V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM REGULATIONS AND SYLLABUS
(with effect from Academic Year 2023 - 2024)

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 15 UG Programmes (SF), 15 PG Programmes and 6 Ph.D.Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) &Tamil Nadu State Council for Higher Education (TANSCHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

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

A. CHOICE BASED CREDIT SYSTEM (CBCS)

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

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

UG PROGRAMMES

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

PG PROGRAMMES

Arts & Humanities	:	History, English, Tamil
Physical & Life Sciences	:	Mathematics, Physics, Chemistry, Zoology, Biochemistry, Home Science - Nutrition and Dietetics, Biotechnology, Computer Science, Computer Science (Data 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. Elective Courses
   - Generic Elective Courses
   - Discipline Specific Elective Courses (DSEC)
   - Non Major Elective Courses (NMEC)
3. Skill Enhancement Courses (SEC)
4. Environmental Studies (EVS)
5. Value Education
6. Self Study Courses (Online)
7. 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 Basic Accounting Principles	23UCON11 23UCON22	I II	Commerce (Aided)
Financial Literacy-I Financial Literacy -II	23UCON12 23UCON21	I II	Commerce (SF)
Self-Employment and Startup Business Fundamentals of Marketing	23UCCN11 23UCCN21	I II	Commerce CA (SF)

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	

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

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

Vision of the Institution

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

Mission of the Institution

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

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

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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 Biochemistry

To empower our students with scientific knowledge and skills and transform intellectually, socially and personally.

Mission of the Department of Biochemistry

The department of Biochemistry Discovers and transfers new knowledge about Biochemistry, basis of life through

- enhancing understanding of biochemistry, molecular biology, and science in general.
- providing an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to develop entrepreneur skill.
- extending the fundamental knowledge of biochemistry by leading innovative research and careers, to create a positive impact on society

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.

Program Educational Objectives (PEOs) of B.Sc. Biochemistry Programme
The students will be able to

- apply fundamental knowledge related to pure sciences in an interdisciplinary manner for providing innovative solutions to need based problems for national and global impact.
- analyze scientific data, draw objective conclusions related to Biochemistry and apply this knowledge for human welfare.
- gain domain knowledge and know-how for successful career in academia and industry.

Key Components of the Mission Statement	PEO1	PEO2	PEO3
Enhancing understanding of biochemistry, molecular biology, and science	√	√	√
To develop entrepreneur skill	√	√	√
Innovative research and careers, to create a positive impact on society	√	√	√

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 fullfillment 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.

PROGRAMME SPECIFIC OUTCOMES

On completion of B.Sc. Biochemistry programme the students will be able to

PO1 - *Disciplinary Knowledge*

PSO 1: Apply the fundamental knowledge of Biochemistry incorporated with knowledge in related courses that would enable them to comprehend the emerging and advanced biochemical concepts in life sciences to pursue higher studies with entrepreneurial outlook for better placement

PO2 – *Communication Skills*

PSO 2: Apply the acquired conceptual knowledge with communicative skills by connecting disciplinary and interdisciplinary aspects of Biochemistry, Microbiology, Biotechnology and Biology which can be extended to society

PO3 – *Scientific Reasoning and Problem Solving*

PSO 3.a: Evaluate the need and impact of scientific solutions on the environment and society, keeping in view of their sustainable development and to have entrepreneurial skills acquired by skill oriented course.

PSO3.b: Strengthen their biochemical, biological and chemical experimental techniques to meet future challenges in their career.

PO4 – *Critical Thinking and Analytical Reasoning*

PSO 4.a: Analyze the techniques, reactions and concepts in various fields of Biochemistry through the research activities and to provide valid suggestions to the industry and to the business world.

PSO 4.b: Apply the principles of various fields of biochemistry to provide cost effective solutions in life science related issues with the knowledge required to become good entrepreneur for the betterment of society.

PO5 – *Digital Literacy, Self - Directed and Lifelong Learning*

PSO 5.a: Use standard laboratory protocols of Biochemistry and biology and apply computers for data acquisition through available software.

PSO 5.b: Apply various technical knowledge with more parameters and update their academics as lifelong learning activities.

PO6 – *Co-operation/Team Work and Multicultural Competence*

PSO 6: Uphold leadership qualities, team spirit and good interpersonal skills in team Works for life and for business life.

PO7 –*Moral and Ethical Awareness*

PSO 7: Follow the global standards of codes of conduct in life science community and practice the imbibed moral values in their profession and society to maintain a sustainable environment.

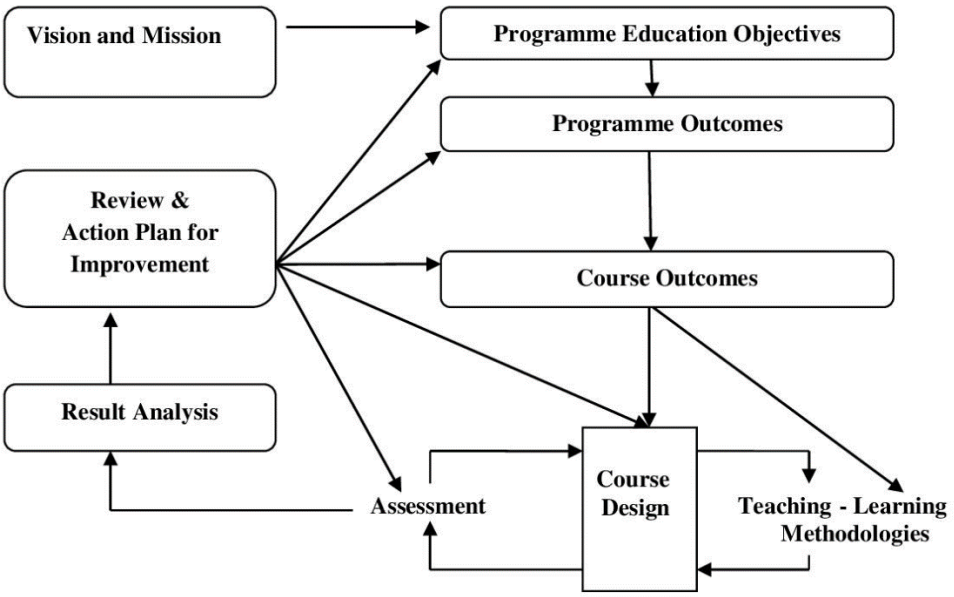
PO-PEO Mapping Matrix

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

PEOs / POs/PSOs	PEO1	PEO2	PEO3
PO1/PSO1.a	-	✓	✓
PO1/PSO1.b	✓	✓	✓
PO2/PSO2.a	✓	✓	-
PO2/PSO2.b	✓	✓	-
PO3/PSO3	-	✓	✓
PO4/PSO4.a	-	✓	✓
PO4/PSO4.b	✓	✓	-
PO5/PSO5	✓	✓	-
PO6/PSO6	-	✓	✓
PO7/PSO7	-	-	✓

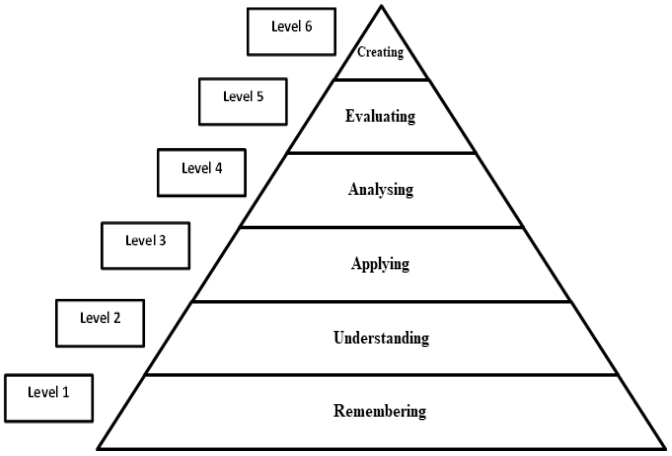
B.1.4 Course Outcomes (COs)

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



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

BLOOM'S TAXONOMY



CO – PO Mapping of Courses

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

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

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

ELIGIBILITY FOR ADMISSION

The candidate should have passed the Higher Secondary Examination conducted by the Board of Higher Secondary Education, Tamil Nadu or any other equivalent examination accepted by the Academic Council with Biology and Chemistry 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 Course
Part II	:	English
Part III	:	Core Courses
		Elective Courses • Generic Elective Courses • Discipline Specific Elective Courses
		Self Study Course - online
Part IV	:	Skill Enhancement Courses (SEC)
		Elective Course (NMEC)
		Environmental Studies Value Education
		Field Project/Internship
		Self Study Course - online
Part V	:	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/ 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	60	100
Practical	5	15	
Assignment	5	-	

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

B.2.2.Part I & PART III - Core Courses, Elective Courses (Generic, DSEC)

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

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

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

*Average of the two Practical Tests will be considered

Question Pattern for Internal Tests **Duration: 2 Hours**

Section	**Q. No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 4	Multiple Choice	4	4	1	4
B	5 -6	Internal Choice - Either … or Type	3	3	7	21
C	8 -9	Internal Choice - Either… or Type	2	2	10	20
					Total	**45***

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

SUMMATIVE EXAMINATION

Question Pattern **Duration: 3 Hours**

Section	**Q. No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 -10	Multiple Choice	10	10	1	10
B	11 - 15	Internal Choice – Either …or Type	5	5	7	35
C	16 - 18	Internal Choice – Either… or Type	3	3	10	30
					Total	**75**

PROJECT

Assessment by Internal Examiner Only

Internal Assessment

Distribution of Marks

Mode of Evaluation	:	Marks
Project work and Report	:	60
Presentation and Viva –Voce	:	40
Total	:	100

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

B.2.3.1 FOUNDATATION COURSE

INTERNAL ASSESSMENT
Distribution of Marks
Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K2 Level	:	5
Quiz	K1 Level	:	5
Total		**:**	**25**

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

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

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

SUMMATIVE EXAMINATION

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

Question Pattern **Duration: 2 Hours**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.3.2 Skill Enhancement Course - Entrepreneurial skills

INTERNAL ASSESSMENT ONLY
Distribution of Marks

Mode of Evaluation		**Marks**
Periodic Test	:	15
Assignment	:	5
Quiz	:	5
Model Examinations	:	60
Online Quiz(Multiple Choice Questions - K2 Level)	:	15
Total	**:**	**100**

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12

Total					**30**

Two Periodic Tests - Better of the two will be considered

Two Assignments - Better of the two will be considered

Two Quiz Tests - Better of the two will be considered

Question Pattern for Model Examination **Duration: 2 Hours**

Section	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A Q. No.(1-5)	Internal Choice – Either Or Type	5	5	6	30
B Q. No.(6- 8)	Internal Choice – Either Or Type	3	3	10	30
Total					**60**

