Components      | Title of the Course                 | Course Code                                  | Hours Per Week | Credits   | Exam. Hours | Marks      |      |       |     |
|--------------|-----------------|-------------------------------------|--|----------------|-----------|-------------|------------|------|-------|-----|
|              |                 |                                     |  |                |           |             | Int.       | Ext. | Total |     |
| 1.           | <b>Part I</b>   | Tamil/<br>Hindi                     | 23UTAG21/<br>23UH DG21                       | 6              | 3         | 3           | 25         | 75   | 100   |     |
| 2.           | <b>Part II</b>  | English                             | 23UENG21                                     | 6              | 3         | 3           | 25         | 75   | 100   |     |
| 3.           | <b>Part III</b> | Core Course -3                      | Genetics                                     | 23UBOC21       | 5         | 5           | 3          | 25   | 75    | 100 |
| 4.           |                 | Core Course -4<br>Practical-II      | Genetics<br>Practical                        | 23UBOC21P      | 3         | 2           | 3          | 40   | 60    | 100 |
| 5.           |                 | Elective Course-1                   | Fundamentals of<br>Microbiology              | 23UBOA21       | 4         | 3           | 3          | 25   | 75    | 100 |
| 6.           |                 | Elective Course -1-<br>Practical-II | Fundamentals of<br>Microbiology<br>Practical | 23UBOA21P      | 2         | 1           | 3          | 40   | 60    | 100 |
| 7.           | <b>Part IV</b>  | NME-2                               | Organic Farming<br>and Health<br>Management  | 23UBON21       | 2         | 2           | 3          | 25   | 75    | 100 |
| 8.           |                 | SEC – 2                             | Food Chemistry                               | 23UBOS21       | 2         | 2           | 3          | 25   | 75    | 100 |
| <b>Total</b> |                 |                                     |  | <b>30</b>      | <b>21</b> |             | <b>800</b> |      |       |     |



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**B.Sc., Biotechnology**

**(2023-2024 onwards)**

|                                |   |                |                |
|--------------------------------|---|----------------|----------------|
| Semester I                     | <b>CELL AND MOLECULAR<br/>DEVELOPMENTAL BIOLOGY</b> | Hours/Week: 5  |                |
| Core Course -I                 |   | Credits: 5     |                |
| Course Code<br><b>23UBOC11</b> |   | Internal<br>25 | External<br>75 |

## Course Outcomes:

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

**CO1:** Recall the cell structure, organelles, central dogma, cell division and development.

(K1)

**CO2:** Understand the cell types, function, genetic material, signal transduction and organogenesis. (K2)

**CO3:** Summarize the structure and function of cells & nucleic acids, the molecular mechanism of replication, transcription, translation, signalling pathway, morphogenesis & growth (K2)

**CO4:** Illustrate the cell structure, cell organelles, response of cells to the intra and extracellular environment, and cellular differentiation. (K3)

**CO5:** Distinguish the structure, function of cells, replication, transcription, translation of prokaryotic & eukaryotic cells, cell signalling and morphogenesis. (K3)

## UNIT I

Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells). (10 Hours)

## UNIT II

Biomacromolecules and Biomicromolecules (Primary functions in the cell). Structure and Functions of Cell Organelles: Cell wall - Cell membrane - Cytoplasm - Nucleus - chromosomes -Endoplasmic reticulum - Ribosomes - Golgi bodies - Plastids - Vacuoles - Lysosomes - Mitochondria - Microbodies - Flagella - Cilia - Centrosome and Centrioles - Cytoskeleton. (17 Hours)

### UNIT III

Structure and functions of DNA and RNA -Central Dogma of the cell. DNA -Replication in prokaryotes - Transcription in Prokaryotes and Eukaryotes - RNA Processing - Genetic code- Translation - Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications - Protein Sorting - Protein degradation. (16 Hours)

### UNIT IV

Cell cycle - Cell cycle check points - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell Adhesion - Extra Cellular Matrix - Cell to cell communications - Signal transduction - G - Protein Coupled Receptors Signal transduction pathways. (16 Hours)

### UNIT V

Gametogenesis - Spermatogenesis and Oogenesis in mammals. Fertilization- Types of cleavage, blastula formation, embryonic fields, gastrulation, and formation of germ layers in animals- Organogenesis. (16 Hours)

### TEXTBOOKS

1. Devasena T. (2012) Cell Biology, Oxford University Press.
2. Gupta R, Makhija S, and Toteja R. (2018) Cell Biology: Practical Manual.
3. Gilbert S.F. (2023) Developmental Biology, 13<sup>th</sup> Edition. Sinauer Associates Inc. Publishers, MA. USA.
4. Bruce Alberts, (2022) Molecular Biology of the cell, 7<sup>th</sup> Edition W. W. Norton & Company.
5. James D. Watson (2010) The Double Helix: A personal account of the Discovery of the Structure of DNA, Touchstone Publishers.

### Reference Books

1. James D. Watson, (2014) Molecular Biology of the Gene, 7<sup>th</sup> Edition, Pearson Publications
2. Gerald Karp, Janet Iwasa, Wallace Marshall (2019) Karp's Cell and Molecular Biology: Concepts and Experiments. 9<sup>th</sup> Edition, Wiley Publications.
3. Geoffrey M. Cooper, (2015). The Cell: A Molecular Approach, 7<sup>th</sup> Edition, Sinauer Associates, Oxford University Press.
4. Lodish Harwey, (2021) Molecular Cell Biology, 9<sup>th</sup> Edition W. H. Freeman Publications.
5. Wolpert L, Tickle C, (2015) Principles of Development, 5<sup>th</sup> Edition, Oxford University Press.

