



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

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

V.V.Vanniaperumal College for Women, Virudhunagar, established in 1962, offers 13 UG Programmes (Aided), 14 UG Programmes (SF), 13 PG Programmes and 6 Ph.D. Programmes. The curricula for all these Programmes, except Ph.D. Programmes, have been framed as per the guidelines given by the University Grants Commission (UGC) & Tamil Nadu State Council for Higher Education (TANSICHE) under Choice Based Credit System (CBCS) and the guidelines for Outcome Based Education (OBE).

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

A. CHOICE BASED CREDIT SYSTEM (CBCS)

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

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

UG PROGRAMMES

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

PG PROGRAMMES

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

OUTLINE OF CHOICE BASED CREDIT SYSTEM – UG

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

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

Name of the Course	Course Code	Semester	Department
Introduction to Tourism	23UHN11	I	History(EM)
Indian Constitution	23UHN21	II	History(EM)
சுற்றுலா ஓர் அறிமுகம்	23UHN11	I	History (TM)
இந்திய அரசியலமைப்பு	23UHN21	II	History(TM)
Popular Literature and Culture	23UENN11	I	English
English for Professions	23UENN21	II	
பேச்சுக்கலைத்திறன்	23UTAN11	I	Tamil
பயன்முறைத் தமிழ்	23UTAN21	II	
Practical Banking	23UCON11	I	Commerce (Aided)
Basic Accounting Principles	23UCON22	II	
Financial Literacy-I	23UCON12	I	Commerce (SF)
Financial Literacy -II	23UCON21	II	
Self-Employment and Startup Business	23UCCN11	I	Commerce CA (SF)
Fundamentals of Marketing	23UCCN21	II	
Women Protection Laws	23UCPN11	I	Commerce (Professional Accounting)
Basic Labour Laws	23UCPN21	II	
Basics of Event Management	23UBAN11	I	Business Administration
Business Management	23UBAN21	II	

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

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

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)

1. Value Education
2. Environmental Studies

GENERIC ELECTIVE COURSES 1

1. Human Rights
2. Women Studies

GENERIC ELECTIVE COURSES 2

1. Constitution of India

2. Modern Economics
3. Adolescent Psychology
4. Disaster Management

B. OUTCOME BASED EDUCATION (OBE) FRAMEWORK

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

Vision of the Institution

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

Mission of the Institution

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

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

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

Vision of the Department of 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 fulfillment of the local, national and global developmental needs. (*Critical Thinking and Analytical Reasoning*)
- 5 use ICT in a variety of self-directed lifelong learning activities to face career challenges in the changing environment. (*Digital Literacy, Self - directed and Lifelong Learning*)
- 6 self-manage and function efficiently as a member or a leader in diverse teams in a multicultural society for nation building. (*Co-operation/Team Work and Multicultural Competence*)
- 7 uphold the imbibed ethical and moral values in personal, professional and social life for sustainable environment. (*Moral and Ethical Awareness*)

B.1.3 Programme Specific Outcomes (PSOs)

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

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.