B.2.3.3 Skill Enhancement Courses/ Non Major Elective Courses

INTERNAL ASSESSMENT

Distribution of Marks

Theory

Mode of Evaluation			**Marks**
Periodic Test		:	15
Assignment	K3 Level	:	5
Quiz	K2 Level	:	5
Total		**:**	**25**

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 3	Internal Choice - Either …or Type	3	3	5	15

B	4	Internal Choice – Either …or Type	1	1	10	10
	Total					**25***

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

SUMMATIVE EXAMINATION

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

Question Pattern **Duration: 2 Hours**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 7	Internal Choice – Either… or Type	2	2	10	20
	Total					**50**

B.2.4 PART IV- ENVIRONMENTAL STUDIES / VALUE EDUCATION

INTERNAL ASSESSMENT ONLY

Evaluation Pattern

Mode of Evaluation		**Marks**
Periodic Test	:	15
Assignment (Based on the listed activities) - K3 Level	:	10
Online Quiz (Multiple Choice Questions - K2 Level)	:	25
Poster Presentation - K3 Level		10
Report on student's Awareness creation on Environmental Protection /Ethical Values - K3 Level		10
Model Examination	:	30
Total	**:**	**100**

Three Assignment - Best of the three will be considered

Question Pattern for Periodic Tests **Duration: 1 Hour**

Section	**Types of Question**	**No. of Questions**	**No. of Questions**	**Marks for each**	**Total Marks**

			to be answered	**Question**	
A Q. No.(1- 3)	Internal Choice – Either Or Type	3	3	6	18
B Q. No.(4)	Internal Choice – Either Or Type	1	1	12	12
Total					**30***

Two Periodic tests - Better of the two will be considered
The total marks obtained in the Periodic test will be calculated for 15 marks

Question Pattern for Model Examination **Duration: 2 ½ Hours**

Section	**Q.No.**	**Types of Question**	**No. of Questions**	**No. of Questions to be answered**	**Marks for each Question**	**Total Marks**
A	1 - 5	Internal Choice - Either … or Type	5	5	6	30
B	6 - 8	Internal Choice – Either… or Type	3	3	10	30
	Total					**60***

*The total marks obtained in the Model Examination will be calculated for 30 marks

B.2.5 PART IV- Internship/ Field Project

Internship / Field Project is compulsory for II year UG Science Students

- **Internship:** A designated activity that carries one credit involving not less than 15 days of working in an organization under the guidance of an identified mentor
- **Field Project:** Students comprising of maximum 5 members in a team need to undertake project that involve conducting surveys inside/outside the college premises and collection of data from designated communities or natural places.
- Assessment by Internal Examiner only

Mode of Evaluation		**Marks**
Onsite Learning/Survey	:	50
Report	:	25
Viva-Voce	:	25
Total		**100**

B.2.6 SELF STUDY COURSE

B.2.6 .1 PART III - Core & Elective Courses Quiz – Online

- Assessment by Internal Examiner only
- Question Bank is prepared by the Faculty Members of the Departments for all the Core and Elective Courses offered in all the Semesters.
- No. of Questions to be taken 700.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in VI Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Distribution of Marks

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

Two Periodic Tests - Better of the two will be considered

B.2.6 .2 PART IV - Practice for Competitive Examinations – Online

Assessment by Internal Examiner only

- Question Bank prepared by the Faculty Members of the respective Departments will be followed.
- Multiple Choice Question pattern is followed.
- Online Test will be conducted in V Semester for 100 Marks.
- Model Examination is conducted after two periodic tests.

Subject wise Allotment of Marks

Subject		Marks
Tamil	:	10
English	:	10
History	:	10
Mathematics	:	10
Current affairs	:	10
Commerce, Law & Economics	:	10
Physical Sciences	:	10
Life Sciences	:	15
Computer Science	:	5
Food and Nutrition	:	5
Sports and Games	:	5
Total	**:**	**100**

Distribution of Marks

Mode of Evaluation		Marks
Periodic Test	:	25

Model Examination	:	75
Total	**:**	**100**

Two Periodic Tests - Better of the two will be considered

B.2.7. Part V – Extension Activities

INTERNAL ASSESSMENT ONLY
Distribution of Marks

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

*The marks obtained will be calculated for 100 marks

B.2.8 EXTRA CREDIT COURSES (OPTIONAL)

2.8.1 Extra Credit Course offered by the Department.

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

Distribution of Marks

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

Question Pattern for Model Examination

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

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

- The Courses shall be completed within the first V Semesters of the Programme.
- The allotment of credits is as follows **(Maximum of 10 credits)**

4weeks Course - 1 credit

8 weeks Course - 2 credits

12 weeks Course - 3 credits

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study, 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, Elective Courses (Generic Elective, DSEC Courses)
- Pass minimum for External Examination is 18 marks out of 50 marks for Skill Enhancement Courses and Non Major Elective Courses (NMEC).
- 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 2023-2024 onwards.

B.3 ASSESSMENT MANAGEMENT PLAN

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

B.3.1 Assessment Process for CO Attainment

Assessment is one or more processes carried out by the institution that identify, collect and prepare data to evaluate the achievement of Course Outcomes and Programme

Outcomes. Course Outcome is evaluated based on the performance of students in the Continuous Internal Assessments and in End Semester Examination of a Course. Target levels of attainment shall be fixed by the Course teacher and Heads of the respective departments.

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

Indirect Assessment – Done through Course Exit Survey.

CO Assessment Rubrics

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

CO Attainment

Direct CO Attainment

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

Target Setting for Assessment Method

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

Formula for Attainment for each CO

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

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

Attainment Levels of COs

Assessment Methods	**Attainment Levels**	
Internal Assessment	Level 1	50% of students scoring more than set target marks in Internal Assessment tools

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

Indirect CO Attainment

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

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

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

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

B.3.2 Assessment Process for Overall PO Attainment

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

PO Assessment Tools

Mode of Assessment	Assessment Tool	Description
Direct Attainment (Weightage -75%)	CO Assessment	This is computed from the calculated CO Attainment value for each Course

Indirect Attainment (Weightage - 25%)	Graduate Exit Survey 10%	At the end of the Programme, Graduate Exit Survey is collected from the graduates and it gives the opinion of the graduates on attainment of Programme Outcomes
	Co-curricular/ Extra-curricular activities 15%	For participation in Co-curricular/Extra-curricular activities during the period of their study.

Programme Articulation Matrix (PAM)

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7
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 ≥70%	Excellent
60% ≤ Attainment Value < 70%	Very Good
50% ≤ Attainment Value < 60%	Good
40% ≤ Attainment Value < 50%	Satisfactory
Attainment Value <40%	Not Satisfactory

Level of PO Attainment

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

B.3.3 Assessment Process for PEOs

The curriculum is designed so that all the Courses contribute to the achievement of PEOs. The attainment of PEOs is measured after 5 years of completion of the Programme only through indirect methods.

Target for PEO Attainment

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

Attainment of PEOs

Assessment Criteria & Tool	Weightage
Record of Employment	10
Progression to Higher Education	20
Record of Entrepreneurship	10

Feedback from Alumnae	30
Feedback from Parents	10
Feedback from Employers	20
Total Attainment	**100**

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

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

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

Expected Level of Attainment for each of the Programme Educational Objectives

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

Level of PEO Attainment

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

C. PROCESS OF REDEFINING THE PROGRMME EDUCATIONAL OBJECTIVES

The College has always been involving the key stakeholders in collecting information and suggestions with regard to curriculum development and curriculum revision. Based on the information collected the objectives of the Programme are defined, refined and are inscribed in the form of PEOs. The level of attainment of PEOs defined

earlier will be 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. Biochemistry Programme.

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VIRUDHUNAGAR

Quality Education with Wisdom and Values

BACHELOR OF SCIENCE BIOCHEMISTRY (2021)

Outcome *Based Education with Choice Base Credit System*

Programme Structure - Allotment of Hours and Credits

For those who join in the academic Year 2023-2024

Components	**Semester**						**Total Number of Hours (Credits)**
	I	**II**	**III**	**IV**	**V**	**VI**	
Part I : Tamil /Hindi	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24 (12)

Part II : English	6 (3)	6(3)	6 (3)	6 (3)	-	-	24 (12)
Part III : Core Courses, Elective Courses & Self Study Course							
Core Course	5 (5)	5 (5)	5 (5)	4 (4)	6 (5)	6(5)	31 (29)
Core Course	-	-	-	-	5 (4)	6 (5)	11 (9)
Core Course	-	-	-	-	5 (4)	5(5)	10(9)
Core Course Practical	3(2)	3 (2)	3 (2)	3 (2)	3 (2)	3 (2)	18(12)
Core Course Project	-	-	-	-	1 (3)	-	1 (3)
Elective Course (DSEC)	-	-	-	-	5(4)	5 (5)	10 (9)
Elective Course (DSEC Practical)	-	-	-	-	3(2)	3(2)	6(4)
Elective Course I (Allied)	4 (3)	4 (3)	-	-	-	-	8(6)
Elective Course I Practical I(Allied)	2(1)	2(1)	-	-	-	-	4 (2)
Elective Course II(Allied)	-	-	4 (3)	4 (3)	-	-	8(6)
Elective Course II Practical II(Allied)	-	-	2 (1)	2 (1)	-	-	4 (2)
Self Study Course	-	-	-	-	-	0 (1)	0 (1)
Part IV : Skill Enhancement Courses, Elective Courses, , Environmental Studies, Value Education, Self Study Course &Internship/ Field Project							
SEC	2 (2)	-	1 (1)	2 (2)	-	-	5(5)
SEC	-	2 (2)	2 (2)	2 (2)	-	2 (2)	8 (8)
Elective Course(NME)	2 (2)	2 (2)	-	-	-	-	4 (4)
Value Education	-	-	-	-	2 (2)	-	2 (2)
Environmental Studies	-	-	1 (0)	1 (2)	-	-	2 (2)
Self Study Course	-	-	-	-	0 (1)	-	0 (1)
Internship/ Field Project	-	-	-	-	0 (1)	-	0 (1)
Part V : Extension Activities	-	-	-	-	-	0 (1)	0 (1)
Total	**30 (21)**	**30 (21)**	**30 (20)**	**30 (22)**	**30 (28)**	**30 (28)**	**180 (140)**
Extra Credit Course (Self Study Course)	-	-	-	-	0(2)	-	0(2)