### Web Resources

<http://www.cellbiol.com/education.php>

<https://global.oup.com/uk/orc/biosciences/cellbiology/wang/student/weblinks/ch16/>

<https://www.cellsignal.com/contents/science/cst-pathways/science-pathways>

<https://nptel.ac.in/courses/102/106/102106025/11>.



| Course<br>Code<br>23UBOC11 | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|----------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                            | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                        | 3           | 3           | 2           | 3           | 3        | 3           | 2           | 2        | 3        | 2        |
| CO2                        | 3           | 2           | 2           | 2           | 3        | 3           | 2           | 3        | 2        | 2        |
| CO3                        | 3           | 2           | 3           | -           | 1        | 1           | 2           | 2        | 1        | -        |
| CO4                        | 3           | 2           | 1           | -           | 1        | 2           | 2           | 3        | 2        | -        |
| CO5                        | 2           | 2           | 1           | 2           | -        | 1           | 2           | 2        | 3        | -        |

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

Dr.V.Jeyasinga  
Head of the Department

C.Girija  
Course Designer



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(2023-2024 onwards)

|                                 |   |                |                |
|---------------------------------|---|----------------|----------------|
| Semester I                      | <b>Cell and Molecular<br/>Developmental Biology Practical</b> | Hours/Week: 3  |                |
| Core Course – 2<br>Practical I  |   | Credits: 2     |                |
| Course Code<br><b>23UBOC11P</b> |   | Internal<br>40 | External<br>60 |

### Course Outcomes

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

**CO1:** Use microscopy and micrometry in biotechnological applications. K2

**CO2:** Know and perform cell counting techniques and be able to prepare the Blood smear and Buccal smear.K2

**CO3:** identify and explain the salient features of the given spotters.K3

**CO4:** Infer the result and complete the record work. K3

**CO5:** Demonstrate the basic principles of Cell fractionation and Identification of cell organelles.K3

1. Components of a Compound / Light Microscope.
2. Blood smear preparation and Identification of Blood cells
3. Buccal smear preparation and Identification of squamous epithelial cells.
4. Isolation and Identification of plant cells, animal cells.
5. Observation of sperm & Egg
6. Mounting of chick embryo - 24 hrs, 48 hrs, 72 hrs, 96 hrs.
7. Types of placenta in mammals.
8. Cell fractionation and Identification of cell organelles (Demo)

**Recommended Text** - K.V. Chaitanya, (2013), Cell and molecular biology: Lab manual, PHI publishers, ISBN 978-81-203-800-4.

| Course Code<br><b>23UBOC11P</b> | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|---------------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                                 | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                             | 3           | 3           | 2           | 3           | 3        | 3           | 2           | 2        | 3        | 2        |
| CO2                             | 3           | 2           | 2           | 2           | 3        | 3           | 2           | 3        | 2        | 3        |
| CO3                             | 3           | 2           | 3           | -           | 1        | 1           | 2           | 2        | 1        | 3        |
| CO4                             | 3           | 2           | 1           | -           | 1        | 2           | 2           | 3        | 2        | 2        |
| CO5                             | 2           | 2           | 1           | 2           | -        | 1           | 2           | 2        | 3        | 1        |

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

Dr.V.Jeyasimga  
Heads of the Department

Dr.Sinthia Ganeshan  
Course Designer



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**B.Sc., Biotechnology**

(2023-2024 onwards)

|                                |                             |                |                |
|--------------------------------|-----------------------------|----------------|----------------|
| Semester I                     | <b>BIOLOGICAL CHEMISTRY</b> | Hours/Week: 4  |                |
| Elective Course-I              |                             | Credits: 3     |                |
| Course Code<br><b>23UBOA11</b> |                             | Internal<br>25 | External<br>75 |

### Course Outcomes:

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

**CO1:** Recall the basic concepts in Chemistry and Biochemistry. (K1)

**CO2:** Understand the acid-base concept, buffer, classification, structure, chemistry, properties, and metabolism of biomolecules. (K2)

**CO3:** Summarize the types of chemical bonds, types of organic reactions and significance of buffer, and metabolic pathways of biomolecules. (K2)

**CO4:** Illustrate the configuration of atoms, types of chemical bonds, types of organic reactions, concentration of solution and structure of biomolecules (K3)

**CO5:** Explain the periodic table, organic compounds, significance of pH, pH in living systems and metabolic pathway of biomolecules. (K3)

### UNIT I

Atomic theory, formation of molecules, electronic configuration of atoms- s & p shapes of atomic orbitals. Periodic table, periodic classification, valency. Types of chemical bonds - Hybridization in methane, ethane, acetylene and benzene. Definition with examples- electrophiles, nucleophiles and free radicals. Types of reactions with an example: addition, substitution, elimination, condensation and polymerization. Electrophilic substitution reaction in benzene, nitration and sulphonation. (12 Hours)

### UNIT II

Acids & Bases properties and differences, Concepts of acids and bases- Arrhenius, Lowry-Bronsted and Lewis. Concentration of solution, ways of expressing concentrations of solutions – per cent by weight, normality, molarity, molality, mole fraction. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson-Hasselbalch equation, mechanism of buffer action of acidic buffer and basic buffer. (12 Hours)

### UNIT III

Importance to Biochemistry-the chemical foundation of life. Water: its unique properties, and characteristics of water. Classification of carbohydrates. Properties of carbohydrates. The ring structure of sugars and conformations of sugars. Metabolism of Carbohydrates –Glycolysis, TCA cycle, bioenergetics of carbohydrate metabolism.

(12 Hours)

### UNIT IV

Classification of Lipids. Characteristics, Properties and Biological importance of lipids. Metabolism of Fatty acids -  $\beta$ -oxidation of fatty acids. Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA and RNA. Metabolism of Nucleic acids, Salvage pathway.

(12 Hours)

### UNIT V

Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. Degradation of Amino acids and Urea Cycle. ATP production. Oxidative phosphorylation, Electron transport chain and Photophosphorylation.

(12 Hours)

### TEXTBOOKS

1. P.L. Soni, (2013) A Textbook of Inorganic Chemistry, 11<sup>th</sup> Edition, S. Chand & Sons publications
2. Abhilasha Shourie, Shilpa S, Chapadgoankar and Anamika Singh (2020) Textbook of Biochemistry 1<sup>st</sup> Edition, I K International Publishing House Pvt. Ltd,
3. J.L. Jain, (2016) Fundamentals of Biochemistry, 7th Edition. S. Chand publication,
4. A.C. Deb, (2016) Fundamentals of Biochemistry, 7th Edition. New central book agencies.
5. Satyanarayana. U, (2022) Biochemistry, 7<sup>th</sup> edition. MJ publishers.

