

# VIVEKANANDHA

## COLLEGE OF ARTS AND SCIENCES FOR WOMEN

ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

An ISO 9001: 2015 Certified Institution  
(Affiliated to Periyar University, Approved by AICTE, recognized u/s 2 (f) & 12 (B) & Re-accredited with 'A+' by NAAC)



## DEPARTMENT OF BIOCHEMISTRY

B.Sc., BIOCHEMISTRY

SYLLABUS AND REGULATIONS

FOR CANDIDATES ADMITTED FROM 2023-24  
ONWARDS UNDER AUTONOMOUS OBE AND CBCS  
PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS  
Angammal Educational Trust  
Elayampalayam, Tiruchengode (Tk.), Namakkal (Dt.)

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## **College Vision & Mission**

### **Vision**

- To evolve into a center of excellence in higher education through creative and innovative practices to social equity for women.

### **Mission**

- To provide sufficient learning infrastructure to the students to pursue their studies.
- To provide good opportunity for higher education and conducive environment to the students to acquire education.
- To provide quality academic programs training activities and research facilities.
- To facilitate industry-institute interaction.

## **DEPARTMENT OF BIOCHEMISTRY**

### **Vision**

To be recognized as a centre for excellence in Biochemistry that provides an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to enhance the quality of life.

### **Mission**

- To help the students to gain more knowledge through visits to research Institutions, Industries, and hospitals through Job training and project work.
- To give an opportunity to students to meet eminent scientists working in various fields of Biochemistry by way of invited lectures, seminars & workshops
- Designing strategies and catalysts for making chemical bonds in new ways
- To provide opportunities to get hands on experience in –
  - Research oriented education in Biochemistry
  - Molecular Biology and Biotechnology
  - Apprenticeship in industries and service agencies
  - Entrepreneurship in Biochemistry-related areas.
- Promote research based projects/activities in the emerging areas of technology convergence.

### **PROGRAMME EDUCATIONAL OBJECTIVES**

1. To equip the graduates with the ability to prepare to a fast changing situations by gaining strength to learn and apply the new skills with competency
2. To teach the basic and essential knowledge in the field of Biochemistry both practically and theoretically with the team setup and with proper ethical practices.
3. To make the graduates to develop the spirit of empathy, humanity and commitment for Nation development

### **PROGRAMME SPECIFIC OBJECTIVES (PSO)**

1. To create interest among students so that they can pursue higher education in Biochemistry to take up the career of teaching, research or to serve the needs of medicine, agriculture related industrial establishments.
2. To make graduates understand Biochemistry with various application in clinical diagnosis, understanding pathology of diseases treatment of diseases, designing of drugs and understanding their metabolism and manufacture of various biological products like amino acids, proteins, antibiotics, hormones, enzymes, nutrients etc.,

- To promote students with leadership quality to organize seminar, guest lectures and promote research based projects, to undergo internship programmes in the emerging areas of biological sciences.

### PO and Knowledge level

PO No	PROGRAMME OUTCOME	Knowledge Level
PO1	<b>Disciplinary knowledge:</b> Ability to understand fundamental concepts of biology, chemistry and biochemistry, ability to relate various interrelated physiological and metabolic events. A general awareness of current developments at the forefront in Biochemistry and allied subjects, ability to critically evaluate a problem and resolve to challenge blindly accepted concept. Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.	K2
PO2	<b>Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share ones views and express herself; demonstrate the ability to listen carefully, read and write analytically and follow scientific viewpoints, and present complex information in a clear and concise manner to different groups.	K1
PO3	<b>Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; ability to substantiate critical readings of scientific texts. Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.	K4
PO4	<b>Problem solving:</b> ability to closely observe the situation, and apply lateral thinking and analytical skills.	K3
PO5	<b>Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesis data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.	K5
PO6	<b>Research-related skills:</b> Ability to problematize; to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers. Ability to plan, execute and report the results of an experiment and write a research paper.	K6
PO7	<b>Cooperation/Team work:</b> Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group in the interests of a common cause and work efficiently as a member of a team.	K6
PO8	<b>Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments.	K4
PO9	<b>Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. Ability to see the	K2

	influence of location –regional, national, global-on critical thinking.	
PO10	<b>Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.	K3
PO11	<b>Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. Ability to critically analyse research literature and postulate hypothesis, questions and search for answers.	K6
PO12	<b>Multicultural competence:</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.	K5
PO13	<b>Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.	K3
PO14	<b>Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.	K6
PO15	<b>Lifelong learning:</b> Ability to acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trends and demands of work place through knowledge/skill development/reskilling.	K6

#### IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year Degree course shall be required to have passed

- A pass in +2 with Chemistry as compulsory subject and studied Botany and Zoology or Biology in the plus 2.

#### V. DURATION OF THE COURSE

- The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.

- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

## VI ASSESSMENT

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers.

A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when his / her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

### A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

#### Distribution Of Continuous Assessment Marks (25/40)

Activity	Period (WD)	Marks (25)	Activity	Marks (40)
Attendance	90	5	Attendance	5
CIA Test I	30 to 35	2.5	CIA Test I/Review	5
CIA Test II	60 to 65	2.5	CIA Test II/Review II	5
Model	After 90	10	Model/Model Presentation	10
Assignment		05	Observation note	10
			Results in lab/Work	5
<b>Total</b>		<b>25</b>	<b>40</b>	

#### Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	1
2	81-85	2	2
3	86-90	3	3
4	91-95	4	4
5	96-100	5	5

## A. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valued by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

### Distribution Of Final Assesment Marks (75/60)

Section	Activity	Marks (75)	Activity	Marks (60)
A	One mark (20)	20	Record work	5
B	Five marks (Either or)	25	Viva Voce	5
C	Ten marks (3/5)	30	Sportters	10
			Experiment I	20
			Experiment II	20
<b>Total</b>		<b>75</b>	<b>Total</b>	<b>60</b>

## VII. PASSING MINIMUM

### INTERNAL

There is no passing minimum for CIA

### EXTERNAL

In the EA, the passing minimum shall be 40% out of 75 Marks. (30 Marks)

## VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

- 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
- 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
- 50% and above but below 60% shall be declared to have passed the examinations in second class.
- All the remaining successful candidates shall be declared to have passed the examinations in third class.
- Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for College rank.