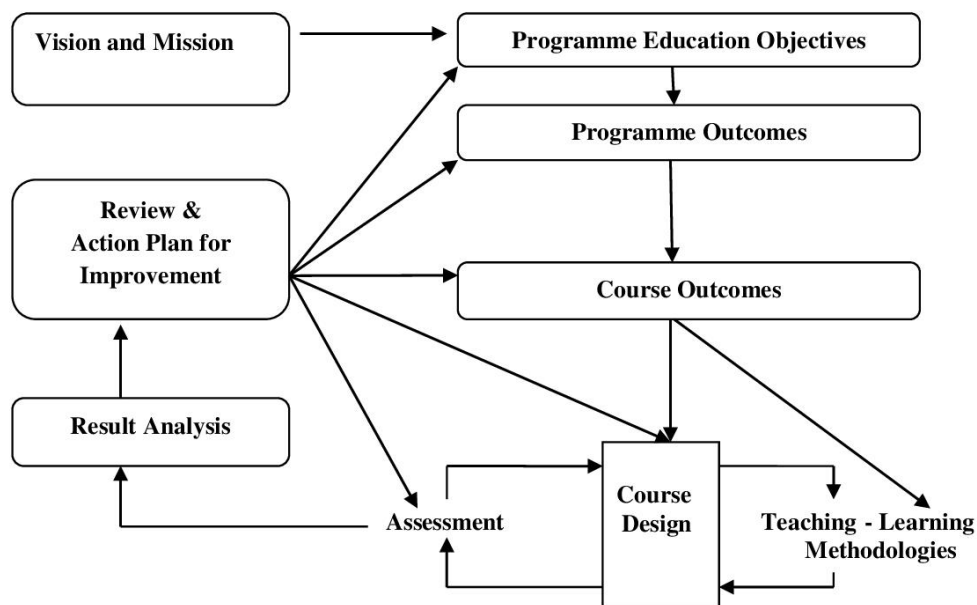
PO-PEO Mapping Matrix

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)

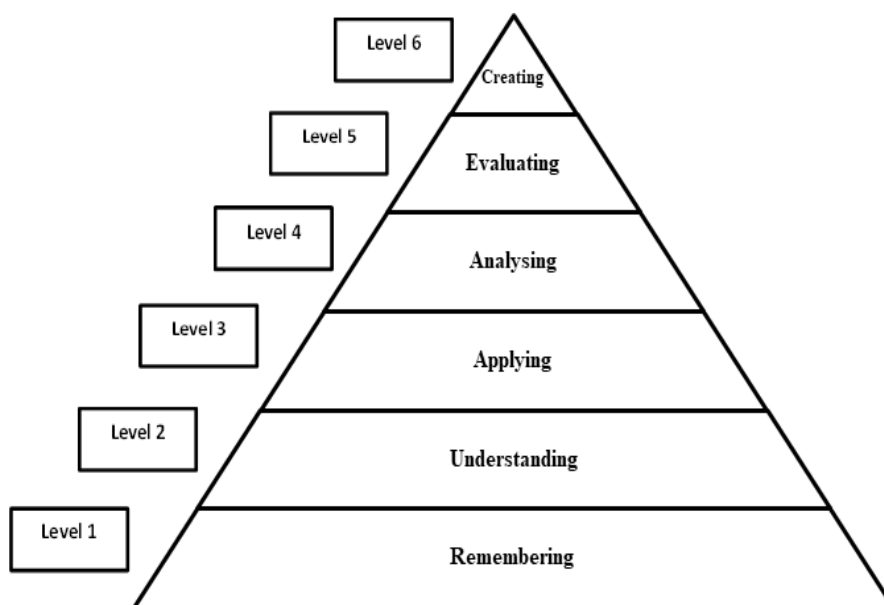
Course Outcomes are narrow statements restricted to the Course contents given in five units. Course Outcomes describe what students would be capable of, after learning the contents of the Course. They reflect the level of knowledge gained, skills acquired and attributes developed by the students after 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, 2 and 1 respectively.

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

PO/PSOs	PO1/ PSO1	PO2/ PSO2	PO3/ PSO3	PO4/ PSO4	PO5/ PSO5	PO6/ PSO6	PO7/ PSO7
COs							
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/Alternate Course
Part II	:	English
Part III	:	Core Courses
	:	Elective Courses
	:	Elective Courses: Discipline Specific Elective Courses
	:	Self Study Course
Part IV	:	Skill Enhancement Courses (SEC)
	:	Field Project/Internship
	:	Non-Major Elective Courses (NMEC)
	:	Ability Enhancement Compulsory Courses (AECC)
	:	Generic Elective Courses (GEC)
Part V	:	Self Study Course
	:	National Service Scheme/ Physical Education/ Youth Red Cross Society/ Red Ribbon Club/ Science Forum/ Eco Club/ Library and Information Science/ Consumer Forum/ Health and Fitness Club and National Cadet Corps/ Rotaract club

B.2 EVALUATION SCHEME

B.2.1.PART II

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

INTERNAL ASSESSMENT**Distribution of Marks**

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

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

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

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

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

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

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

Two Assignments - Better of the two will be considered

Three Quiz Tests - Best of the three will be considered

Practical

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

Internal Test - Average of the best two will be considered

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

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

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

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

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

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

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

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

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

Question Pattern for Internal 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