### Reference Books

1. Leininger (2021) Principles of Biochemistry 8<sup>th</sup> Edition WH Freeman and Company NY.
2. Murray *et al.*, (2022) Harper's biochemistry 32<sup>nd</sup> Edition Appleton and Lange Publishers Florida USA.
3. Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, (1995) Principles of Biochemistry, 3<sup>rd</sup> Edition. W.C. Brown Publishers.

4. Lubert Stryer (2019) Biochemistry –Stanford University 9<sup>th</sup> Edition, W H Freeman company, Francisco.
5. Bahl Arun, Bahl B. S. (2019), A Textbook of Organic Chemistry, 22<sup>nd</sup> 'e' Edition, S. Chand & Sons publications

### Web Resources

<http://dwb4.unl.edu/chem869p/chem869plinks/s>

[www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp](http://www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp)

<https://www.britannica.com/science/biochemistry>

| Course Code<br><b>23UBOA11</b> | PO1      |          | PO2      |          | PO 3  | PO4      |          | PO 5  | PO 6  | PO 7  |
|--------------------------------|----------|----------|----------|----------|-------|----------|----------|-------|-------|-------|
|                                | PSO 1. a | PSO 1. b | PSO 2. a | PSO 2. b | PSO 3 | PSO 4. a | PSO 4. b | PSO 5 | PSO 6 | PSO 7 |
| CO1                            | 3        | 3        | 2        | 3        | 3     | 3        | 2        | 2     | 3     | 2     |
| CO2                            | 3        | 2        | 2        | 2        | 3     | 3        | 2        | 3     | 2     | 2     |
| CO3                            | 3        | 2        | 3        | -        | 1     | 1        | 2        | 2     | 1     | 2     |
| CO4                            | 3        | 2        | 1        | -        | 1     | 2        | 2        | 3     | 2     | 3     |
| CO5                            | 2        | 2        | 1        | 2        | -     | 1        | 2        | 2     | 3     | 3     |

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

Dr.V.Jeyasimga  
Dr.M.Dhanalakshmi  
Heads of the Departments

Dr.Sinthia Ganeshan  
Dr.M.Vairalakshmi  
Course Designers



## V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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Re-accredited with 'A' Grade (3<sup>rd</sup> Cycle) by NAAC

VIRUDHUNAGAR - 626 001

### B.Sc., Biotechnology (2023-2024 onwards)

|                                   |   |                |                |
|-----------------------------------|---|----------------|----------------|
| Semester II                       | <b>BIOLOGICAL CHEMISTRY<br/>PRACTICAL</b> | Hours/Week: 2  |                |
| Elective Course– I<br>Practical I |   | Credits: 1     |                |
| Course Code<br><b>23UBOA11P</b>   |   | Internal<br>40 | External<br>60 |

#### Course Outcome

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

- CO1:** Perform and estimate the amount of chemical substance present in a solution qualitatively. To analyze and detect the nature of various organic class of compounds qualitatively. K2
- CO2:** Qualitatively analyze the carbohydrates and amino acids and report the type of carbohydrate based on specific tests. K2
- CO3:** make use of formula, tables and graphs for the quantitative estimation, K3
- CO4:** infer the result and complete the record work. [K3]
- CO5:** distinguish different group of compounds. K3

#### Systematic analysis of Organic compounds

1. Functional group tests (Carboxylic acid (Benzoic acid, phthalic acid), Phenol, Urea, Benzaldehyde, Aniline (Aniline not to be given for exam))
2. Detection of elements (N, Halogens)
3. Distinguish between aliphatic and aromatic compounds.
4. Distinguish between Saturated and unsaturated compounds.

#### Qualitative Analysis

1. Qualitative analysis of carbohydrates - Glucose, Fructose, Lactose, maltose, sucrose, starch and glycogen.
2. Qualitative analysis of amino acids - Tyrosine, Tryptophan, Arginine, Proline and Cysteine.

**Volumetric Analysis**

1. Estimation of Glycine- Formal Titration.
2. Determination of Ascorbic acid – DCPIP method.
3. Estimation of Ferrous sulphate using standard Mohr's salt

**Colorimetric Analysis**

1. Estimation of glucose
2. Estimation of Cholesterol- Zak's method
3. Estimation of proteins – Bradford's method

**Recommended Text**

1. J. Jayaraman, (2011) Laboratory Manual in Biochemistry, New Age International Pvt Ltd Publishers.
2. S. K. Sawhney Randhir, Singh, (2005) Introductory Practical Biochemistry, 2<sup>nd</sup> Edition Alpha Science International Ltd.
3. Irwin H. Segel, (1991) Biochemical calculations, Liss, New York.

**Reference Books**

1. Dr. O P Panday, D N Bajpai, Dr. S Giri, (2016) PRACTICAL CHEMISTRY, Revised edition, S Chand.
2. Hands Thacher Clarke, (2007) A handbook of Organic: Qualitative and Quantitative Analysis.
3. N.S. Gnanapragasam and G. Ramamurthy, (1998) Organic chemistry Lab manual, S.Viswanathan Co. Pvt. Ltd.

| Course Code<br><b>23UBOA11P</b> | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|---------------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                                 | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                             | 3           | 3           | 2           | 3           | 3        | 3           | 2           | 2        | 3        | 2        |
| CO2                             | 3           | 2           | 2           | 2           | 3        | 3           | 2           | 3        | 2        | 2        |
| CO3                             | 3           | 2           | 3           | -           | 1        | 1           | 2           | 2        | 1        | 2        |
| CO4                             | 3           | 2           | 1           | -           | 1        | 2           | 2           | 3        | 2        | 3        |
| CO5                             | 2           | 2           | 1           | 2           | -        | 1           | 2           | 2        | 3        | 3-       |