## **IX. ELIGIBILITY FOR AWARD OF THE DEGREE**

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than three academic years comprising of six semesters and passed the examinations prescribed and fulfilled such conditions has have been prescribed therefore.

## **X. PROCEDURE IN THE EVENT OF FAILURE**

Candidates fail in any subject would be permitted to appear for each failed subject or subjects in the subsequent EA. However, final year students failed in one or two subjects would be allowed to appear for a supplementary exam within a month of the final result.

## **XI. COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2020-21 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2020-21 and thereafter.

## **XII. TRANSITORY PROVISIONS.**

Candidates who have undergone the UG Course of study before 2020-21 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., upto and inclusive of the examination of April/May 2023. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years. (3+5)

## XII. COURSE PATTERN

### VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS) SYLLABUS FRAME WORK

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
<b>YEAR I</b>													
<b>Semester I</b>							<b>Semester II</b>						
Language I	5	3	3	25	75	100	Language I	5	3	3	25	75	100
English I	5	3	3	25	75	100	English I	5	3	3	25	75	100
Prof Eng	4	4	3	25	75	100	Prof Eng	4	4	3	25	75	100
Core I	4	4	3	25	75	100	Core I	3	2	3	25	75	100
Core Practical	3	3	6	40	60	100	Core Practical	3	2	6	40	60	100
Allied I	4	4	3	25	75	100	Allied I	3	3	3	25	75	100
Allid Practical I	3	-	-	-	-	-	Allid Practical I	3	2	3	40	60	100
Value education	2	2	3	25	75	100	EVS	4	4	3	25	75	100
<b>Total</b>	<b>30</b>	<b>23</b>	<b>24</b>	<b>190</b>	<b>510</b>	<b>700</b>	<b>Total</b>	<b>30</b>	<b>23</b>	<b>27</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>YEAR II</b>													
<b>Semester III</b>							<b>Semester IV</b>						
Language III	6	3	3	25	75	100	Language IV	6	3	3	25	75	100
English III	6	3	3	25	75	100	English IV	6	3	3	25	75	100
Core III	4	4	3	25	75	100	Core IV	4	4	3	25	75	100
Core III Practical	3	2	6	40	60	100	Core IV Practical	3	2	6	40	60	100
Allied III	4	4	3	25	75	100	Allied IV	4	4	3	25	75	100
Allied III Practical	3	3	3	40	60	100	Allied IV Practical	3	3	3	40	60	100
SBEC I	2	2	3	25	75	100	SBEC II	2	2	3	25	75	100
NMEC I	2	2	3	25	75	100	NMEC II	2	2	3	25	75	100
<b>Total</b>	<b>30</b>	<b>23</b>	<b>27</b>	<b>230</b>	<b>570</b>	<b>800</b>	<b>Total</b>	<b>30</b>	<b>23</b>	<b>27</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>YEAR III</b>													
<b>Semester V</b>							<b>Semester VI</b>						
Core V	6	5	3	25	75	100	Core VII	5	5	3	25	75	100
Core VI	5	4	3	25	75	100	Core VIII	5	4	3	25	75	100
Core V Practical	6	5	6	40	60	100	Core VII Practical	6	4	6	40	60	100
Core VI Practical	6	5	6	40	60	100	Core VIII Practical	6	4	6	40	60	100
Elective I	4	3	3	25	75	100	Elective II	4	3	3	25	75	100
SBEC III	2	2	3	25	75	100	SBEC IV	2	2	3	25	75	100
							Mini Project	1	1				
							Extension Work	1	1		40	60	100
<b>Total</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>Total</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>220</b>	<b>480</b>	<b>700</b>
<b>TOTAL CREDIT FOR THE COURSE</b>									<b>140</b>	<b>153</b>	<b>1280</b>	<b>3120</b>	<b>4400</b>



**Distribution Of Duration And Credit Under Different Papers**

<b>PART</b>	<b>SEMESTER</b>	<b>COURSE</b>	<b>NO.OF COURSE</b>	<b>HOURS</b>	<b>CREDIT</b>	<b>TOTAL CREDIT</b>
Part I	I-II	Foundation Tamil / Hindi / Malayalam/French	4	6	3	12
Part II	I-II	Foundation English	4	6	3	12
Part III	I-VI	Core/ Practical	15-20	5-6	4	70
	I-IV	Allied/Practical	4	4	4	16
	I-IV	Allied Practical	3	3	3	9
Part IV	III-IV	Skill Based Electives	2	4	2	4
	III-IV	Non Major Electives	2	4	2	4
	V-VI	Elective	2	8	3	6
	I	Value Based Education	1	2	2	2
	II	Environmental Studies	1	4	4	4
Part V	VI	Extension Activities	1	-	1	1
<b>TOTAL</b>						140

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)**  
**DEPARTMENT OF BIOCHEMISTRY**  
**CBCS AND OBE PATTERN SYLLABUS - UG**  
**(For candidates admitted from 2020-2021 onwards)**