DSEC: Discipline Specific Elective Course SEC: Skill Enhancement Course

NMEC: Non Major Elective Course

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B.Sc. BIOCHEMISTRY - 2021
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.	**Part I**		Tamil/ Hindi	23UTAG11/ 23UHDG11	6	3	3	25	75	100
2.	**Part II**		English	23UENG11	6	3	3	25	75	100
3.	**Part III**	Core Course -1	Nutritional Biochemistry	23UBCC11	5	5	3	25	75	100
4.		Core Course -2 Practical I	Nutritional Biochemistry Practical	23UBCC11P	3	2	3	40	60	100
5.		Elective Course I	Organic, Inorganic and Physical Chemistry – I	23UCHA11	4	3	3	25	75	100
6.		Elective Course I Practical I	Volumetric Analysis Practical	23UCHA11P	2	1	3	40	60	100
7.	**Part IV**	NME -1	Nutrition and Health	23UBCN11	2	2	3	25	75	100
8.		SEC-1 Foundation Course	Fundamentals of Biochemistry	23UBCF11	2	2	3	25	75	100
				Total	**30**	**21**				**800**

B.Sc. BIOCHEMISTRY - SEMESTER II

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	23UTAG21/ 23UHDG21	6	3	3	25	75	100
2.	**Part II**		English	23UENG21	6	3	3	25	75	100
3.	**Part III**	Core Course -3	Cell Biology	23UBCC21	5	5	3	25	75	100
4.		Core	Cell Biology	23UBCC21P	3	2	3	40	60	100

		Course -4 Practical II	Practical							
5.		Elective Course-I	Organic, Inorganic and Physical Chemistry – II	23UCHA21	4	3	3	25	75	100
6.		Elective Course–I Practical - II	Organic Analysis Practical	23UCHA21P	2	1	3	40	60	100
7.	**Part IV**	NME-2	Life Style Diseases	23UBCN21	2	2	3	25	75	100
8.		SEC-2	Microbial Techniques	23UBCS21	2	2	3	25	75	100
				Total	**30**	**21**				**800**

B.Sc. BIOCHEMISTRY - 2024
PROGRAMME CONTENT
SEMESTER III

S.No.	**Components**		**Title of the Course**	**Course Code**	**Hours Per Week**	**Credits**	**Exam. Hours**	**Marks**		
								Int.	**Ext.**	**Total**
1.	**Part I**		Tamil/Hindi	23UTAG31/ 23UHDG31	6	3	3	25	75	100
2.	**Part II**		English	23UENG31	6	3	3	25	75	100
3.	**Part III**	Core Course - 5	Biomolecules	23UBCC31	5	5	3	25	75	100
4.		Core Course Practical - 3	Biomolecules Practical	23UBCC31P	3	2	3	40	60	100

5.		Elective Course	Allied Botany - I	23UBIA31	4	3	3	25	75	100
6.		Elective Course Practical	Allied Botany Practical - I	23UBIA31P	2	1	3	40	60	100
7.	**Part IV**	SEC – 3	Bioentrepreneurship	23UBCS31	1	1	2	100	-	100
8.		SEC- 4	Medical Laboratory Technology	23UBCS32	2	2	2	25	75	100
9.			Environmental Studies	23UGES41	1	-	-	-	-	-
				Total	**30**	**20**				**800**

B.Sc. BIOCHEMISTRY - SEMESTER IV

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part I**		Tamil/ Hindi	23UTAG41/ 23UHDG41	6	3	3	25	75	100
2.	**Part II**		English	23UENG41	6	3	3	25	75	100
3.	**Part III**	Core Course – 6	Biochemical Techniques	23UBCC41	4	4	3	25	75	100
4.		Core Course	Biochemical Techniques	23UBCC41P	3	2	3	40	60	100

		Practical - 4	Practical							
5.		Elective Course	Allied Zoology	23UZYA41	4	3	3	25	75	100
6.		Elective Course Practical	Allied Zoology Practical	23UZYA41P	2	1	3	40	60	100
7.	**Part IV**	SEC - 5	Basics of Forensic Science	23UBCS41	2	2	2	25	75	100
8.		SEC- 6	Tissue Culture	23UBCS42	2	2	2	25	75	100
9.			Environmental Studies	23UGES41	1	2	-	100	-	100
				Total	**30**	**22**				**900**

SEMESTER V

S.No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part III**	Core Course -5	Enzymes	23UBCC51	6	5	3	25	75	100
2.		Core Course -6	Intermediary Metabolism	23UBCC52	5	4	3	25	75	100
3.		Core Course - 7	Clinical Biochemistry	23UBCC53	5	4	3	25	75	100
4.		Core Course Practical - 5	Clinical Biochemistry	23UBCC51P	3	2	3	40	60	100

			Practical							
5.		Core Course Project	Project	23UBCC54PR	1	3	-	100	-	100
6.	**Part III**	Elective Course (DSEC)	Immunology / Biochemical Pharmacology	23UBCE51 / 23UBCE52	5	4	3	25	75	100
7.		Elective Course (DSEC Practical)	Immunology and Microbiology Practical	23UBCE51P	3	2	3	40	60	100
8.	**Part IV**		Value Education	23UVEG51	2	2	2	100	-	100
9.		Self Study Course	Practice for Competitive Examinations	23UCEG51	-	1	-	100	-	100
10.			Field Project / Internship	23UBCI51G	-	1	-	100	-	100
				Total	**30**	**28**				**1000**
11.	Extra Credit Course		Emergency Care	23UBCO51	-	2	3	100	-	100

SEMESTER VI

S. No.	Components		Title of the Course	Course Code	Hours Per Week	Credits	Exam. Hours	Marks		
								Int.	Ext.	Total
1.	**Part III**	Core Course -8	Molecular Biology	23UBCC61	6	5	3	25	75	100
2.		Core Course -9	Human Physiology	23UBCC62	6	5	3	25	75	100
3.		Core Course - 10	Plant Biochemistry and plant Therapeutics	23UBCC63	5	5	3	25	75	100
4.		Core Course Practical - 6	Molecular Biology and Haematology Practical	23UBCC61P	3	2	3	40	60	100
5.		Elective Course DSEC	Bioinformatics / Biotechnology	23UBCE61 / 23UBCE62	5	5	3	75	25	100
6.		Elective Practical DSEC Practical	Bioinformatics Practical	23UBCE61P	3	2	3	40	60	100
7.		Self Study Course	Core Course Quiz - online	23UBCQ61	-	1	-	100	-	100
8.	**Part IV**	SEC – 7	Medical Coding	23UBCS61	2	2	2	25	75	100
9.	**Part V**		Extension Activities		-	1	-	100	-	100
				Total	**30**	**28**				**900**

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VIRUDHUNAGAR - 626 001

B.Sc. Biochemistry
(2023-2024 onwards)

Semester I	**NUTRITIONAL BIOCHEMISTRY**	Hours/Week: 5	
Core Course - 1		Credits: 5	
Course Code **23UBCC11**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Define the concept of basic food groups, nutrients, food additives and functional foods. [K1]

CO2: Describe the specific functions of nutrients in foods, functional foods, food groups, food pyramid and food additives. [K2]

CO3: Classify the food groups, nutrients, food additives, functional foods and its significance. [K2]

CO4: Explain the importance of calorific value, SDA, Biological value of protein, balance diet, food colors and pigments. [K3]

CO5: Identify the effect of BMR, nutrient deficiency, junk foods, food additives and functional foods. [K3]

UNIT I

Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods. Energy- definition, Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI. (15 Hours)

UNIT II

Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures. (15Hours)

UNIT III

Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects. (15 Hours)

UNIT IV

Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives. (15 Hours)

UNIT V

Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.

(15 Hours)

TEXT BOOKS

1.Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.

2.Arumugam, N. (2014). Biochemistry, 5 th Edition, Nagercoil: Saras Publications.

3.Garrow, JS,James WPT and Ralph A (2000). Human nutrition and dietetics(10th edition) Churchill Livingstone.

REFERENCE BOOKS

1. Denise R. Ferrier. (2020). Lippincott Illustrated Reviews Biochemistry, South Asian Edition, New Delhi: Wolters kluwer India pvt ltd.
2. Sathyanarayana, U. (2020). Biochemistry, 5 th Edition, Netherland: Elsvier.
3. Sharma, D.C. (2017). Nutritional Biochemistry, New Delhi: CBS publishers & distributors.
4. Singh, S.P. (2006). Principles of Biochemistry, New Delhi: CBS publishers.
5. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
6. Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010
7. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.
8. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK.

Course Code 23UBCC11	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO 1	PSO 2	PSO 3.a	PSO 3.b	PSO 4a	PSO 4 b	PSO 5a	PSO 5b	PSO 6	PSO 7
CO 1	2	3	2	1	1	3		3	-	2
CO 2	2	1	2	2	3	3	-	2	-	2
CO 3	3	2	2	3	3	2	-	2	-	3
CO 4	2	3	2	3	2	2	-	3	-	2
CO 5	2	2	2	2	2	2	-	3	-	3

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

Dr.P.Annapoorani
Head of the Department

Mrs.P.Ramalakshmi
Course Designer

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B.Sc Biochemistry
(2023-2024 onwards)

Semester I	**NUTRITIONAL BIOCHEMISTRY PRACTICAL**	Hours/Week: 3	
Core Course – 2 Practical I		Credits: 2	
Course Code **23UBCC11P**		Internal 40	External 60

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Write the principles and procedures in qualitative and quantitative analysis of biochemical metabolites. [K2]

CO2: Prepare the macronutrients from rich sources. [K2]

CO3: use colorimetry to detect the concentration of unknown compounds using a standard graph. [K3]

CO4: Estimate the biomolecules in biological samples and complete the record work. [K3]

CO5: Identify the role of reagents and biochemical techniques in nutritional analysis. [K3]

TITRIMETRY **(20 Hours)**

1. Estimation of ascorbic acid in a citrus fruit.
2. Estimation of calcium in milk.
3. Estimation of glucose by Benedict's method in honey.
4. Estimation of phosphorous (Plant source)

BIOCHEMICAL PREPARATIONS **(15 Hours)**

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.
6. Starch from potato.
7. Casein and Lactalbumin from milk.

GROUP EXPERIMENT **(10 Hours)**

8.Determination of ash content and moisture content in food sample

9.Extraction of lipid by Soxhlet's method.

TEXT BOOKS

1.Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge International Publishers, 2011,

2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

REFERENCE BOOKS

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016

2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.

3 Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.

4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.

4. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 3rd edition. Chand Publishers.