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

Dr.V.Jeyasinga  
Head of the Department

Dr.Sinthia Ganeshan  
Course Designer





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**VIRUDHUNAGAR - 626 001**

**B.Sc. Biotechnology**

**(2023-2024 onwards)**

|                                |                        |                |                |
|--------------------------------|------------------------|----------------|----------------|
| Semester I                     | <b>HERBAL MEDICINE</b> | Hours/Week: 2  |                |
| NME - 1                        |                        | Credits: 2     |                |
| Course Code<br><b>23UBON11</b> |                        | Internal<br>25 | External<br>75 |

### Course Outcomes:

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

**CO1:** Appreciate the concepts of Ethnomedicine (K1)

**CO2:** Learn the role of herbal medicines in health (K2)

**CO3:** Understand the importance of Tribal medicine (K2)

**CO4:** Explain about the role of traditional medicine for today's health (K3)

**CO5:** Apply the concepts of medicinal herbs to improve health (K3)

### UNIT I

(6 Hours)

Ethnomedicine – definition, history, and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

### UNIT II

(6 Hours)

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids, and vitamins).

### UNIT III

(6 Hours)

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos*, *Ficus benghalensis*, *Curcuma domestica*, *Cynodon dactylon* and *Sesamum indicum*.

#### UNIT IV

(6 Hours)

Traditional knowledge and utility of some medicinal plants in Tamil Nadu –  
*Solanum trilobatum*, *Cardiospermum halicacabum*, *Vitex negundo*, *Adathoda vasica*,  
*Azadirachta indica*, *Gloriosa superba*, *Eclipta alba*, *Aristolochia indica* and *Phyllanthus fraternus*.

#### UNIT V

(6 Hours)

Plants in day today life – *Ocimum sanctum*, *Centella asiatica*, *Cassia auriculata*, *Aloe vera*. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and Vegetables - Greens (*Moringa*, *Solanum nigrum* Cabbage).

#### TEXTBOOKS

1. R. K. Sinha and Shweta Sinha (2001) Ethnobiology. Surabhe Publications – Jaipur.
2. D.C. Pal & S.K. Jain Naya Prakash, (1998) Tribal medicine, Bidhan Sarani, Calcutta.
3. S.K. Jain (2001) Contribution to Indian Ethnobotany 3rd edition, scientific publishers, B.No.91, Jodhpur, India.
4. Andrew Chevallie, (2000) Encyclopaedia of Herbal Medicine
5. James Green (2000) The Herbal Medicine-Maker's Handbook: A Home Manual

#### REFERENCE BOOKS

1. M.C. Joshi (2007) Handbook of Indian Medicinal Plants Hardcover.
2. Neelesh Malviya and Sapna Malviya (2019) Herbal Drug Technology, 1<sup>st</sup> Edition, CBS Publishers, and Distributors.
3. Rageeb Md. Usman, Vaibhav M. Darvhekar, Vijay Kumar D, and Akhila S.A, (2019) Practical Book of Herbal Drug Technology, 1<sup>st</sup> Edition, Nirali Prakashan Publishers.
4. Pragi and Varun Arora (2019) Herbal Drug Technology, 1<sup>st</sup> Edition, S.Vikas and Company Publisher.

| Course Code<br><b>23UBON11</b> | PO1      |          | PO2      |          | PO 3  | PO4      |         | PO 5  | PO 6  | PO 7  |
|--------------------------------|----------|----------|----------|----------|-------|----------|---------|-------|-------|-------|
|                                | PSO 1. a | PSO 1. b | PSO 2. a | PSO 2. b | PSO 3 | PSO 4. a | PSO 4.b | PSO 5 | PSO 6 | PSO 7 |
| CO1                            | 2        | -        | 3        | 1        | 2     | 2        | 1       | -     | 2     | -     |
| CO2                            | 1        | -        | 2        | 1        | 3     | 2        | 2       | -     | 2     | -     |
| CO3                            | 3        | 2        | 2        | 2        | 2     | 2        | 2       | -     | 2     | 2     |
| CO4                            | 2        | 1        | 2        | 3        | 2     | 2        | 2       | 1     | 2     | 3     |
| CO5                            | 3        | 1        | 2        | 3        | 2     | 3        | 2       | 2     | 3     | 3     |

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

Dr. V. Jeyasimga  
Head of the Department

Dr. Sinthia Ganeshan  
Course Designer



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**VIRUDHUNAGAR - 626 001**

### B.Sc., Biotechnology

(2023-2024 onwards)

|                                 |                                |                |                |
|---------------------------------|--------------------------------|----------------|----------------|
| Semester I                      | <b>BASICS OF BIOTECHNOLOGY</b> | Hours/Week: 2  |                |
| SEC - 1<br>Foundation<br>course |                                | Credits: 2     |                |
| Course Code<br>23UBOF11         |                                | Internal<br>25 | External<br>75 |

#### Course Outcomes:

**CO1:** Know the basics of Biotechnology (K1)

**CO2:** Elaborate the applications of Biotechnology in various fields such as healthcare, Agriculture, Bioprocess and Environment (K1)

**CO3:** Understand the history scope and various avenues of Biotechnology (K2)

**CO4:** Illustrate the Historical developments in Biotechnology, industrially important microbes, environmental application, and food processing technology (K2)

**CO5:** Explain the genetic engineering, Agricultural and forestry applications, genetically Modified plants. (K2)

#### UNIT I

##### Origin and development of Biotechnology

Introduction and definitions, Historic perspectives- Biotechnology in prehistoric times, microorganisms and fermentation, Origin of genetics, Classical and modern genetics, DNA-structure, types, genetic Engineering, Beginning of modern Biotechnology. (6 hours)

#### UNIT II

**Scope of Biotechnology-** Commercial potential, Biotechnology in India and its global trends, Major Biotechnology institutes and companies in India, Application of Biotechnology.