Sem	Subject code	Part	Course	Subjects	Hrs/week	Credit	Int. marks	Ext. mark	Tot. mark	
I	22U1LT01	I	Language-I	Tamil-I	5	3	25	75	100	
	20U1LH01			Hindi-I						
	20U1LM01			Malayalam-I						
	20U1CE01	II	English-I	Communicative English I	5	3	25	75	100	
	21U1LSPE01			Professional English I	4	4	25	75	100	
	20U1BCC01	III	Core-I	Biomolecules	4	4	25	75	100	
	21U1BCCP01			Core Practical-I	3	3	40	60	100	
	21U1CHA01 21U1CHAP01	III	Allied-I	Allied chemistry I	4	4	25	75	100	
				Allied Chemistry Practical I	3		-	-	-	
20U1VE01	IV	-	Value education – (Yoga)	2	2	25	75	100		
			<b>Total</b>	<b>30</b>	<b>23</b>	<b>190</b>	<b>510</b>	<b>700</b>		
II	22U2LT02	I	Language-II	Tamil-II	5	3	25	75	100	
	20U2LH02			Hindi-II						
	20U2LM02			Malayalam-II						
	20U2CE02	II		Communicative English-II	5	3	25	75	100	
	21U1LSPE01			Professional English I	4	4	25	75	100	
	20U2BCC02	III	Core-II	Major- Biochemical Techniques	3	2	25	75	100	
	20U2BCCP02			Core Practical-II	3	2	40	60	100	
	20U2CHA02	III	Allied-II	Allied Chemistry II	3	3	25	75	100	
	20U2CHAP01			Allied Chemistry Practical II	3	2	40	60	100	
	20U2VES01	IV	-	Environmental studies	4	4	25	75	100	
			<b>Total</b>	<b>30</b>	<b>23</b>	<b>230</b>	<b>570</b>	<b>800</b>		
III	22U3LT03	I	Language – III	Tamil-III	6	3	25	75	100	
	20U3LH03			Hindi-III						
	20U3LM03			Malayalam-III						
	20U2CE02	II	English-III	Communicative English-III	6	3	25	75	100	
	20U3BCC03	III	Core-III	Enzymes and Enzyme Technology	4	4	25	75	100	
	20U3BCN01 20U3BCN02			NMEC I	Health and Hygiene Biochemistry in Diagnosis	2	2	25	75	100
	20U3BCCP03			Core III	Core Practical-III	3	2	40	60	100
	20U3MBP03	III	Allied-III	Allied Microbiology	4	4	25	75	100	
	20U3UMB03			Allied Microbiology Practical	3	3	40	60	100	
	20U3BCS01	IV	SBEC-I	Biostatistics	2	2	25	75	100	
			<b>Total</b>	<b>30</b>	<b>23</b>	<b>230</b>	<b>570</b>	<b>800</b>		

IV	22U4LT04	I	Language-IV	Tamil-IV	6	3	25	75	100
	20U4LH04			Hindi-IV					
	20U4LM04			Malayalam-IV					
	20U4LE04	II	English-IV	Communicative English-IV	6	3	25	75	100
	20U4BCC04	III	Core-IV	Intermediary Metabolism	4	4	25	75	100
	20U4BCCP04		Core IV	Core Practical-IV	3	2	40	60	100
	20U4BCN01	III	NMEC II	Biochemistry and Health Molecular basis of human disease	2	2	25	75	100
	20U4BCN02								
	20U4CSA04	III	Allied-IV	Allied Biotechnology	4	4	25	75	100
	20U4CSAP03			Allied Biotechnology Practical	3	3	40	60	100
20U4BCS02	IV	SBEC-II	Computer in Biology	2	2	25	75	100	
			<b>Total</b>	<b>30</b>	<b>23</b>	<b>230</b>	<b>570</b>	<b>800</b>	
V	20U5BCC05	III	Core-V	Human Physiology	6	5	25	75	100
	20U5BCC06	III	Core-VI	Molecular Biology	5	4	25	75	100
	20U5BCCP05	III	Core-V Practical	Core Practical-V	6	5	40	60	100
	20U5BCCP06	III	Core-VI Practical	Core Practical-VI	6	5	40	60	100
	20U5BCE01 20U5BCE02	III	Elective-I	Drug Biochemistry Nutritional Biochemistry	4	3	25	75	100
	20U5BCS03	IV	SBEC-III	Genetic Engineering	2	2	25	75	100
			<b>Total</b>	<b>30</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>	
VI	20U6BCC07	III	Core-VII	Immunology and Immunotechniques	5	5	25	75	100
	20U6BCC08	III	Core-VIII	Clinical Biochemistry	5	4	25	75	100
	20U6BCCP07	III	Core-VII Practical	Core Practical-VII	6	4	40	60	100
	20U6BCCP08	III	Core-VIII Practical	Core Practical-VIII	6	4	40	60	100
	20U6BCE03 20U6BCE04	III	Elective-II	Biochemistry of Hormones Cell Biology	4	3	25	75	100
	20U6BCS04	IV	SBEC-IV	Biochemistry in diagnostic medicine	2	2	25	75	100
	20U6BCPR1	III	-	Mini Project	1	1			
	20U6EX01	-	-	Extension Work	1	1	40	60	100
			<b>Total</b>	<b>30</b>	<b>24</b>	<b>220</b>	<b>480</b>	<b>700</b>	
<b>Overall Total</b>				<b>180</b>	<b>140</b>	<b>1280</b>	<b>3120</b>	<b>4400</b>	

## **MAJOR ELECTIVE COURSES (ELECTIVE)**

### **SEMESTER V:**

1. Drug Biochemistry (20U5BCE01)
2. Nutritional Biochemistry (20U5BCE02)

### **SEMESTER VI:**

1. Biochemistry of Hormones (20U6BCE03)
2. Cell Biology (20U6BCE04)

## **NON MAJOR ELECTIVE COURSES (NMEC)**

### **SEMESTER III :**

1. Health and Hygiene (20U3BCN01)
2. Biochemistry in Diagnosis (20U3BCN02)

### **SEMESTER VI:**

1. Biochemistry and Health (20U4BCN03)
2. Molecular basis of human disease (20U4BCN03)

## BIOMOLECULES

Paper : Core I  
 Hours/Week : 4  
 Credit : 4  
 Paper Code : 20U1BCC01

Total Hours : 60  
 Exam Hours : 03  
 Internal : 25  
 External : 75

**Aim:**

To understand the structure, properties and functions of biomolecules.