Course Code 23UBCC11P	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO 1	PSO 2	PSO 3.a	PSO 3.b	PSO 4a	PSO 4 b	PSO 5a	PSO 5b	PSO 6	PSO 7
CO 1	3	3	2	3	3	2	3	3	3	2
CO 2	3	2	3	3	3	3	3	3	3	1
CO 3	3	3	2	3	2	3	3	3	3	2
CO 4	3	3	3	3	3	3	3	3	3	2
CO 5	3	3	3	3	3	3	3	2	3	3

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

Dr.P.Annapoorani
Head of the Department

Mrs.P.Ramalakshmi
Course Designer

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An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai
Re-accredited with 'A' Grade (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc. Biochemistry
(2023 -2024 onwards)

Semester I	**ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – I**	Hours/Week: 4	
Elective Course -I		Credits: 3	
CourseCode **23UCHA11**		Internal 25	External 75

COURSE OUTCOME

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

CO1 : know the theories of Chemical bonding, Fuel gases, hybridisation, antibiotics and principles of volumetric analysis. [K1]

CO2 : recognize the bonding and antibonding orbitals, Silicones, Polar effect, structure of drugs and uses. [K2]

CO3 : explain the nuclear reactions, manufacture of fuel gas, hyperconjugation, artificial sweeteners, distillation and crystallisation. [K2]

CO4 : understand the nuclear fiction and fusion reactions, fertilizers, geometry of the molecules, and chromatography. [K3]

CO5 : identify the applications of radioactive isotopes, NPK fertilizers, types of reactions, organic halogen compounds, and the types of chromatography. [K3]

UNIT I

Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M.O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

(12 Hours)

UNIT II

Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).

Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate. **(12 Hours)**

UNIT III

Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

(12 Hours)

UNIT IV

Drugs and Speciality Chemicals

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon. **(12 Hours)**

UNIT V:

Analytical Chemistry

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography. **(12 Hours)**

Recommended Text

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.
3. ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition,2012.
4. P.L.Soni, H.M.Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

Reference Books

1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company,
   New Delhi, twentieth edition, 2007.
2. B.K,Sharma, Industrial Chemistry; GOEL publishing house,Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Course Code 23UCHA11	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	3	2	2	2
CO2	2	2	2	2	1	1	1
CO3	2	1	2	2	1	2	1
CO4	2	1	2	3	1	2	2
CO5	2	1	2	2	2	2	1

Dr.M.Dhanalakshmi — **Head of the Department**

Dr.M.Amutha — **Course Designer**

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B.Sc Biochemistry
(2023 -2024 onwards)

Semester I	**VOLUMETRIC ANALYSIS PRACTICAL**	Hours/Week: 2	
Elective Course I Practical I		Credits: 1	
CourseCode **23UCHA11P**		Internal 40	External 60

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

CO1 : understand the use of Standard flash, pipette and burette [K2]

CO2 : carry out the reactions and find out the values in titrations. [K2]

CO3 : find the results of Volumetric titrations. [K3]

CO4 : apply their skill in the analysis of hardness using EDTA [K3]

CO5 : identify the Chemical constituents in allied chemical products. [K3]

VOLUMETRIC ANALYSIS

1. Estimation of sodium hydroxide using standard sodiumcarbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standardsodium hydroxide.
6. Estimation of magnesium using EDTA. (Demonstration only) (30 Hours)

Reference Books

V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic PrinciplesofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Code 23UCHA11P	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	3	2	2	2
CO2	2	2	2	2	1	1	1
CO3	2	1	2	2	1	2	1
CO4	2	1	2	3	1	2	2
CO5	2	1	2	2	2	2	1

Dr.M.Dhanalakshmi
Head of the Department

Dr.J.Kavitha
Course Designer

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B.Sc Biochemistry
(2023-2024 onwards)

Semester I	**NUTRITION AND HEALTH**	Hours/Week: 2	
NME- 1		Credits: 2	
Course Code **23UBCN11**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Define the concept of health, nutrition and diet. [K1]

CO2: Describe the different types of nutrients and its sources. [K1]

CO3: Explain the functions of nutrients on health and RDA. [K2]

CO4: Identify the properties and deficiencies of nutrients. [K2]

CO5: Relate the role of proteins, carbohydrates, vitamins and minerals on health. [K3]

UNIT I:

Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value. (6 Hours)

UNIT II:

Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. (6 Hours)

UNIT III:

Sources and functions of dietary fats, role of fats in health and diseases. (6 Hours)

UNIT IV:

Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc. (6 Hours)

UNIT V:

Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications. (6 Hours)

TEXT BOOKS

1. Arumugam, N. (2014). Biochemistry, 5 th Edition, Nagercoil: Saras Publications.
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone

REFERENCE BOOKS

1. Denise R. Ferrier. (2020). Lippincott Illustrated Reviews Biochemistry, South Asian Edition, New Delhi: Wolters kluwer India pvt ltd.
2. Sathyanarayana, U. (2020). Biochemistry, 5 th Edition, Netherland: Elsvier.
3. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall
4. Nagini, S. (2007). Textbook of Biochemistry, 2 nd Edition, Chennai: Scitech publications.
5. Sharma, D.C. (2017). Nutritional Biochemistry, New Delhi: CBS publishers & distributors.

Course Code 23UBCN11	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO 1	PSO 2	PSO3 3.a	PSO3 3.b	PSO 4a	PSO 4 b	PSO 5a	PSO 5b	PSO 6	PSO 7
CO 1	2	3	2	1	1	3	-	1	-	2
CO 2	2	1	2	2	3	3	-	1	-	2
CO 3	3	2	2	3	3	2	-	1	-	2
CO 4	2	3	2	3	2	2	-	1	-	2
CO 5	2	2	2	2	2	2	-	1	-	2

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

Dr.P.Annapoorani
Head of the Department

Dr.P.Annapoorani
Course Designer

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B.Sc. Biochemistry
(2023-2024 onwards)

Semester I	**FUNDAMENTALS OF BIOCHEMISTRY**	Hours/Week: 2	
SEC – 1 Foundation Course		Credits: 2	
Course Code **23UBCF11**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Define the terms frequently used in Biochemistry. [K1]

CO2: Explain the basics of biochemistry. [K1]

CO3: Identify the fundamental elements of biochemistry. [K2]

CO4: Write the basic principle applied in the biological field. [K2]

CO5: Describe the significance of biochemistry related concepts. [K2]

UNIT I:

Biochemistry - Introduction, history and scope. Branches of biochemistry, applications of biochemistry, role of biochemistry in various fields. (6 Hours)

UNIT II:

Origin of life, chemical composition of life, structure of atoms, molecules and chemical bonds. Atomic number, types of chemical bonds and its biological importance. Water - structure, property and functions. (6 Hours)

UNIT III :

Enzymes- Definition, nomenclature, classification and functions. Introduction to metabolism- anabolism and catabolism, ATP. Introduction to Immunology - antigen and antibodies - definition and structure. (6 Hours)

UNIT IV:

Introduction to Basic Laboratory Operations - identification and use of common laboratory glassware, laboratory reagents and equipment. Care and maintenance of common laboratory instruments. Basic needs of a biochemistry laboratory, safety measures in laboratory. (6 Hours)

UNIT V:

Biomolecules - carbohydrates, amino acids, lipids, nucleic acids - classification and its importance. Basic principles of pH meter, Colorimetry, Electrophoresis and Chromatography (Paper chromatography only) (6 Hours)

TEXT BOOKS

1. Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7thedition S.Chand&CompanyLtd.
2. Biochemistry, U. Sathyanarayana & U. Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.

REFERENCE BOOKS

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company.
2. Voet.D,Voet.J.G.and Pratt, C. W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
3. Zubay G.L,*et.al*., 1995, Principles of Biochemistry, 1st edition, WmC. Brown Publishers.
4. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

Course Code 23UBCF11	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO1	PSO 2	PSO3 3.a	PSO3 3.b	PSO 4a	PSO4 b	PSO 5a	PSO5b	PSO6	PSO 7
CO 1	2	3	2	1	3	1	3	3	-	2
CO 2	2	1	2	2	3	1	2	2	-	2
CO 3	3	2	2	3	3	2	2	2	-	3
CO 4	2	3	2	3	2	2	2	3	-	2
CO 5	2	2	2	2	2	2	1	3	-	3

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

Dr.P.Annapoorani
Head of the Department

Dr. R. Renuka
Course Designer

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B.Sc. Biochemistry
(2023-2024 onwards)

Semester II	**CELL BIOLOGY**	Hours/Week: 5	
Core Course - 3		Credits: 5	
Course Code **23UBCC21**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, cytoskeleton, genome organization, chromatin, biomembranes, cell division, cancer cells and cell junctions. [K1]

CO2: Understand the organization of cell organelles, genome, cytoskeleton and chromatin, transport systems, cell cycle and cell junctions . [K2]

CO3: Explain the structure, composition and functions of prokaryotic, eukaryotic and cancer cells, biomembranes, cell division and extracellular matrix [K2]

CO4: Interpret the types and significance of cells and cell cycle, cell division, biomembranes and transport systems, chromatin,chromosomes and desmosomes . [K3]

CO5: Illustrate the structure and biological role of cell organelles, cytoskeleton, extracellular matrix, cellular interactions and genome organization [K3]

UNIT I

Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions (15 Hours)

UNIT II

Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome -prokaryotic, and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes. (15 Hours)

UNIT III

Biomembranes-Structural organization of bilipid layer model and basic functions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.

(15Hours)

UNIT IV

Cell cycle-Definition and Phases of Cell cycle – Cell division – Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells. (15 Hours)

UNIT V

Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions- Types-gap junctions, tight junctions and Desmosomes. (15Hours)

TEXT BOOKS

1.Arumugam. N, Cell biology. Saras publication (10ed, paperback), 2019

2.Devasena. T. Cell Biology. Oxford University Press India - ISBN: 9780198075516, 0198075510, 2012

3.Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4”ed). Garland Science.