(6 hours)

### UNIT III

**Applied Biotechnology - I:** Industrial Biotechnology- Bioprocess and Fermentation Technology, Bioreactors, Environmental Biotechnology- Biofuels, Single cell protein, sewage and Effluent treatment; Medical Biotechnology- safer and cheaper medicines by biotechnology, new medicines through genetic engineering, Biopharming. (6 hours)

### UNIT IV

**Applied Biotechnology - II:** Agriculture and Forest Biotechnology- Traditional methods of Crop improvement, Crop improvement through Biotechnology, Genetically Modified crops- benefits,- Herbicide tolerance, Insect resistance, genetically modified Livestock. -, application of Biotechnology in food processing. (6 hours)

### UNIT V

**Safety and Ethics in Biotechnology** - Good Laboratory Practices (GLP), Good Laboratory Practices for Students, Good Manufacturing Practices (GMP), Marketing of Biotechnology Products. Bioethics (6 hours)

### Reference Books

1. H.K. Das (2017) Textbook of Biotechnology, 5<sup>th</sup> Edition, Wiley India.
2. Daniel Callahan President (1998) Biotechnology and Ethics: A Blueprint for the Future, Hastings Centre, Centre for Biotechnology, Northwestern University.
3. Collins H. and T. Pinch, (2012) The Golem: What everyone should know about science, 2<sup>nd</sup> Edition, Cambridge University Press.

| Course Code<br>23UBOF11 | PO1         |             | PO2         |             | PO 3     | PO4         |            | PO 5     | PO 6     | PO 7     |
|-------------------------|-------------|-------------|-------------|-------------|----------|-------------|------------|----------|----------|----------|
|                         | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4.b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                     | 3           | -           | 3           | 1           | 2        | 2           | 1          | -        | 2        | -        |
| CO2                     | 1           | -           | 2           | 1           | 3        | 2           | 2          | -        | 2        | -        |
| CO3                     | 3           | 2           | 2           | 2           | 2        | 2           | 2          | -        | 2        | 2        |
| CO4                     | 2           | 1           | 2           | 3           | 2        | 2           | 2          | 1        | 2        | 3        |
| CO5                     | 3           | 1           | 2           | 3           | 2        | 3           | 2          | 2        | 3        | 3        |

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

Dr.V.Jeyasimga  
Head of the Department

Dr.V.Jeyasimga  
Course Designer



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**VIRUDHUNAGAR - 626 001**

**B.Sc., Biotechnology**

**(2023-2024 onwards)**

|                                |                 |                |                |
|--------------------------------|-----------------|----------------|----------------|
| Semester II                    | <b>GENETICS</b> | Hours/Week: 5  |                |
| Core Course -3                 |                 | Credits: 5     |                |
| Course Code<br><b>23UBOC21</b> |                 | Internal<br>25 | External<br>75 |

### Course Outcomes

**CO1:** Recall the key concepts of Genetics. (K1)

**CO2:** Understand the inheritance, variation, sex determination, chromosomal mapping, mutation, and evolution. (K2)

**CO3:** Outline the Mendelian and non-Mendelian inheritance, allelic interaction, linkage and population genetics. (K2)

**CO4:** Illustrate the concepts of genetics using specific examples or by solving simple genetic problems. (K3)

**CO5:** Analyze the Mendelian laws, allelic interaction, sex linkage, chromosomal mapping, mutation, and evolution. (K3)

### UNIT I

Mendel's experiments, Monohybrid cross, Dihybrid cross, Backcross or Testcross, Mendel's laws. Incomplete dominance. Interaction of Genes- Epistasis -lethal genes. Multiple alleles – In *Drosophila*, Rabbit, and Blood group inheritance in man.

(15 Hours)

### UNIT II

Linkage - linkage in *Drosophila*- Morgan's experiments, factors affecting linkage. Crossing over- types, mechanism, significance of crossing over. Mapping of Chromosomes, interference, and coincidence. Cytoplasmic inheritance -Carbon dioxide sensitivity in *Drosophila* and milk factor in mice. Sex –Linked Inheritance and Sex-Determination in Man.

(15 Hours)

### **UNIT III**

Fine structure of the gene and gene concept, Operon Concept. Identification of the DNA as the genetic material- Griffith experiments, Avery, McLeod, McCarty, and Hershey Chase experiment. Microbial Genetics- bacterial recombination, Conjugation, Transformation, Transduction and sexduction (15Hours)

### **UNIT IV**

Mutation – types of mutation, mutagens, DNA damage and Repair Mechanism. Chromosomal aberrations- Numerical and Structural, Pedigree Analysis- Mendelian inheritance in human. (Cystic Fibrosis, Muscular Dystrophy) (15 Hours)

### **UNIT V**

Population Genetics– Hardy Weinberg principle, gene frequency, genotype frequency and factors affecting gene frequency. Eugenics, Euphenics and Euthenics. (15 Hours)

### **TEXTBOOKS**

1. Dr. Veer Bala Rastogi, (2020) Elements of Genetics, 11<sup>th</sup> Revised & Enlarged Edition, Kedar Nath Ram Nath Publications, Meerut.
2. Verma, P.S. and Agarwal, V.K., (2009) Genetics, 9<sup>th</sup> Edition, S. Chand & Co., New Delhi – 110055.

### **REFERENCE BOOKS**

1. Gardener E.J. Simmons M.J. Slustad D. P. (2006) Principles of Genetics 8<sup>th</sup> Edition.
2. Lewis, R. (2018) Human Genetics- Concepts and application. 12<sup>th</sup> Edition. McGraw Hill.
3. Griffiths, Miller, J.H., (2020) An Introduction to Genetic Analysis, 12<sup>th</sup> Edition. W.H. Freeman. New York.
4. Winter, P.C., Hickey, G.J. and Fletcher, H. L., (2012) Instant notes in Genetics. 4<sup>th</sup> Edition Viva books, Ltd.
5. Good enough U. (1985) Genetics. Hold Saunders International.