**Objective:**

The objective of the paper is to make the students to understand the structure, properties and functions of the biomolecules like carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.

**OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Familiarize about the definition, occurrence, and types of carbohydrates,	K1
CO2	Explain the types, structure and functions of lipids and lipoproteins.	K2
CO3	Describe the types of amino acids and structural organization of protein.	K2
CO4	Understand the structure and biological significance of nucleic acids	K3
CO5	Understand the sources and importance of vitamins and minerals.	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	S	M	S	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	M	S	M	M	S	S	S	S	S	S
CO3	S	S	M	M	S	M	L	M	S	L	M	S	L	S	M
CO4	S	M	S	L	S	S	M	L	S	M	S	L	S	M	M
CO5	S	S	S	S	M	S	S	S	L	L	S	M	S	L	S

S- Strong; M-Medium; L-Low

## **CONTENT:**

### **Unit- I**

**12 Hours**

**Carbohydrates:** Introduction and general classification of carbohydrates.

**Monosaccharides:** Classifications of Monosaccharides. Structures, properties and biological functions of monosaccharides. Isomerism - structural and stereo isomerism, interconversion of sugars, muta-rotation.

**Oligosaccharides:** Structure, chemistry and function – Sucrose, Lactose, Maltose and Cellobiose

**Polysaccharides:** Classifications of polysaccharides, Structures, properties and biological functions of Homo-polysaccharides - starch, cellulose, glycogen, pectin and Hetero-polysaccharides -Hyaluronic acid, Chondroitin sulphate, chitin and Heparin.

### **Unit- II Fatty acids and Lipids**

**12 Hours**

**Fatty acids:** Definition, classification of fatty acids-saturated and unsaturated fatty acids. Essential fatty acids.

**Lipids:** Classification of lipids- simple, conjugated and derived lipids, occurrence, structure and physical and chemical properties of phospholipids, glycolipids, sphingolipids and cholesterol.

**Lipoproteins:** Types and functions of lipoproteins – Chylomicrons, VLDL, LDL and HDL.

### **Unit -III: Amino acids and Proteins:**

**12 Hours**

**Amino acids:** Structure and classification of amino acids based on chemical nature, chemical reaction of amino acids due to carbonyl and amino groups. Essential amino acids.

**Peptides:** Features of peptide bond, naturally occurring peptides – Glutathione, enkaphalins and endorphins.

**Protein:** Classification, physical and chemical properties of proteins, structural organization of proteins - Primary, secondary, tertiary and quaternary structures, Forces stabilizing each level of structure.

### **Unit -IV : Nitrogenous bases &Nucleicacids:**

**12 Hours**

**Nitrogenous bases:** Structure of Purines and Pyrimidines. Nucleosides, nucleotides and formation of phosphodiester bond.

**DNA:** - Types of DNA, Structure of DNA – Watson and Crick double helix model, physico-chemical properties and functions of DNA.

**RNA:** - Types and basic structural features of RNA – mRNA, tRNA and rRNA, properties and functions of RNA.

## **Unit -V : Vitamins**

**12 Hours**

**Vitamins:** Introduction to vitamins, classification of vitamins - structures, sources, RDA, functions, deficiency diseases of fat soluble and water-soluble vitamins.

### **TEXT BOOKS:**

1. Fundamentals of Biochemistry(2005)J.L.Jain, 6 th Edition, S.Chand &Co Ltd.,NewDelhi.
2. Satyanarayana.U., Fundamentals of Biochemistry, Allied & Books Pvt Ltd, Calcutta, 2019
3. Deb, A.C., Fundamentals of Biochemistry, New Central Agency, Calcutta, 2016.

### **REFERENCE BOOKS:**

1. Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, W H Freeman Publishers, 7th Edition, 2017
2. Lubert stryer, Biochemistry, Freeman and company, 9th Edition, 2019
3. Principles of Biochemistry (1994), Garrette & Grisham, Saunders College publishing.
4. Fundamentals of Biochemistry (1999) Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.

### **WEBRESOURCES**

1. [https://www.phys.sinica.edu.tw/TIGPNANO/Course/2010\\_Spring/Classnotes/AAC\\_lehninger4e\\_ch03%20\(Protein\).pdf](https://www.phys.sinica.edu.tw/TIGPNANO/Course/2010_Spring/Classnotes/AAC_lehninger4e_ch03%20(Protein).pdf)

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

**YEAR I – SEMESTER II**  
**BIOCHEMICAL TECHNIQUES**

Paper	: Core II	Total Hours	: 60
Hours/Week	: 3	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 20U2BCC02	External	: 75

**Aim:** To understand the principles, instrumentation, working and application of the instruments commonly used in the laboratories.

**Objectives:** The students learned the principles and applications of the instruments. - chromatography, electrophoresis Solid and liquid Scintillation. Autoradiography and its applications.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Describe the basics of measurements and various biological buffer systems of blood	K1
CO2	Demonstrate the principle, techniques and applications of chromatography	K2
CO3	Explain the various electrophoresis and centrifugation techniques and their applications in Biochemistry	K3
CO4	Categorize the colorimetry and Spectroscopic techniques for the assessment of biological Samples	K3
CO5	Classify the radioactive tracer techniques and applications of radioisotopes	K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L
CO2	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
CO3	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
CO4	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L
CO5	L	L	M	M	S	S	S	M	L	L	S	S	L	M	M

S- Strong; M-Medium; L-Low



## CONTENT

### UNIT – I

12 Hours

**pH Scale:** methods of calculating pH from Henderson's –Hasselbalch equation, buffer solutions, buffer systems of blood - protein, bicarbonate, Hemoglobin and phosphate buffer system. Various ways of expressing the concentrations of solutions - molality, molarity, normality, mole fraction and percentage solution. Simple problems to be worked out.