REFERENCE BOOKS

1. S.C,R. Cell Biology. New age Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886, 2008

2.Cooper,G.A.TheCell:AMolecularApproach.SinauerAssociates,Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013

3...E.M.F.,D.R,Cel land Molecula rBiology.Lippincott Williams Wilkins Philadelphia - ISBN: 0781734932 9780781734936, 2006

4. LodishH.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.

Course Code 23UBCC21	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO2**	**PSO3 3.a**	**PSO 3.b**	**PSO 4a**	**PSO 4 b**	**PSO 5a**	**PSO 5b**	**PSO6**	**PSO 7**
CO 1	3	2	1	2	3	2	1	2	1	2
CO 2	3	2	1	2	3	2	1	2	1	2
CO 3	3	2	1	2	3	2	1	2	1	2
CO 4	3	2	1	2	3	2	1	2	1	2
CO 5	3	2	1	2	3	2	1	2	1	2

Dr.P.Annapoorani
Head of the Department

Dr.R.Salini
Course Designer

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B.Sc. Biochemistry
(2023-2024 onwards)

Semester II	**CELL BIOLOGY PRACTICAL**	Hours/Week: 3	
Core Course – 4 Practical II		Credits: 2	
Course Code **23UBCC21P**		Internal 40	External 60

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Write the principles and procedure of slides preparation, mitosis, meiosis and staining methods. [K2]

CO2: Prepare the slides and view eukaryotic and prokaryotic cells and organelles. [K2]

CO3: Identify the stages of mitosis & meiosis, organelles and cells by staining methods. [K3]

CO4: Visualize the eukaryotic and prokaryotic cells, nucleus and mitochondria by staining methods and complete the record work. [K3]

CO5: Identify the functions of cells, organelles and stages of cell division. [K3]

I MICROSCOPY AND STAINING TECHNIQUES (20 Hours)

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. Staining and visualization of mitochondria by Janus green stain

II GROUP EXPERIMENT (15 Hours)

7.Identification of different stages of mitosis in onion root tip

8.Identification of different stages of meiosis in onion bulb

III SPOTTERS **(10 Hours)**

9. a) **Cells**: Nerve, plant and Animal cell

   b) **Organelles**: Mitochondria, Chloroplast, Endoplasmic reticulum,

   c) **Mitosis stages**–Prophase, Anaphase, Metaphase, Telophase

TEXT BOOKS

1.Rickwood, DandJ.R. Harris cell Biology: Essential Techniques, Johnwikey1996.

2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.

3.Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2nd Edition.

REFERENCE BOOKS

1) Essential practical handbook of Cell biology, Genetics and Microbiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017

2) Cell biology Practical, Dr.Venugupta ISBN 8193651219, Prestige publisher, 1st Jan 2018.

3) Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987.

Web resources

1.http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

2. https://www.microscopemaster.com/organelles.html

3. https://www.pdfdrive.com/biochemistry-books.htm

4.http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.

5. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

6.https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-geneticdiversity/a/phases-of-meiosis

Course Code 23UBCC21P	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO 1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO 4 b**	**PSO 5a**	**PSO 5b**	**PSO 6**	**PSO 7**
CO 1	2	2	2	2	2	3	1	2	1	1
CO 2	2	2	2	2	2	3	1	2	1	1
CO 3	2	2	2	2	2	3	1	2	1	1
CO 4	2	2	2	2	2	3	1	2	1	1
CO 5	2	2	2	2	2	3	1	2	1	1

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

Dr.P.Annapoorani
Head of the Department

Dr.R.Gloria Jemmi Christobel
Course Designer

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B.Sc. Biochemistry
(2023 -2024 onwards)

Semester II	**ORGANIC, INORGANIC AND PHYSICAL CHEMISTRY – II**	Hours/Week: 4	
Elective Course - I		Credits: 3	
Course Code **23UCHA21**		Internal 25	External 75

COURSE OUTCOME

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

CO1 : know about the basic concepts in organic, inorganic and physical chemistry [K1]

CO2 : . understand the chemical constituent in oils, fats, soaps, detergents, biomolecules, colloids and pollutants [K2]

CO3 : identify the methods of preparation for organic and inorganic compounds, sources, effects and control measures of pollutions, methods for removal of salt from water [K2]

CO4 : comprehend the classification of biomolecules, colloids, catalyst, pollutions, application of adsorption and biomolecule [K3]

CO5 : analyze the oils, fats and biomolecules functions, sources of pollutions, characteristics of catalysts and the effects with control measures for various pollution [K3]

UNIT I

1. Oils and Fats – Definition – Properties - Distinction between them -Hydrogenation, Hydrogenolysis, Rancidification and Drying of oils – Preparation of Vanaspathi- Analysis of oils and Fats – Saponification and iodine number.
2. Soaps and Detergents

Soap – Definition – Different types – Manufacture of soap – Kettle process - Detergent – Definition – Synthetic detergents – examples – Distinction between soaps and detergents.

(12Hours)

UNIT II

1. Carbohydrates – classification – Differences between glucose and fructose – Inter conversion of glucose and fructose – Haworth structure of glucose and fructose- Differences between starch and cellulose – Derivatives of cellulose and their uses.
2. Amino acids – classification – preparation of α-amino acids– properties – Zwitterion – isoelectric point .
3. Proteins – classification – Biological function – colour reaction of proteins.
4. Nucleic acids – RNA and DNA – Biological functions (Elementary idea only).

(12Hours)

UNIT III

1. Colloids – Definition and classification.
2. Sols – Different types – examples –Dialysis – electro osmosis – electrophoresis – stability of colloids- Gold number.
3. Emulsion – Types of emulsion – Emulsifier – Examples – Cleansing action of soap.
4. Gels – Types of gels – examples – Properties – Hydration – Swelling – syneresis – Thixotropy.
5. Applications of colloids. **(**12Hours)

UNIT IV

1. Adsorption – Characteristics – Types of adsorption and comparison – Factors influencing adsorption – Langmuir and Freundlich adsorption isotherm (No derivation) – Applications of adsorption.
2. Catalysts – Characteristics- Different types with examples – Catalytic poisoning – promoters with examples. (12 Hours)

UNIT V

1. Air pollution – Definition – sources of air pollution –classification and effects of air pollutants – Ozone layer- formation and depletion – Green house effect – Acid rain – Preventive measures of air pollution.
2. Water pollution –types and sources of water pollution –classification and effects of water pollutants-control of water pollution-Desalination of sea water by electrodialysis and reverse osmosis.
3. Radioactive pollution – sources – nuclear waste disposal – Effects of radiations.

(12 Hours)

TEXT BOOKS

1. Soni P.L.,(2008).*Text book of Organic Chemistry*, Latest Edition.Sultan Chand & Sons.
2. Soni P.L.,(2008).*Text book of Inorganic Chemistry*, Latest Edition. Sultan Chand & Sons.
3. Arun Bahl, Bahl B.S &.Tuli G.D, (2009) *Essentials of Physical chemistry*, S.Chand & Company Ltd., New Delhi.

REFERENCE BOOKS

1. Jain, M.K. & Sharma, S.C. (2016). *Modern Organic Chemistry*, 1st Edition. New Delhi: Vishal Publishing Co.
2. Madan .R.D, *Modern Inorganic Chemistry*, S.Chand & Company Ltd.

Course Code 23UCHA21	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	3	2	2	2
CO2	2	2	2	2	1	1	1
CO3	2	1	2	2	1	2	1
CO4	2	1	2	3	1	2	2
CO5	2	1	2	2	2	1	1

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

Dr.M.Dhanalakshmi
Head of the Department

Mrs.R.Nagasathya
Course Designer

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B.Sc. Biochemistry
(2023 -2024 onwards)

Semester II	**ORGANIC ANALYSIS PRACTICAL**	Hours/Week: 2	
Elective Course I Practical-II		Credits: 1	
Course Code **23UCHA21P**		Internal 40	External 60

COURSE OUTCOME

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

CO1 **:** remember the functioned group of Organic Compounds. [K2]

CO2 **:** carry out the reactions and find out the elements of Organic compounds. [K2]

CO3 **:** determine the functional group and distinguish the aliphatic and aromatic compunds.[K3]

CO4 **:** apply the skill in the analysis of functional group of Organic compunds. [K3]

CO5 **:** identify the chemical constituents of Organic compunds. [K3]

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), ester, aldehydeand glucose].

(b) Detection of elements (N, S, Halogens).

(c) To distinguish between aliphatic and aromaticcompounds.

(d) To distinguish – Saturated and unsaturated compounds. **(30 Hours)**

Reference Book

1.V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Code 23UCHA21P	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	3	2	2	2
CO2	1	2	2	2	1	1	1
CO3	2	1	-	2	1	-	1
CO4	2	1	2	3	1	-	2
CO5	2	1	2	2	2	-	1

Dr.M.Dhanalakshmi
Head of the Department

Dr.J.Kavitha
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 (3rd Cycle) by NAAC
VIRUDHUNAGAR - 626 001

B.Sc. Biochemistry
(2023-2024 onwards)

Semester II	**LIFE STYLE DISEASES**	Hours/Week: 2	
NME - 2		Credits: 2	
Course Code **23UBCN21**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Define Lifestyle diseases and describe the contributing factors. [K1]

CO2: Identify the symptoms of top lifestyle diseases and its impact on life. [K1]

CO3: Explain the treatment and prevention measures of common lifestyle diseases. [K2]

CO4: Describe the lifestyle diseases that affect women's health. [K2]

CO5: Illustrate the various measures for prevention of lifestyle diseases. [K3]

UNIT I:

Lifestyle diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation. (6 Hours)

UNIT II:

Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country. (6 Hours)

UNIT III :

Non-communicable diseases- Obesity, cardiovascular disease, diabetes and cancer- Causes, symptoms**,** types, preventive measures and treatment. (6 Hours)

UNIT IV:

Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. (6 Hours)

UNIT V:

Prevention of lifestyle diseases: Balanced diet, fasting, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation. (6 Hours)

TEXTBOOKS

1. JamesM R, Lifestyle Medicine, 2nd Edition, CRC Press,2013
2. Akira Miyazaki, New Frontiers in Life style - Related Disease, Springer,2008

REFERENCEBOOKS

1. Steyn K, Life style and related risk factors for chronic diseases
2. Willett WC, Prevention of chronic disease by means of diet and lifestyle.
3. Kumar M & R. Kumar, Guide to prevention of lifestyle diseases. Deep & Deep publications

Course Code 23UBCN21	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO 1	**PSO 2**	**PSO 3.a**	**PSO 3.b**	**PSO 4.a**	**PSO 4 .b**	**PSO 5.a**	**PSO 5.b**	**PSO 6**	**PSO 7**
CO 1	3	2	2	2	2	3	1	2	-	1
CO 2	3	2	2	2	2	3	1	2	-	1
CO 3	3	2	2	2	2	3	1	2	-	1
CO 4	3	2	2	2	2	3	1	2	-	1
CO 5	3	2	2	2	2	3	1	2	-	1

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

Dr.P.Annapoorani
Head of the Department

Dr. R. Renuka
Course Designer

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B.Sc Biochemistry
(2023-2024 onwards)

Semester II	**MICROBIAL TECHNIQUES**	Hours/Week: 2	
SEC - 2		Credits: 2	
Course Code **23UBCS21**		Internal 25	External 75

COURSE OUTCOMES

On completion of the course the students will be able to

CO1: Define the concept of microscopy, staining, food microbiology, growth and cultivation of bacteria. [K1]