**Web resources**

<https://nptel.ac.in/courses/102/106/102106025/>

<http://www.ocw.mit.edu>

<http://enjoy.m.wikipedia.org>

<https://www.acpsd.net>

| Course Code<br>23UBOC21 | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|-------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                         | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                     | 2           | -           | 3           | 1           | 2        | 2           | 1           | -        | 2        | -        |
| CO2                     | 1           | -           | 2           | 1           | 3        | 2           | 2           | -        | 2        | -        |
| CO3                     | 3           | 2           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO4                     | 2           | 1           | 2           | 3           | 2        | 2           | 2           | 1        | 2        | 3        |
| CO5                     | 3           | 1           | 2           | 3           | 2        | 3           | 2           | 2        | 3        | 3        |

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

Dr.V.Jeyasimga  
Head of the Department

Dr.V.Jeyasimga  
Course Designer



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VIRUDHUNAGAR - 626 001

### B.Sc., Biotechnology

(2023-2024 onwards)

|                                 |                           |                |                |
|---------------------------------|---------------------------|----------------|----------------|
| Semester II                     | <b>GENETICS PRACTICAL</b> | Hours/Week: 3  |                |
| Core Course -4<br>practical-II  |                           | Credits: 2     |                |
| Course Code<br><b>23UBOC21P</b> |                           | Internal<br>40 | External<br>60 |

#### Course Outcomes:

**CO1:** Demonstrate the basic principles of Genetics.[K2]

**CO2:** Analyze the Polytene chromosome of the organisms.[K2]

**CO3:** Identify Barr bodies from Buccal smear.[K3]

**CO4:** Infer the result and complete the record work [K3]

**CO5:** identify and explain the salient features of the given spotters.[K3].

1. Mitotic stages of onion (*Allium cepa*) root tip
2. Meiotic stages of cockroach testes/ Flower bud
3. Giant chromosomes from Chironomus larvae/ *Drosophila* salivary glands
4. Identification of Barr bodies from Buccal smear
5. Preparation of culture medium and culture of *Drosophila* – methods of maintenance
6. Study of monohybrid and dihybrid crosses
7. Human karyotyping (Demo)

#### TEXTBOOKS

Practical Manual on "Fundamentals of Genetics" (PBG-121). (2019) Edition: First Publisher: Odisha University of Agriculture & Technology. Editor: Kaushik Kumar Panigraha

| Course Code<br>23UBOC21P | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|--------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                          | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                      | 2           | -           | 3           | 1           | 2        | 2           | 1           | -        | 2        | -        |
| CO2                      | 1           | -           | 2           | 1           | 3        | 2           | 2           | -        | 2        | -        |
| CO3                      | 3           | 2           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO4                      | 2           | 1           | 2           | 3           | 2        | 2           | 2           | 1        | 2        | 3        |
| CO5                      | 3           | 1           | 2           | 3           | 2        | 3           | 2           | 2        | 3        | 3        |

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

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### B.Sc., Biotechnology

(2023-2024 onwards)

|                                |   |                |                |
|--------------------------------|---|----------------|----------------|
| Semester II                    | <b>FUNDAMENTALS OF<br/>MICROBIOLOGY</b> | Hours/Week: 4  |                |
| Elective Course-1              |   | Credits: 3     |                |
| Course Code<br><b>23UBOA21</b> |   | Internal<br>25 | External<br>75 |

#### Course Outcomes:

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

**CO1:** Recall the fundamental concepts in Microbiology. (K1)

**CO2:** Describe the history of Microbiology, microscopy, classification, cultivation, nutritional requirements of microorganisms, microbial disease, and role of microbes in Biotechnology. (K2)

**CO3:** Understand the contributions of microbiologists, working of microscopy, identification of microbes, sterilization techniques and interaction of microbes. (K2)

**CO4:** Apply basic concepts of Microbiology for identification, utilisation of beneficial microbes and diagnosis of pathogens. (K3)

**CO5:** Illustrate the interaction and relationship of microbes, host and the factors affecting growth of microorganisms. (K3)

#### UNIT I

History of Microbiology, Classification of bacteria, fungi, virus, protozoa, and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology. (12 Hours)

#### UNIT II

Structure of bacteria - Bacterial growth and measurement of growth, Media – types and preparation- plating methods - staining methods (Gram's, capsule, spore, LCB mount)- methods of preservation and storage of microbes. Culture of fungi, viruses, and algae. (12 Hours)

### UNIT III

Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL. (12 Hours)

### UNIT IV

Bioinsecticides - *Bacillus thuringiensis*, Baculoviruses- Biofertilizers -*Azospirillum* and blue green algae - single cell protein – prebiotics and probiotics - Dairy products (Cheese and Yoghurt). (12 Hours)

### UNIT V

Microbial

Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria). (12 Hours)

### TEXTBOOKS

1. Pelczar. M. J., Chan E.C.S. and Noel. R.K. (2023) Microbiology. 5<sup>th</sup> Edition, East West Press Private Limited, New Delhi, (Indian Edition)
2. Ananthanarayanan, Paniker and Kapil. (2022) Textbook book of Microbiology, 12<sup>th</sup> edition, Orient Black Swan,
3. Dubey R.C. and Maheswari, S. (2022). A textbook of Microbiology, 5<sup>th</sup> Edition. New Delhi: S. Chand & Co.
4. Prescott, Harley, Klein, (2022) Microbiology, 12<sup>th</sup> Edition, McGraw – Hill.
5. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC. Web Resources

Horst W. Doelle (2004). Microbial Metabolism and Biotechnology. Proceedings of an E-seminar organized by the International organization for Biotechnology and Bioengineering (IOBB)

<http://www.ejb.org/content>

[www.Biotech.kth.se](http://www.Biotech.kth.se) Electronic Journal of biotechnology

[https://www.cliffsnotes.com/study\\_guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology](https://www.cliffsnotes.com/study_guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology)