### UNIT – II

12 Hours

**Chromatography:** principle, instrumentation and applications - Paper chromatography, Thin layer chromatography, Column chromatography, GLC, Ion exchange chromatography, Affinity chromatography, High performance Thin Layer chromatography (HPTLC) and Molecular sieve chromatography

### UNIT – III

12 Hours

**Electrophoresis and Centrifugation:** Principle, instrumentation and applications of Paper electrophoresis, Agarose gel, SDS-PAGE and Isoelectric focusing . Types of centrifuges, Analytical Ultracentrifugation and its applications in determination of molecular weight, Preparative Ultracentrifugation- Differential and density gradient centrifugation.

### UNIT – IV

12 Hours

**Colorimetry:** colour and absorption spectra, Beer and Lambert's law , working of a Single cell photoelectric colorimeter, measurement of extinction coefficient, calibration curve. Spectrophotometry – instrumentation and applications of UV-Visible and IR Spectrophotometers. comparison and advantages of spectrophotometer over colorimeter. Fluorimetry – principle, instrumentation and applications - determination of Thiamine and Riboflavin. Flame photometer - principle, instrumentation and applications.

### UNIT – V

12 Hours

**Radio isotope techniques:** The nature of radioactivity, detection and measurement of radioactivity, detection based on gas ionization- Geiger Muller counter- principle and applications. Detection based on excitation- Liquid Scintillation counter-principle and applications. Applications of radioisotopes in biological sciences. Hazards and safety aspects of radioactivity.

## **TEXT BOOKS**

1. Allen, J.P. (2008), Biophysical Chemistry, 1st Edition, Markono Print Media Limited, Singapore.
2. Upadhyay, A., Upadhyay, K., and Nath, N., (2014), Biophysical chemistry – principle & techniques, Himalaya publishing House, Mumbai.
3. Gurdeep, R. Chatwal and Aanand. S.K. (2009). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.

## **REFERENCE BOOKS**

1. Keith Wilson, and John Walker, (2010), Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, New York, USA.
2. Pattabhi, V and Gautham, (2015), Biophysics, Narosa Publishing House PVT Ltd, New Delhi.
3. Wilson, K and Goulding, KH (1987). A Biologist Guide to Principles and Tecchniques of Practrical Biochemistry, 3rd edition, Edward Arnold Publishers. Londen, UK.
4. Nicolau, C., (1973), Experimental methods in Biophysical chemistry, Wiley–Blackwell Publisher,
5. Keith Wilson and Kenneth, (1994). Goulding A Biologist Guide to Principles and Tecchniques of Biochemistry, EdWard Arnold Publishers. UK.

## **WEB SOURCES:**

1. [https://chem.libretexts.org/Ancillary\\_Materials/Reference/Organic\\_Chemistry\\_Glossary/Henderson-Hasselbach\\_Equation](https://chem.libretexts.org/Ancillary_Materials/Reference/Organic_Chemistry_Glossary/Henderson-Hasselbach_Equation)
2. <https://www.pharmatutor.org/pharma-analysis/write-a-note-on-size-exclusion-chromatography-with-applications>
3. <https://microbenotes.com/centrifugation-principle-types-and-applications/>
4. <https://microbenotes.com/uv-spectroscopy-principle-instrumentation-applications/>
5. <https://www.cpp.edu/~pbsiegel/bio431/texnotes/chapter4.pdf>

## **PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

**YEAR I – SEMESTER I  
CORE PRACTICAL – I**

Paper : Core Practical I	Total Hours : 75
Hours/Week : 3	Exam Hours : 06
Credit : 3	Internal : 40
Paper Code : <b>20U1BCCP01</b>	External : 60

- CO1 Learn and understand the principles of reactions involved in the qualitative analysis of carbohydrates and amino acids
- CO2 Demonstrate the acid and iodine number of lipids
- CO3 Analyze, interpret and identify the unknown carbohydrates and amino acids

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	M	S	L	L	M	S	M	M	M	M	M
CO2	S	M	M	S	M	S	M	L	S	M	M	L	L	L	L
CO3	S	S	L	M	S	M	M	L	S	M	M	L	L	L	L

S- Strong; M-Medium; L-Low

**I. Preparation of Solution**

1. Normal, Molar, Percentage solution and calculation

**II. QUALITATIVE ANALYSIS**

**A. ANALYSIS OF CARBOHYDRATES**

- a) Monosaccharides-Glucose, Fructose, Galactose, Pentose.  
 b) Disaccharides-Sucrose, Maltose and Lactose.  
 c) Polysaccharides-Starch

**II. QUALITATIVE ANALYSIS OF AMINO ACIDS**

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

**III. ANALYSIS OF LIPIDS (DEMONSTRATION)**

- a) Oil, Unsaturated fat, Sterol

**REFERENCE BOOKS:**

- Biochemical Methods 1992, by **S.Sadasivam and A. Manickam**, Second Edition, New Age International Publishers, New Delhi.
- Laboratory Manual in Biochemistry, 1981. **J.Jayaraman**, New Age International publishers, New Delhi.