Summative Examination

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

Question Pattern**Duration: 2 Hours**

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

B.2.6. Part V – Extension Activities

Assessment by Internal Examiner only

Distribution of Marks

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

*The marks obtained will be calculated for 100 marks

ELIGIBILITY FOR THE DEGREE

- The candidate will not be eligible for the Degree without completing the prescribed Courses of study, lab work, *etc.*, and a minimum Pass marks in all the Courses.
 - No Pass minimum for Internal Assessment.
 - Pass minimum for External Examination is 27 marks out of 75 marks for Core Courses, Discipline Specific Elective Courses and Allied Courses.
 - Pass minimum for External Examination is 21 marks out of 60 marks for Skill Enhancement Courses and Non Major Elective Courses.
 - The aggregate minimum pass percentage is 40.
 - Pass minimum for External Practical Examination is 21 marks out of 60 marks.
 - Pass minimum for Ability Enhancement Compulsory Courses and Generic Elective Courses is 40 marks.
 - Pass minimum for Self Study Courses is 40 marks.
- Attendance
 - For UG, PG Programmes,
 - a) The students who have attended the classes for 76 days (85%) and above are permitted to appear for the Summative Examinations without any condition.
 - b) The students who have only 60-75 days (66% - 84%) of attendance are permitted to appear for the Summative Examinations after paying the required fine amount and fulfilling other conditions according to the respective cases.
 - c) The students who have attended the classes for 59 days and less – upto 45 days (50% - 65%) can appear for the Summative Examinations only after getting special permission from the Principal.
 - d) The students who have attended the classes for 44 days or less (<50%) cannot appear for the Summative Examinations and have to repeat the whole semester.
 - For Part V in UG Programmes, the students require 75 % of attendance to get a credit.
 - For Certificate, Diploma, Advanced Diploma and Post Graduate Diploma Programmes, the students require 75% of attendance to appear for the Theory/Practical Examinations.

These rules come into effect from 2020-2021 onwards.

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 $\geq 70\%$	Excellent
$60\% \leq$ Attainment Value $< 70\%$	Very Good
$50\% \leq$ Attainment Value $< 60\%$	Good
$40\% \leq$ Attainment Value $< 50\%$	Satisfactory
Attainment Value $< 40\%$	Not Satisfactory

Level of PO Attainment

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

B.3.3 Assessment Process for PEOs

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

Target for PEO Attainment

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

Attainment of PEOs

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

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

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

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

Expected Level of Attainment for each of the Programme Educational Objectives

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

Level of PEO Attainment

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

C. PROCESS OF REDEFINING THE PROGRAMME EDUCATIONAL OBJECTIVES

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



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VIRUDHUNAGAR - 626 001

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

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

SEC: Skill Enhancement Course
GEC: Generic Elective Course



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VIRUDHUNAGAR - 626 001

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/ 23UH DG21	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 Course -4 Practical II	Cell Biology Practical	23UBCC21P	3	2	3	40	60	100
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	



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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: Elsevier.
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, Fatih Yildiz (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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VIRUDHUNAGAR - 626 001

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.
5. 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)

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Mrs.P.Ramalakshmi
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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 fission 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 K_a 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

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Dr.M.Amutha
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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 flask, 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 sodium carbonate.
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 standard sodium hydroxide.
6. Estimation of magnesium using EDTA. (Demonstration only) (30 Hours)

Reference Books

V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical 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

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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: Elsevier.
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, 7th edition S.Chand & Company Ltd.
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



V.V.VANNIAPERUMAL COLLEGE FOR WOMEN

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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 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. (4thed). 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	PSO3 3.b	PSO4 4a	PSO4 4 b	PSO5 5a	PSO5 5b	PSO6	PSO7
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, D and J.R. Harris cell Biology: Essential Techniques, John Wiley 1996.
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-genetic-diversity/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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VIRUDHUNAGAR - 626 001

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 functional 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 compounds. [K3]
- CO4** : apply the skill in the analysis of functional group of Organic compounds. [K3]
- CO5** : identify the chemical constituents of Organic compounds. [K3]

SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

- Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), ester, aldehyde and glucose].
- Detection of elements (N, S, Halogens).
- To distinguish between aliphatic and aromatic compounds.
- To distinguish – Saturated and unsaturated compounds. **(30 Hours)**

Reference Book

- 1.V.Venkateswaran, R.Veerasingam, 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



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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. James M 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
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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 by Authors: 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 Bhadauria 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)

Dr.P.Annapoorani
Head of the Department

Dr. R. Renuka
Course Designer