CO2: Describe the types of microscope, staining, bacterial growth, growth media and preservation methods. [K1]

CO3: Identify the factors affecting bacterial growth and microscopic examination. [K2]

CO4: Explain the bacteria growth phases, microscope, staining methods, culture methods and food preservation methods. [K2]

CO5: Illustrate the structure of microorganisms and microbial techniques. [K3]

UNIT I:

Growth of bacteria- Definition, growth phases, factors affecting growth (pH, temperature, and oxygen), cell count (hemocytometer, Bacterial cell- Bacillus subtilis), fungal cell (Saccharomyces) and human blood cell. General characteristics of viruses. (6 Hours)

UNIT II:

Microscopy- Principle, types - Compound microscope, electron microscope- TEM, SEM, use of oil immersion objective. (6 Hours)

UNIT III:

Stains and staining- Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endospore Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (Penicillium, Aspergillus), Agaricus. (6 Hours)

UNIT IV:

Cultivation of bacteria– Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stab culture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria. (6 Hours)

UNIT V:

Food microbiology- Microbiological examination of food: microscopic examination and culture, phosphatase test of Pasteurized milk. Preservation of food- High temperature (boiling, pasteurization, appreciation), low temperature (freezing), dehydration, osmotic pressure, chemical preservations, radiation. Microorganisms as food SCP. (6 Hours)

TEXT BOOKS

1. Sherris Medical Microbiology, 7th Edition byAuthors: Kenneth Ryan, C. George Ray, Nafees Ahmad, W. Lawrence Drew, Michael Lagunoff, Paul Pottinger, L. Barth Reller and Charles R. Sterling
2. Food Microbiology: Fundamentals And Frontiers, 5th Edition by Editor(s):Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill
3.Text book of microbiology by Ananthanarayan and Panicker's
4. Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria5. 5.Prescott's Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

REFERENCE BOOKS

1.Bailey & Scott's Diagnostic Microbiology, 14th Edition by Author: Patricia Title
2. Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller
3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierc

Course Code 23UBCS21	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO 1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4.a**	**PSO 4. b**	**PSO 5.a**	**PSO 5.b**	**PSO 6**	**PSO 7**
CO 1	2	3	2	1	3	1	3	3		2
CO 2	2	1	2	2	3	1	2	2		2
CO 3	3	2	2	3	3	2	2	2		3
CO 4	2	3	2	3	2	2	2	3		2
CO 5	2	2	2	2	2	2	1	3		3

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

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B.Sc. Biochemistry
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Semester III	**BIOMOLECULES**	Hours/Week: 5	
Core Course - V		Credits: 5	
Course Code **23UBCC31**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will be able to

CO1:	explain the various elements present in the biomolecules such as carbohydrates, proteins, lipids, nucleic acids and vitamins, their occurrence and classification	[K1]
CO2:	identify various molecular structures and to understand monomers, polymers and isomeric forms.	[K2]
CO3:	Explain the properties of biomolecules.	[K2]
CO4:	Apply the role of biomolecules in life	[K3]
CO5:	Describe the fundamental properties of biomolecules, their role in chemical reactions within the living system and to prevent diseases.	[K3]

UNIT I

Carbohydrates-Classification and biological significance, physical properties - stereo isomerism, optical isomerism, anomers, epimers and mutarotation. Monosaccharides: Occurrence, linear and cyclic structure. Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide (sucrose). Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significance of mucopolysaccharides - hyaluronic acid, chondroitin sulphate and heparin. (structural elucidation not needed). (15 Hours)

UNIT II

Amino acids - Classification based on composition of side chain. General structure of amino acids. 3 - and 1- letter abbreviations. Modified amino acids in protein and non - protein amino acids. Physical properties of amino acids, isoelectric point. (15 Hours)

UNIT III

Proteins-Classification based on shape, composition, solubility and functions. Properties of proteins - Ampholytes, isoelectric point, salting in and salting out, denaturation and renaturation, UV absorption. Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle, Secondary structure-α helix (egg albumin), β- pleated sheath (keratin), triple helix (collagen). Tertiary structure – with reference to myoglobin. Quaternary structure with reference to haemoglobin. (15 Hours)

UNIT IV

Lipids- Lipids: Bloor's classification, chemical nature and biological functions. Fatty acids: classification, nomenclature, structure and properties of fatty acids. Simple and mixed triglycerides: structure and general properties, Characterization of fats – definition for iodine value, saponification value, acid number and acetyl number. Compound lipids-Structure and functions of phospholipids and glycolipids.Derived lipids-Structure and functions of cholesterol, bile acids and bile salts.

(15 Hours)

UNIT V

Nucleic acids-Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA: A, B, C, Z DNA, structure and biological significance, superhelicity. Types of RNA: mRNA, tRNA, rRNA, hnRNA, snRNA , Secondary and tertiary structure of tRNA. Properties of DNA-Hypochromic and hyperchromic effect, melting temperature, viscosity. Denaturation and annealing. (15 Hours)

Textbooks

1. Biochemistry, U.Sathyanarayana & U.Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7thedition S.Chand & Company Ltd.
3. Textbook of Medical Biochemistry, MN Chatterjea, Rana Shinde, 2002, 8th edition, Jaypee Brother.

Reference books

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company.

2.Voet. D, Voet. J. G. and Pratt, C. W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.

3.Zubay G. L, *et. al*., 1995, Principles of Biochemistry, 1stedition, WmC. Brown Publishers.

Web resources

https://www.britannica.com/science/biomolecule

https://en.wikipedia.org/wiki/Biomolecule

https://www.khanacademy.org/science/biology/macromolecules

Course Code 23UBCC31	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO1	PSO 2	PSO3 3.a	PSO3 3.b	PSO 4a	PSO4 b	PSO 5a	PSO5b	PSO6	PSO 7
CO 1	2	3	-	1	1	3	-	3	-	2
CO 2	2	1	-	2	3	3	-	2	-	2
CO 3	3	2	2	3	3	2	-	2	-	3
CO 4	2	3	2	3	2	2	-	3	-	2
CO 5	2	2	-	2	2	2	-	3	-	3

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

Dr.P.Annapoorani
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Semester III	**BIOMOLECULES PRACTICAL**	Hours/Week: 3	
Core Practical 3		Credits: 2	
Course Code **23UBCC31P**		Internal 40	External 60

COURSE OUTCOMES

On completion of this course, students will be able to

CO1:	write the principle and procedure to detect various biomolecules present in the given sample.	[K2]
CO2:	identify the given spotters and comment on them with illustrations	[K2]
CO3:	observe the reactions of the biomolecules through various biochemical tests and prepare various biochemical polymers from natural sources	[K3]
CO4:	infer the findings of the biochemical reactions, report the results and complete the record note book.	[K3]
CO 5:	analyze and compare the properties of various biomolecules.	[K3]

I**)Qualitative test for 15 Hrs**

1) Carbohydrates

a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g)Starch

2) Amino acids

a) Arginine b)Cysteine c) Histidine d)Proline e) Tryptophan f) Tyrosine g) Methionine

II Titrimetric methods15 Hrs

1) Determination of Saponification value of an edible oil

2) Determination of Iodine number of an edible oil

3) Determination of Acid number of an edible oil

III. Group Experiments 15 hrs

1) Isolation of DNA from plant/animal source.

2) Isolation of RNA from rich source.

Text books

1.David T Plummer ,An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition

2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited \ Fifth edition 2015

3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher's third edition 2018

Reference books

1.Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on Biochemistry Everest publishing house1st Edition, 2019

2.Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.

3. Biochemical Tests – Principles and Protocols. Anil Kumar, SarikaGarg and NehaGarg.VinodVasishtha Viva Books Pvt Ltd, 2012.

4. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.

5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain.1995.

Web resources

1.https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html 14

2.https://www.pdfdrive.com/analytical-biochemistry-e46164604.html

3. https://www.pdfdrive.com/biochemistry-books.html

Course Code 23UBCC31P	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO4 b**	**PSO 5a**	**PSO5b**	**PSO6**	**PSO 7**
CO 1	3	3	2	3	3	2	3	3	3	2
CO 2	3	2	3	3	3	3	3	3	3	1
CO 3	3	3	2	3	2	3	3	3	3	2
CO 4	3	3	3	3	3	3	3	3	3	2
CO 5	3	3	3	3	3	3	3	2	3	3

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

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Semester III	**Allied Botany - I**	Hours/Week: 4	
Elective Course - I		Credits: 3	
Course Code **23UBIA31**		Internal 25	External 75

Course Outcomes:
On successful completion of the course, the learners should be able to

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

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

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

CO4: Identify the importance of cell as a basic unit of life **.** **[**K3]

CO5: Interpret the structure and function of cells and explain the development of Cells. [K3]

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

UNIT II: Fungi, Bacteria and Virus: General characters of fungi, structure, reproduction and life cycle of *Agaricus* and economic importance of fungi. Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. (14 Hours)

UNIT III : Bryophytes, Pteridophytes and Gymnosperms:

General characters of Bryophytes, Structure and life cycle of *Funaria*. General characters of Pteridophytes, Structure and life cycle of *Lycopodium*. General characters of Gymnosperms, Structure and life cycle of *Cycas*. (12 Hours)

UNIT IV: Cell Biology:

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

UNIT V :**Genetics and Plant Biotechnology:**

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology. (12 Hours)

TEXT BOOKS

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications,Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.
6. Verma, P.S. & Agarwal, V.K. (2006). *Cell Biology*, New Delhi: S. Chand & Company Ltd.,

REFERENCE BOOKS

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.

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

Course Code **23UBIA31**	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7
CO1	3	3	3	3	2	2	2
CO2	3	3	3	3	2	2	2
CO3	3	3	3	3	2	2	2
CO4	3	3	3	3	2	2	2
CO5	3	3	3	3	2	2	2

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

Dr. B. Karunai Selvi
Head of the Department

Dr. B. Karunai Selvi
Course Designer

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Semester III	**Allied Botany Practical - I**	Hours/Week: 2	
Elective Course - I		Credits: 1	
Course Code **23UBIA31P**		Internal 40	External 60

Course Outcomes:
On successful completion of the course, the learners should be able to

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

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

CO3: Sketch the diagrams of Plant Diversity and Cell Biology. [K3]

CO4: Interpret the structure and functions of the cell organelles [K3]

CO5: Identify the different stages of mitosis [K3]

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae – *Sargassum* leaf, Fungi - *Agaricus*, and Gymnosperms – *Cycas* leaf.
2. Spotters – Algae - *Anabaena* and *Sargassum* (Thallus and Conceptacles), Fungi - *Penicillium* and *Agaricus* (Fruiting Body), Bryophytes – *Funaria* (Gametophyte and Sporophyte), Pteridophytes (Sporophyte and Gametophyte), Gymnosperms - *Cycas* (Habit, Ovule), Biotechnology – Callus and Artificial Seeds.
3. Study of cell organelles - Chloroplast, Mitochondria and Nucleus
4. Cell division – Stages of Mitosis
5. Simple genetic problems – Test Cross, Back cross, Monohybrid and Dihybrid Cross.