**YEAR I – SEMESTER II**  
**CORE PRACTICAL – II**

Paper	: Core Practical II	Total Hours	: 60
Hours/Week	: 3	Exam Hours	: 06
Credit	: 2	Internal	: 40
Paper Code	: <b>20U2BCCP02</b>	External	: 60

CO1	Imbibe the usage of paper chromatography, TLC, SDS- PAGE, colorimeter and spectrophotometer, flame photometry
CO2	Comprehend the principles involved in the estimation of sodium and potassium
CO3	Analyze and interpret the results of estimation of ascorbic acid

**I. QUANTITATIVE ANALYSIS**

- a) Estimation of Aminoacid (Glycine) by Formal titration method.
- b) Estimation of Ascorbicacid by 2,6 Di Chlorophenol Indophenol Dyemethod.
- c) Estimation of Sodium and Potassium by Flame Photometry
- d) Estimation of DNA by Diphenylamine method.

**II. QUALITATIVE EXPERIMENTS**

- a) Preparation of buffer and its pH measurements using pH meter.
- b) Separation of amino acids by Paper Chromatography (Ascending and Descending)
- c) Separation of amino acids by TLC.

**REFERENCE BOOKS:**

1. Biochemical Methods 1992, by **S.Sadasivam and A. Manickam**, Second Edition, New Age International Publishers, New Delhi.
2. Laboratory Manual in Biochemistry, 1981. **J.Jayaraman**, New Age International publishers, New Delhi.
3. An Introduction to Practical Biochemistry (1998) 3rd ed., **Plummer D. T.**, Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.

## YEAR II – SEMESTER III

### ENZYME AND ENZYME TECHNOLOGY

Paper	: Core III	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>20U3BCC03</b>	External	: 75

**Aim:** To inculcate knowledge on enzymes, classification, structure kinetics and applications.

**Objectives:** On successful completion of the course the students will acquire knowledge about Techniques of isolation & purification of the enzymes. Enzyme Kinetics Enzymes that are used in medicine and industry.

#### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Describe the various systems for classifying the enzymes	K1
CO2	Apply appropriate methods for determination of catalytic parameters and activity of enzymes and resolve problems considering kinetics and	K1
CO3	Characterize the structure and functions of coenzymes, and the mechanism of enzyme catalysis	K2
CO4	Explain the regulatory mechanisms of enzyme activity which involve in the maintenance of body's homeostasis	K3
CO5	Use appropriate enzymes for use in industries for recognizing their potential	K3

#### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

## CONTENT

### Unit I Introduction of Enzyme and features of enzyme catalysis

10 hour

Characteristics, IUBMB Classification of enzymes, holoenzyme, co-enzyme, co-factors, apoenzymes, prosthetic group, abzymes, ribozymes, Active Site: Structure of active site and its characteristics, theories of ES complex -Fischer's Lock and key hypothesis, Koshland's induced fit hypothesis.

### Unit II Enzyme kinetics and Bisubstrate reaction

16 hour

**Michaelis-Menten Equation:** - Initial velocity and steady state approach,  $V_{max}$ ,  $K_m$  and their significance, Linear transformation of Michaelis-Menten Equation; - Lineweaver-Burk Plot, Eadie-Hofstee Plot, Hanes Plot. Effect of pH, temperature, substrate, product concentration, and metal ions on the activity of enzyme. Bisubstrate reaction- random and ping-pong reactions

### Unit III Enzyme inhibition and regulation of enzyme activity

14 hour

Reversible (competitive, non-competitive and uncompetitive) and irreversible inhibition, feedback inhibition (aspartate transcarbamylase), Isoenzymes – Properties and physiological significance (Lactate dehydrogenase), Multi-enzyme complex as regulatory enzymes.

### Unit IV Mechanism of enzymes and Co-enzymes

13 hour

General features- Proximity and orientation, acid base and covalent catalysis (lysozyme and chymotrypsin), metal activated enzymes and metalloenzymes, involvement of coenzymes in enzyme catalysed reactions- TPP, TPP, NAD, FAD, coenzyme-A, pyridoxal phosphate and biotin.

### Unit V Enzyme Technology and Applications

7 hour

Method of Immobilized enzymes, Effects of thermal and stability on the immobilized enzyme. Isolation and purification of enzymes. Industrial and agricultural use of enzymes

## TEXT BOOKS

1. Nicholas., C. Price, (2016). **Fundamentals of Enzymology**. 3<sup>rd</sup> Edition, Oxford University Press.
2. Trevor Palmer, (2010). **Enzymes**. 5<sup>th</sup> Edition, Affiliated East –West press (P) Ltd.
3. Gary Walsh, Denis, and Headon, (2014). 2nd Edition **Protein Biochemistry and Biotechnology**. John Wiley and Sons Ltd, USA.

## **REFERENCES BOOKS**

1. Dixon, E.Cwebb, (1999). **Enzymes**.3<sup>rd</sup> Edition, CJRthorne and K.F.Tipton,Longmans Green &Co , London and Academic Press, New York.
2. Punekar 2018 Enzymes: Catalysis Kinetics and Mechanism, Springer Publisher
3. Khan 2015 Principles of enzymes Technology 1<sup>st</sup> Edition PH1 Learning Pvt Ltd

## **WEB RESOURCES**

<http://expasy.org/enzyme/>.

<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>.

[www1.lsbu.ac.uk/water/enztech/inhibition.html](http://www1.lsbu.ac.uk/water/enztech/inhibition.html)

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

## YEAR II – SEMESTER III

### HEALTH AND HYGIENE

Paper : **NMEC I**  
Hours/Week : 2  
Credit : 2  
Paper Code : **20U3BCN01**

Total Hours : 30  
Exam Hours : 03  
Internal : 25  
External : 75

#### Aim

- Learn the functions of biomolecules.
- Understand the physiological changes of various diseases.
- Know about the nutritional requirements and dietary management of the diseases.