<https://bio.libretexts.org/@go/page/9188>

**REFERENCE BOOKS**

1. Madigan, Martinko, Bender, Buckley, and Stahl, (2021) Brock Biology of Microorganisms, 10<sup>th</sup> edition.
2. Gillespie, Bamford, (2022) Medical Microbiology and Infection at a Glance, 5<sup>th</sup> edition.
3. Boyd, R.F. (2016) General Microbiology, 2<sup>nd</sup> Edition., Times Mirror, Mosby College Publishing, St Louis.
4. Tortora, G.J., Funke, B.R., Case, C.L. (2018) Microbiology. An Introduction 13<sup>th</sup> Edition., A La Carte Pearson.
5. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7<sup>th</sup> Edition., McGraw Hill Inc. New York.
- 6.. C.A. Reedy., T.J. Beveridge., J.A.Breznak. G.A., Maerzluf, T.M. Schmidt., and L.R. Snyder. (2007). Methods for general and molecular Microbiology 3<sup>rd</sup> Edition, Wiley. ASM press.

| Course<br>Code<br>23UBOA21 | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|----------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                            | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                        | 2           | -           | 3           | 1           | 2        | 2           | 1           | -        | 2        | -        |
| CO2                        | 1           | -           | 2           | 1           | 3        | 2           | 2           | -        | 2        | -        |
| CO3                        | 3           | 2           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO4                        | 2           | 1           | 2           | 3           | 2        | 2           | 2           | 1        | 2        | 3        |
| CO5                        | 3           | 1           | 2           | 3           | 2        | 3           | 2           | 2        | 3        | 3        |

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

Dr.V.Jeyasinga  
Head of the Department

Dr.D. Karthiyaini  
Course Designer



## 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 (3<sup>rd</sup> Cycle) by NAAC

VIRUDHUNAGAR - 626 001

### B.Sc., Biotechnology

(2023-2024 onwards)

|                                      |   |                |                |
|--------------------------------------|---|----------------|----------------|
| Semester II                          | <b>FUNDAMENTALS OF<br/>MICROBIOLOGY PRACTICAL</b> | Hours/Week: 2  |                |
| Elective Course -1<br>practical - II |   | Credits: 1     |                |
| Course Code<br><b>23UBOA21P</b>      |   | Internal<br>40 | External<br>60 |

#### Course Outcomes

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

**CO1:** Develop Skills in Media Preparation, Isolation & Serial Dilution Techniques, and

Pure Culture Techniques general Laboratory safety & Sterilization Techniques.[K2]

**CO2:** Microscopically analyze the morphological features of Bacteria and fungi and define

various Staining Techniques.[K2]

**CO3:** Perform the Motility of organisms and identify bacteria using Biochemical tests.[K3]

**CO4:** Infer the result and complete the record work [K3]

**CO5:** identify and explain the salient features of the given spotters.[K3].

1. Sterilization techniques – Preparation of Media
2. Inoculation techniques- Pour plate, spread plate
3. Isolation of bacteria from various sources and dilution techniques.
4. Staining techniques: Simple, Gram's
5. Preparation of temporary mounts- Lacto-phenol cotton blue staining.
6. Motility tests: Hanging drop technique.
7. Biochemical characterization - catalase, oxidase, IMVIC test and TSI.
8. Antibiotic sensitivity test (demonstration)

#### Recommended Text

1. James G Cappucino and Chad T. Welsh (2023) Microbiology: A Laboratory Manual, 11<sup>th</sup> Edition. Pearson, New York.
2. Kannan. N (2002) Laboratory manual in General Microbiology. Panima Publications.
3. Sundararaj T (2005) Microbiology Lab Manual 1<sup>st</sup> Edition publications.

4. Gunasekaran, P. (2018) Laboratory manual in Microbiology. 2<sup>nd</sup> Edition. New Age International Ld., Publishers, New Delhi.
5. R C Dubey and D K Maheswari (2023). Practical Microbiology. 4<sup>th</sup> Edition. S. Chand Publishing.

### Reference Books

1. Atlas.R (2014) Principles of Microbiology, 2<sup>nd</sup> Edition. McGraw Hill.
2. Amita J, Jyotsna A and Vimala V (2018) Microbiology Practical Manual. 1<sup>st</sup> Edition, Elsevier India.
3. Talib VH (2019) Handbook Medical Laboratory Technology. 2<sup>nd</sup> Edition. CBS.
4. Wheelis M, (2008) Principles of Modern Microbiology, 1<sup>st</sup> Edition. Jones and Bartlett Publication.
5. Lim D. (1998) Microbiology, 2<sup>nd</sup> Edition, WCB McGraw Hill Publications.

| Course Code<br>23UBOA21P | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|--------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                          | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                      | 2           | -           | 3           | 1           | 2        | 2           | 1           | -        | 2        | -        |
| CO2                      | 1           | -           | 2           | 1           | 3        | 2           | 2           | -        | 2        | -        |
| CO3                      | 3           | 2           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO4                      | 2           | 1           | 2           | 3           | 2        | 2           | 2           | 1        | 2        | 3        |
| CO5                      | 3           | 1           | 2           | 3           | 2        | 3           | 2           | 2        | 3        | 3        |

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

Dr.V.Jeyasinga  
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VIRUDHUNAGAR - 626 001

### B.Sc. Biotechnology

(2023-2024 onwards)

|                                |  |                |                |
|--------------------------------|--|----------------|----------------|
| Semester II                    | <b>ORGANIC FARMING AND<br/>HEALTH MANAGEMENT</b> | Hours/Week: 2  |                |
| NME – 2                        |  | Credits: 2     |                |
| Course Code<br><b>23UBON21</b> |  | Internal<br>25 | External<br>75 |

#### Course Outcomes:

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

**CO1:** Learn the concepts of ecology, organic farming, Health and fitness (K1)

**CO2:** Know the techniques of Vermicomposting and learn the organic certification ,  
maintenance of good health (K1)

**CO3:** Describe the Principles and Policies in Organic farming , Role of physical activity in  
health ( K2)

**CO4:** Explain the Concept of composting and organic cultivation, Health and importance of  
wellbeing (K2)

**CO5:** Examine the significance of organic manures, Role of exercise and nutrition in Health-  
related fitness (K3)

#### UNIT I

Ecology and Environment – Principles of ecology – Ecosystem - Biotic and abiotic components and interaction – Farming, organic farming - concept, Principles, Types of organic farming, Benefits of organic farming. (6 Hours)

#### UNIT II

Composting – Microbial Compost – Vermicompost Types, Methods and Advantages Setup for vermicompost unit - Nutrition Garden – Ring garden – Double digging – Cultivating vegetables – Common medicinal herbs – Identification and Cultivation.