TEXT BOOKS

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.

3. De Robertis, P, Nowinski, E.D and Saez, A, (2001 reprint), *Cell Biology*, WB Saunders Co, Philadelphia.

REFERENCE BOOKS

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.

Course Code **23UBIA31P**	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO 7
CO1	3	3	3	3	2	3	3
CO2	3	3	3	3	2	3	3
CO3	3	3	3	3	2	3	3
CO4	3	3	3	3	2	3	3
CO5	3	3	3	3	2	3	3

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

Dr. B. Karunai Selvi
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Dr.R.Sreebha
Course Designer

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Semester III	**BIOENTREPRENEURSHIP**	Hours/Week: 1
SEC - IV		Credits: 1
Course Code 23UBCS31		Internal 100

Course Outcomes

After completion of the course the students will be able to

CO1: Understand the concept and scope for entrepreneurship [K1]

CO2: Gather knowledge about Planning, budgeting and funding a winning business. [K1]

CO3: Learn to launch a new business, manage a crisis and make decisions. [K2]

CO4: Describe marketing strategies and advertising of products. [K2]

CO5: Use technology to expand business and protect intellectual property. [K3]

UNIT I: Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; (3Hours)

UNIT II: Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC. (3Hours)

UNIT III:Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability. (3Hours)

UNIT IV: Market Strategy- Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market; (3Hours)

UNIT V: Introduction to information technology for business administration and Expansion. Introduction to Trademarks , Copyrights and patents. (3Hours)

Course Code 23UBCS31	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO4 b**	**PSO 5a**	**PSO5b**	**PSO6**	**PSO 7**
CO 1	2	2	2	3	3	3	-	1	2	1
CO 2	3	2	3	2	3	2	1	2	2	1
CO 3	3	3	3	3	3	2	1	2	3	2
CO 4	1		3	3	2	3	2	3	2	2
CO 5	2	2	3	3	2	2	3	3	2	3

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

Dr.P.Annapoorani
Head of the Department

Dr. Sinthia Ganeshan
Course Designer

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Semester III	**MEDICAL LABORATORY TECHNOLOGY**	Hours/Week: 2	
SEC - IV		Credits: 2	
Course Code 23UBCS32		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will be able to

CO1 define the concepts of biological sample collection, blood grouping and clinical diagnostic tests. [K1]

CO2 explain the collection and preservation methods of biological samples. [K1]

CO3 estimate the various constituents in biological sample [K2]

CO4 write the values for both normal and disease conditions and its significance [K2]

CO5 identify the clinical importance and interpretations of various biological assay [K3]

UNIT I:

Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Non infectious waste , biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines. (6 Hours)

UNIT II :

Determination of Blood group and Rh factor -Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards. (6 Hours)

UNIT III: Estimation of blood sugar – Enzymatic method,HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral , vitamin and CSF analysis. (6 Hours)

UNIT IV: Immuno diagnostics -Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA,, Skin test – Montaux and Lepramin test. (6 Hours)

UNIT V : Assay of clinically important enzymes- Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance.

(6 Hours)

Text Books

1 Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IVth edition,Vol I, 2022.

2.RamnikSood,Text Book of Medical Laboratory Technology, Jaypee Publishers, 2006

3.Tietz, N. Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition, W.B. Saunders Company, 2018.

Reference books

Web Resources

1 https://www.youtube.com/watch?v=QNYlX5Ne9lQ

2 https://www.slideshare.net/doctorrao/

agglutination-tests-and-immunoassys

3 https://microbenotes.com/introduction-to-precipitation-reaction/

Course Code 23UBCS32	PO1	PO2	PO3		PO4		PO5		PO6	PO7
	PSO 1	PSO 2	PSO3 3.a	PSO3 3.b	PSO 4a	PSO4 b	PSO 5a	PSO5b	PSO6	PSO 7
CO 1	2	3	2	1	1	3		1		2
CO 2	2	1	2	2	3	3		1		2
CO 3	3	2	2	3	3	2		1		2
CO 4	2	3	2	3	2	2		1		2
CO 5	2	2	2	2	2	2		1		2

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

Dr.P.Annapoorani
Head of the Department

Mrs.P.Ramalakshmi
Course Designer

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Quality Education with Wisdom and Values

B.Sc. Biochemistry
(for those who join in 2023-2024)

Semester IV	**BIOCHEMICAL TECHNIQUES**	Hours/Week: 4	
Core Course 6		Credits: 4	
Course Code **23UBCC41**		Internal 25	External 75

COURSE OUTCOMES

on completion of the course the students will be able to

CO1:Describe the basic principles ,Instrumentation and applications of Biochemical Techniques used in biological sciences[K1]

CO2 : Understand the principle, methods and applications of biochemical techniques in various fields [K2]

CO3 : Illustrate the methods of separation of various biomolecules using biochemical techniques [K2].

CO4 : apply various biochemical Techniques in analytical Laboratories for separations of biomolecular compounds [K3]

CO5 : demonstrate various analytical techniques to interpret biochemical compounds.[K3]

UNIT I:

Centrifugation - Basic principles, RCF**,** Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Rate zonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge – Determination of molecular weight (Derivation excluded) **(**12 Hours)

UNIT II: Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity
chromatography. **(**12 Hours)

UNIT III: Electrophoresis – General principles, factors affecting electrophoretic mobility. Tiselius moving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentation and applications of agarosegel electrophoresis and SDS-PAGE.9Hrs

(12 Hours)

UNIT IV: Basics of Electromagnetic radiations- Energy, wavelength, wavenumber and frequency. Absorption and emission spectra, Lambert – Beer Law, Light absorption and transmittance. Colorimetry- Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation and applications –enzyme assay, structural studies of proteins and nucleic acids.

(12 Hours)

UNIT V: Radioactivity - Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger Muller Counter. Methods based upon excitation - Solid & Liquid scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes. **(**12 Hours)

Textbooks

1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath, 2002, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.
2. L.Veerakumari, 2009, Bioinstrumentation, 1stedition, MJP Publishers.
3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4thedition.

Reference books

1. Terrance G. Cooper The tools of Biochemistry, 1977, John Wiley & Sons, Singapore.
2. Gurumani, Research Methodology for Biological Sciences, 2011, 1stedition, MJP Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1st edition, Narosa Publishing house.

Web Resources

1.https://www.britannica.com/science/chromatography

2.https://www.youtube.com/watch?v=xgxFBQZYXlE

3.https://www.youtube.com/watch?v=7onjVBsQwQ8

Course Code 23UBCC41	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO 4 b**	**PSO 5a**	**PSO5b**	**PSO6**	**PSO 7**
CO 1	2	3		1	3	1	3	3	1	2
CO 2	2	1		2	3	1	2	2	1	2
CO 3	3	2	2	3	3	2	2	2	2	3
CO 4	2	3	2	3	2	2	2	3	1	2
CO 5	2	2		2	2	2	1	3	2	3

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

Dr.P.Annapoorani
Head of the Department

Mrs. M. Rajakumari
Course Designer

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Semester IV	**BIOCHEMICAL TECHNIQUES PRACTICAL**	Hours/Week: 3	
Core Practical 4		Credits: 2	
Course Code **23UBCC41P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1 : Understand the principles and procedures used in quantitative determination of biochemical and molecular compounds [K2]

CO2 : Estimate the concentration of unknown Biomolecular compounds using Biochemical and Molecular biology techniques[K2].

CO3 : Illustrate the procedure with quantification of Biochemical compounds using Bioanalytical techniques .[K3].

CO4 : Apply the bioanalytical techniques to estimate the biomolecules present in biological samples and interpret the values with standard values [K3].

CO5 : Predict the role of reagents and instruments used for analysis of biochemical and molecular compounds([K3].

I Colorimetry

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of Phosphorus by Fiske and Subbarow method.

II Chromatography

1. Separation and identification of sugars and amino acids by paper chromatography.

2. Separation and identification of amino acids and lipids by thin layer chromatography.

III Demonstration

1. Separation of serum and plasma from blood by centrifugation.
2. Separation of serum proteins by SDS-PAGE.

Text books

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015.

2. S.Sadasivam A.Manickam Biochemical Methods New age International Pvt Ltd publishers third edition 2018.

3. Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press2010, Seventh edition.

Reference books

1. S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.

2. David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw- Hill publishing company limited.

3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition,1988.

Web resources

https://www.pdfdrive.com/biochemistry-books.html

Course Code 23UBCC41P	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO2**	**PSO3 3.a**	**PSO 3.b**	**PSO 4a**	**PSO4 b**	**PSO 5a**	**PSO5b**	**PSO6**	**PSO 7**
CO 1	3	3	2	2	3	2	2	2	1	2
CO 2	3	2	1	2	3	2	1	2	2	2
CO 3	3	3	2	3	3	3	2	2	2	1
CO 4	3	2	3	2	3	2	2	2	2	2
CO 5	3	3	1	3	3	2	1	2	2	2

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

Dr.P.Annapoorani
Head of the Department

Mrs. M. Rajakumari
Course Designer

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Semester IV	**ALLIED ZOOLOGY**	Hours/Week: 4	
Allied Course - I		Credits: 3	
Allied Code **23UZYA41**		Internal 25	External 75

COURSE OUTCOMES

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

CO1: comprehend basic concepts of human and animal biology. [K1]

CO2: describe the working mechanisms of various systems in man. [K2]

CO3: explain the important role of various systems in man. [K2]

CO4: apply their knowledge to find out the importance of genetic materials in controlling body systems. [K3]

CO5: identify the unique facts about man and animals. [K3]

apply their knowledge to find out the importance of cells, organs and systems in controlling body.