#### Objectives:

Explain about the sources, function of carbohydrates and disorders of carbohydrate metabolism and Expound the dietary sources, recommended daily allowance and over consumption of minerals

#### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Gain an appreciation and knowledge of how to deal with health issues	K1 & K2
CO2	To understand the importance of personal health and hygien	K1 & K2
CO3	Provide comprehensive personal hygiene based on accepted scientific theories and research within the scope of accepted standard care	K1,K2 & k3
CO4	Illustrate the awareness of personal hygiene and its applications	K1 & K2
CO5	Ability to apply the knowledge in their day to day life	K1 & K2

#### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
CO4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
CO5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

#### UNIT I

**6 Hrs**

Overview- Introduction , General health, Signs of good health, Personal Hygiene, Hygiene specificities, Handling common Illnesses, Choosing a doctor.



## **UNIT II**

**6 Hrs**

Nutrition and Health – Definition of Food and Nutrition. Nutrients – Sources and functions of Proteins, fats, carbohydrates, vitamins and minerals. Balanced Diet. Nutritional Profile of principle foods – Cereals, Millets, Vegetables, Fruits, Milk, and Milk products, Fish, meat, alcoholic beverages, egg and soft drink.

## **UNIT III**

**6 Hrs**

Maternal and child Health-Mother and child-Intra natal and Post natal care. Complications of post natal period, restoration of mother to optimum health. Breast feeding; Family planning methods – definition, Natural methods and Artificial methods.

## **UNIT IV**

**6 Hrs**

Dental Health – Tooth development, Developmental tooth anomalies , Promotion of Oral health, Viral infections, Oral ulcerations, Dental caries – Diagnostic methods, Non- surgical management and prevention.

## **UNIT V**

**6 Hrs**

Mental Health – Strategies of Stress Management: Prevention of stress Challenging Stressful Thinking; Problem Solving; Emotional and cognitive coping styles. Types and causes of mental illness – Preventive aspects; Alcoholism, Drug dependence – Commonly abused drugs.

## **TEXT BOOKS**

1. **Ahmed. M. N.**, *Hygiene and health*, Anmol publications, New Delhi, 15<sup>th</sup> edi., 2011.
2. **Ashtekar. S.**, *Health and Healing –A Manual of Primary health care*, Orient Longmans publishers. 2010.
3. **Park. K.**, *Social and preventive medicine*, Bhanot publishers, Japalpur, 18<sup>th</sup> edition, 2017.

## **REFERENCE BOOKS**

1. **Patil. R.S.**, *Practical Community Health*, Vora medical publishers, New Delhi, 3<sup>rd</sup> edi 2010.
2. **Prabhakara. G. N.**, *Preventive and social medicine*, Jaypee Publications., New Delhi, 1<sup>st</sup> edi, 2010.
3. **Sridhar Rao. B.**, *Community Health Nursing*, A.I.T.B.S. Publishers, New Delhi, 3<sup>rd</sup> edi 2014, Revised reprint 2009.

## **WEB OF REFERENCE**

1. <https://www.healthline.com/health/personal-hygiene>
2. <https://www.otsuka.co.jp/en/nutraceutical/about/nutrition/functions/>
3. <https://americanpregnancy.org/preventing-pregnancy/natural-family-planning/>

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

**YEAR II – SEMESTER III**  
**BIOCHEMISTRY IN DIAGNOSIS**

Paper	: <b>NMEC II</b>	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: <b>20U3BCN02</b>	External	: 75

**SUBJECT DESCRIPTION:**

This course presents about the techniques, diagnostic values and significance and the interpretation of various enzymes, bio-chemical parameters, hormones and immunoglobulins.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Remember the approaches to clinical quality control, accuracy and collection and preservation of biological samples such as blood, urine and fluids	K1
CO2	Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC	K1
CO3	Apply the knowledge abnormal constituents of urine chemical such as protein, keton bodies, bile pigments and their clinical interpretation	K2
CO4	Analyse and describe the critical based knowledge collection, preservation, abnormal constituent of stools and microscopy studies.	K3
CO5	Evaluate and discuss the estimate the biochemical GTT, SGOT, SGPT and LDH etc	K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
CO4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
CO5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

**UNIT – I**

**06 Hours**

Approaches to clinical biochemistry: Quality control: Concepts of accuracy, precision, sensitivity and reproducibility, Collection of clinical specimens, preservatives for blood and urine, transport of biological samples.

Biomedical waste disposable, First aid equipment in laboratory accident-  
Precautions and first aid equipment

**UNIT – II**

**06 Hours**

Hematology: Composition and functions of blood, Haemoglobin, Differential count- PCV, ESR, RBC, WBC and Platelet count. Fully automated and Semiautomated Analysis.

**UNIT – III**

**06 Hours**

Physical examination of urine: Volume, colour, odour, appearance, specific gravity and pH. Chemical examination of urine: Qualitative tests for Reducing sugar, protein, ketone bodies, Bile pigment, bile salt, Urobilinogen, and mucin. Microscopic Examination of urine.

**UNIT – IV**

**06 Hours**

Stool examination: Collection of fecal specimen, preservation, physical examination:- volume, colour, odour and appearance. Chemical examination:- reducing sugar, occult blood test, detection of steatorrhea. Microscopic examination of stool.

**UNIT – V**

**06 Hours**

Estimation of Biochemical components in Blood: Glucose, GTT, Glycosylated haemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of enzyme activity: SGOT, SGPT and LDH.

**TEXT BOOK**

1. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

**REFERENCE**

1. Kanai L. Mukherjee, Medical Laboratory Technology Vol. I. Tata McGrawHill 1996, New Delhi.
2. Text book of Biochemistry with clinical correlation, Thomas M. Devlin, 3rd edition, A. John Wiley-Liss Inc. Publication.