(6 Hours)

### **UNIT III**

Organic farming – Certification agencies – AGMARK, FSSAI, Halal certification – Participatory grading system (PGS) – Storage – Packing – Transportation – Marketing. Micro-enterprises – Self Help Groups – Economics of cultivation– Sustainability.  
(6 Hours)

### **UNIT IV**

Health: Concept of Health, changing concepts definitions of health, dimensions of health, concept of wellbeing, spectrum of health, determinants of health, ecology of health, right to health, responsibility for health, indicators of health.  
(6 Hours)

### **UNIT V**

Exercise and Health related fitness: Health related fitness, health promotion, physical activity for health benefits. Sports related fitness: Role of nutrition in sports, nutrition to athletic performance.  
(6 Hours)

### **TEXTBOOKS**

1. G.K. Veeresh, (2006) Organic farming, First edition, New Delhi, India Foundation Books in association with Centre for Environment Education.
2. Mangala rai, (2012) Handbook of Agriculture, Sixth Edition, ICAR New Delhi.
3. B.B. Sharma (2007) A Guide to Home Gardening, Second Edition, MIB India, New Delhi
4. Adrienne E. Hardman, 2009. Physical Activity and Health – The evidence explained, Second edition, Taylor, and Francis Group.

### **REFERENCE BOOKS**

1. F. H. King, Farmers of Forty Centuries: Permanent Organic Farming in China, Korea, and Japan (2011) Hardcover.
2. Gehlot D, Organic Farming: Components and Management 1st Edition, Publisher: M/s AGROBIOS (INDIA).

| Course Code<br><b>23UBON21</b> | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|--------------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                                | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                            | 1           | -           | 2           | 1           | 2        | 2           | 1           | -        | 2        | 2        |
| CO2                            | 2           | 3           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO3                            | 1           | -           | 2           | 1           | 2        | 1           | 2           | -        | 3        | 2        |
| CO4                            | 2           | -           | 3           | 2           | 2        | 1           | 2           | -        | 1        | 1        |
| CO5                            | 1           | -           | 2           | 2           | 3        | 2           | 2           | 1        | 2        | 1        |

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

Dr. V. Jeyasimga  
Head of the Department

Dr. Sinthia Ganeshan  
Course Designer



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**VIRUDHUNAGAR - 626 001**

### B.Sc., Biotechnology

(2023-2024 onwards)

|                                |                       |                |                |
|--------------------------------|-----------------------|----------------|----------------|
| Semester II                    | <b>FOOD CHEMISTRY</b> | Hours/Week: 2  |                |
| SEC -2                         |                       | Credits: 2     |                |
| Course Code<br><b>23UBOS21</b> |                       | Internal<br>25 | External<br>75 |

#### Course outcome:

On completion of the course the students will be able to

**CO1:** Know the basic concepts in Food chemistry. [K1]

**CO2:** Explain the food types, food additives, toxins and poisons in food. [K1]

**CO3:** Understand the food components, analytical techniques and the impact of natural poisons, toxins and fat on human health.[K2]

**CO4:** Describe the adulterants, toxins, poisons, pesticide residues, and to do first aid. [K2]

**CO5:** Apply the concepts of Food Chemistry to detect adulterants, toxins and analyse the food quality. [K3]

#### Unit – I

Sources of food, food groups. Functions of food, 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 Poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion)- Chemical poisons - First aid for Poison consumed victims. (6 Hours)

### **Unit – III**

Food additives - artificial sweeteners- Saccharin - Cyclamate and aspartame. Food flavours - esters, aldehydes, and heterocyclic compound. Food colours - Emulsifying agents-preservatives - leavening agents. Baking powder - yeast - taste makers - MSG and vinegar.

(6 Hours)

### **Unit – IV**

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

(6 Hours)

### **Unit – V**

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

(6 Hours)

### **References**

1. Swaminathan M., (1979) Food Science and Experimental foods, Ganesh, and Company.
2. Jayashree Ghosh, (2006) Fundamental concepts of Applied chemistry, S. Chand & Co. Publishers.
3. Thangamma Jacob, (1997) Textbooks of applied chemistry for Home Science and Allied Sciences, Macmillan.
4. Mohini Sethi. E.S. Rao., (2019) Food Science Experiment and Applications. 2<sup>nd</sup> Edition, CBS Publications and Distribution.

| Course Code<br>23UBOS21 | PO1         |             | PO2         |             | PO 3     | PO4         |             | PO 5     | PO 6     | PO 7     |
|-------------------------|-------------|-------------|-------------|-------------|----------|-------------|-------------|----------|----------|----------|
|                         | PSO<br>1. a | PSO<br>1. b | PSO<br>2. a | PSO<br>2. b | PSO<br>3 | PSO<br>4. a | PSO<br>4. b | PSO<br>5 | PSO<br>6 | PSO<br>7 |
| CO1                     | 3           | 3           | 3           | 1           | 2        | 2           | 1           | 2        | 2        | -        |
| CO2                     | 3           | -           | 2           | 1           | 3        | 2           | 2           | -        | 2        | -        |
| CO3                     | 3           | 2           | 2           | 2           | 2        | 2           | 2           | -        | 2        | 2        |
| CO4                     | 2           | 1           | 2           | 3           | 2        | 2           | 2           | 1        | 2        | 2        |
| CO5                     | 3           | 1           | 2           | 3           | 2        | 1           | 1           | 1        | 3        | 1        |

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

Dr.V.Jeyasinga  
Head of the Department

Dr.V.Jeyasinga  
Course Designer