UNIT I

Respiration- Respiratory pigments – Haemoglobin, Haemoerythrin and Haemocyanin. Transport of gases – Oxygen and Carbon di oxide. . Mechanism of blood clotting – Factors and mechanisms. Types of excretory products- Carbon di oxide, Ammonia and Urea. Ornithine cycle. Structure of neuron – Conduction of nerve impulse- Nerve fibre, Synapse and Neuromuscular junction., Structure and Mechanism of vision – Eye. Structure and Mechanism of hearing – Ear. **(12 Hours)**

UNIT II

Reproduction – Human- Gametes – Egg and Sperm – Structure and functions. Oogenesis and Spermatogenesis. Fertilization- Physiological changes. Cleavage, Gastrulation (Events) and Fate map of Frog, Placentation in mammals. **(12 Hours)**

Unit III

Immunity- Classification- Innate and Acquired - Active and Passive. Lymphoid organs- Thymus and Lymphoid nodes- Structure and functions. T and B cells. Antigens and Antibodies-Types, Structure and functions. Immune Response- Humoral and Cell mediated. Vaccination schedule. **(12 Hours)**

Unit IV

Human Genetics: Introduction, Human Chromosome and Gene-DNA-Structure and functions. Chromosomes- types, Sex Determination in Humans; Patterns of Inheritance- Autosomal Dominant, Autosomal Recessive, X-linked, Y-linked, Mitochondrial, Multiple Allelic and Polygenic. Gene Mutation-types. Chromosome abnormality syndromes- Down syndrome, Klinefelter syndrome and Turner syndrome. Genetic Counselling.

(12 Hours)

Unit V

Animal Behaviour: Foraging in Bees, Courtship Behaviour in Birds, Shelter and Nest Construction- Fishes (Bubble nest, Weed nest and Pit nest) and Amphibia – Mud nest, Tree nest and Foam nest. Parental Care- Frogs. Learning Behaviour – Dogs and Monkeys.

(12 Hours)

Reference Books

1. Arumugam, N. & Mariyakuttikan, A. (2019). Animal Physiology. Nagarcoil: Saras Publication
2. Verma, P.S. Tyagi, B.S. & Agarwal, V.K. (1994). Animal Physiology. New Delhi: S.Chand & Company Ltd.
3. Arumugam, N. (2008).Text Book of Embryology. Kottar, Nagarcoil: Saras Publication. 2. Verma, P.S. and Agarwal V.K. (2000). Chordate Embryolog., New Delhi: S.Chand & Co.
4. Meyyan, R.P., (2011). Genetics. Nagarcoil: Saras Publications.
5. Arumugam, N., (2005). Biostatistics and Computer Application. Nagarcoil: Saras Publications.
6. Fatima, D. & Arumugam, N. (2014). Immunology. Nagercoil: Saras Publication.
7. 1. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). A Textbook of Chordates. Nagercoil: Saras Publication.

Website References

1. https://byjus.com/neet/mechanism-of-vision/
2. https://www.slideshare.net/slideshow/blood-clotting/7907861
3. https://byjus.com/question-answer/how-is-oxygen-and-carbon-dioxide-transported-in-human-beings/
4. https://www.zoologytalks.com/respiratory-pigments/

5. https://www.google.com/gasearch?q=mechanism%20of%20hearing%20flowchart&tbm=&source=sh/x/gs/m2/5#vhid=40i4zd06RyTAmM&vssid=l
6. http://tumkuruniversity.ac.in/oc_pg/zoology/I%20MSc%20ZOOLOGY%20CPT%202.1%20Biology%20of%20Chordates%20TOPIC%20-Courtship%20in%20birds.pdf
7. https://flexbooks.ck12.org/cbook/ck-12-advanced-biology/section/14.7/primary/lesson/learned-behavior-in-animals-advanced-bio-adv/

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYA41	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	L	2	-	2	2	1	2	1
CO2	3	3	1	2	1	3	3	1	2	2
CO3	3	3	1	3	1	2	2	1	2	1
CO4	3	2	1	2	2	2	2	1	2	1
CO5	3	2	2	3	3	2	3	3	2	2

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

Dr. R.Radhalakshmi

Dr. J. Rani
Head of the Department

Dr.P. Veeramuthumari
Course Designer

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Semester IV	**ALLIED ZOOLOGY PRACTICAL**	Hours/Week: 2	
Allied Lab Course		Credits: 1	
Allied Code **23UZYA41P**		Internal 40	External 60

COURSE OUTCOMES

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

CO1: explain the types of germ cells based on their structure. [K2]

CO2: outline the important role of organs in immunity. [K2]

CO3: apply the knowledge in identifying the nature of behaviours in animals. [K3]

CO4: identify the immunological and genetic factors involved in physiology of blood. [K3]

CO5: apply the knowledge to identify the genetic disorders to create awareness among the people. [K3]

Practicals

1. Estimation of Bleeding time and clotting time.

2. Estimation of Haemoglobin

4. Identification of Blood Grouping in man.

5. Slide/Specimen/Diagram

(i) Sperm, Egg and Placenta in man

(ii) Placenta in Sheep

(iii) Chromosomal abnormalities- Down syndrome, Klinefelter syndrome and Turner syndrome.

(iv) Lymphoid organs- Thymus and Lymph node

(iv) Nest Construction- Fishes (Bubble nest and Pit nest)

(v) Parental Care- Frogs

Reference Books

1. Arumugam, N. & Mariyakuttikan, A. (2019). Animal Physiology. Nagarcoil: Saras Publication
2. Verma, P.S. Tyagi, B.S. & Agarwal, V.K. (1994). Animal Physiology. New Delhi: S.Chand & Company Ltd.
3. Arumugam, N. (2008).Text Book of Embryology. Kottar, Nagarcoil: Saras Publication. Verma, P.S. and Agarwal V.K. (2000). Chordate Embryolog., New Delhi: S.Chand & Co.
4. Meyyan, R.P., (2011). Genetics. Nagarcoil: Saras Publications.
5. Arumugam, N., (2005). Biostatistics and Computer Application. Nagarcoil: Saras Publications.
6. Fatima, D. & Arumugam, N. (2014). Immunology. Nagercoil: Saras Publication.
7. Thangamani, A., Prasanakumar S., Narayanana L.M., and Arumugan N., (2015). A Textbook of Chordates. Nagercoil: Saras Publication.

Course Code	PO1		PO2	PO3		PO4		PO5	PO6	PO7
23UZYA41P	PSO 1.a	PSO 1.b	PSO 2	PSO 3.a	PSO 3.b	PSO 4.a	PSO 4.b	PSO 5	PSO 6	PSO 7
CO1	3	2	2	1	L	3	3	1	3	2
CO2	3	3	2	1	2	3	3	2	3	2
CO3	3	2	2	2	2	3	3	2	3	2
CO4	2	2	2	2	2	2	2	2	3	2
CO5	3	3	2	3	1	2	3	3	3	2

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

Dr. J. Rani

Head of the Department

Dr.J.Rani
Dr.R.Radhalakshmi
Course Designer

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B.Sc. Biochemistry
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Semester IV	**BASICS OF FORENSIC SCIENCE**	Hours/Week: 2	
SEC - V		Credits: 2	
Course Code **23UBCS41**		Internal 25	External 75

Course Outcomes

On completion of this course, students will be able to

CO1	Gain knowledge on basics of forensic science and method for collection and preservation of samples	[K1]
CO2	Understand the paternity, maternity problems and DNA profiling	[K1]
CO3	Study the presence of alcohol, insecticides and pesticides in body fluids	[K2]
CO4	Describe the test performed to identify the presence of drugs and poisons in body fluids	[K2]
CO5	Identify species and sex from the available body fluids	[K3]

UNIT I: Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis. (6 Hours)

UNIT II: Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling. (6 Hours)

UNIT III: Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides. (6 Hours)

UNIT IV: Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids. (6 Hours)

UNIT V: Identification tests- Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibers. Examination and identification of saliva, milk, urine and faecal matter (6 Hours)

Reference books

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.
2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.
4. Forensics by Embar-Seddon, Ayn and Pass. Allan D.
5. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence Page 24 of 63

Course Code 23UBCS41	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO4 b**	**PSO 5a**	**PSO5b**	**PSO6**	**PSO 7**
CO 1	3	3	2	3	3	3	1	2	1	2
CO 2	3	2	2	2	2	2	2	2	2	1
CO 3	3	3	3	3	2	2	2	2	1	3
CO 4	2	3	2	3	2	3	3	2	3	2
CO 5	2	2	3	3	2	3	3	3	2	2

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

Dr.P.Annapoorani
Head of the Department

Dr. Sinthia Ganeshan
Course Designer

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Semester IV	**TISSUE CULTURE**	Hours/Week: 2	
SEC - VI		Credits: 2	
Course Code **23UBCS42**		Internal 25	External 75

COURSE OUTCOMES

On completion of this course, students will be able to

CO1 describe tissue culture, types, media, methods of gene transfer , cell culture and transgenic plants and animals. [K1]

CO2 state the advantages, importance, tools, techniques of tissue culture[K1]

CO3 explain the types, tools, media and methods of gene transfer [K2]

CO4 summarize the cell culture techniques, transgenic plants and animals along with its applications. [K2]

CO5 illustrate about cell and tissue culture, types, media, methods, tools, techniques, cloning and the applications of plant and animal cell culture [K3]

UNIT l:

Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques (6 Hours)

UNIT II:

Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures. (6 Hours)

UNIT III:

Cell culture technique - Explants selection, sterilization and inoculation. (6 Hours)

UNIT IV:

Methods of gene transfer in plants and animals - direct and indirect gene transfer methods. (6 Hours)

UNIT V:

Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview-Applications of animal cell culture (6 Hours)

Text books

1.Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.

2,Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.

3.Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.

4.Grierson and Covey, S.N.1988. Plant Molecular biology.Blackie.

5.Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference books

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias Publications. 1995.

2. Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Interscience, 2008.

3. Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010.6th Edition.

4. Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.

5. Davis, J. M. (2011).Animal Cell Culture. John Willy and Sons Ltd. USA.6Freshmen R. I. (2005). Culture of Animal Cells. John Willy and Sons Ltd. USA.

6.Butler, M. (2004). Animal Cell Culture and Technology. Taylor and Francis. Keywork USA.

7. Verma, A. S. and Singh, A. (2014).Animal Biotechnology. Academic Press, ELSEVIER, USA

Web Resources

https://www.britannica.com/science/tissue-culture

https://en.wikipedia.org/wiki/Plant_tissue_culture

https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/

Course Code 23UBCS42	**PO1**	**PO2**	**PO3**		**PO4**		**PO5**		**PO6**	**PO7**
	PSO1	**PSO 2**	**PSO3 3.a**	**PSO3 3.b**	**PSO 4a**	**PSO 4 b**	**PSO 5a**	**PSO 5b**	**PSO 6**	**PSO 7**
CO 1	3	2	3	1	1	2	1	2	1	2
CO 2	3	2	3	1	1	2	1	2	1	2
CO 3	3	2	3	1	1	2	1	2	1	3
CO 4	3	2	3	1	1	2	1	2	1	3
CO 5	3	2	3	1	1	2	1	2	1	3

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

Dr.P.Annapoorani
Head of the Department

Dr. R. Salini
Course Designer