3. Tietz Fundamentals of Clinical Chemistry– (5th edition) C. A. Burtis, E. R. Ashwood (eds) Saunders WB Co.

## WEB OF REFERENCE

1. <https://onlinelibrary.wiley.com/doi/abs/10.1002/0470869526.ch3>
2. <http://fblt.cz/en/skripta/v-krev-a-organy-imunitniho-systemu/1-slozeni-krve/>
3. [https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis\\_microscopic\\_exam](https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis_microscopic_exam)
4. <https://www.webmd.com/a-to-z-guides/what-is-a-stool-culture#1>

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

### YEAR II – SEMESTER III CORE PRACTICAL – III

Paper	: Core Practical III	Total Hours	: 75
Hours/Week	: 3	Exam Hours	: 06
Credit	: 2	Internal	: 40
Paper Code	: 20U3BCCP03	External	: 60

#### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Remember the approaches to Isolation and Separation of Starch from Potato, Lecithin from Egg Yolk, Casein from milk	K1 & K2
CO2	Understand the estimation of protein by Lowrys Method	K1 & K2
CO3	Apply the Extraction of Muscle LDH from rabbit muscle using a piston homogenizer	K1,K2

#### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M

S- Strong; M-Medium; L-Low

#### I. PREPARATION:

1. Preparation of Buffer
2. Starch from Potato
3. Lecithin from Egg Yolk

4. Casein from Milk

## **II. ENZYME ASSAY**

1. Optimization of pH, temperature, substrate concentration and Enzyme concentration of Salivary Amylase, Catalase.
2. To determine specific activity of acid phosphatase enzyme.

## **III. EXTRACTION**

Extraction of Muscle LDH from animal muscle using a piston homogenizer.

## **REFERENCES**

1. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2<sup>nd</sup> Edition .New Age International (P) Limited. New Delhi
2. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.
3. Price, N.C and Stevens, L., (1999) **Fundamentals of Enzymology** 3rd ed., Oxford University Press Inc., (New York), ISBN:13: 978-0-19-806439-8.

**YEAR II – SEMESTER IV**  
**INTERMEDIARY METABOLISM**

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>20U4BCC04</b>	External	: 75

**SUBJECT DESCRIPTION:**

Intermediary metabolism and regulation deals with the metabolic reactions of biomolecules, energy production through different mechanism and various regulatory mechanisms that control metabolic reactions under normal condition.

**OBJECTIVE:**

The objective of the paper is to make the students to study about bioenergetics of important metabolic pathways and metabolic changes of molecules in the body. Also to know about the Interrelationship between carbohydrate, fat and protein metabolism. To analyse the fate of nucleic acids and porphyrins in the biological system.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Demonstrate the important carbohydrate metabolic pathways and understand the principle mechanism in energy transfer reactions. living	K1 & K2
CO2	Explain the synthesis and importance of lipids in living system.	K1 & K2
CO3	Gain knowledge on types and significance of anabolic and catabolic reactions of amino acids and understand the interrelationship between carbohydrate ,lipid &protein metabolism	K1,K2 & k3
CO4	To acquire knowledge on biological oxidation and ETC	K1 & K2
CO5	Discriminate the synthesis and degradation of the nucleic acids.	K1 & K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
co1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
co2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
co3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
co4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
co5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

## CONTENT:

### UNIT – I

**12 Hours**

**Carbohydrate Metabolism:** Introduction, glycolysis, TCA cycle, and its energetics. Glycogen metabolism: Glycogenesis & Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis, glyoxylate cycle and its importance.

### UNIT-II

**12 Hours**

**Lipid Metabolism:** Introduction, Oxidation of fatty acids (alpha, beta, omega oxidation). Denovo synthesis of Fatty acid, Biosynthesis of cholesterol, Biosynthesis of TG, Phospholipids (Phosphatidyl serine, Phosphatidyl ethanolamine), Ketone bodies and its metabolism

### UNIT –III

**12 Hours**

**Protein Metabolism:** Degradation of proteins – Deamination, Transamination & Decarboxylation. Transport of ammonia. Urea cycle. Catabolism of carbon skeleton of amino acids (Alpha Keto Glutarate, Pyruvate, Aromatic amino acids) . Interrelation between carbohydrates, fat and protein metabolism.

### UNIT – IV

**12 Hours**

**Biological oxidation:** Introduction, Enzymes in biological oxidation, Redox potential, Electron Transport Chain & its inhibitors, structure of ATPase complex, chemiosmotic theory, Oxidative phosphorylation & its inhibitors, Mitochondrial shuttle system.

### UNIT-V

**12 Hours**

**Purine Nucleotide Metabolism:** Introduction, Biosynthesis (Denovo) Salvage Pathway & degradation of purine Nucleotide. Pyrimidine nucleotides Metabolism: Introduction, Biosynthesis & degradation of pyrimidine. Inhibitors of nucleic acid metabolism.

## TEXT BOOKS

1. Nelson, David, L. and Cox, (2008). Lehninger Principles of Biochemistry. 5<sup>th</sup> Edition,

W.H.Freeman and Co., New York.

2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). Fundamentals of Biochemistry, 3<sup>rd</sup> Edition. John Wiley & Sons, New Jersey.
3. Eric, E. Conn, P.K. Stumpf, G. Brueins, and Ray, H. Doi, (2005). Outlines of Biochemistry. 5th Edition, John Wiley and sons, Singapore.
4. Lubert Stryer, (1995). Biochemistry. 4<sup>th</sup> Edition .WH freeman and co, Sanfrancisco.

### **REFERENCE BOOKS**

1. Devlin, T.M. (2002) Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York.
2. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry. McGraw Hill.

### **WEB SOURCES**

[www.britannica.com/science/glyoxylate-cycle](http://www.britannica.com/science/glyoxylate-cycle)

<https://www.uic.edu/classes/phar/.../transaminationofaminoacid.html>

[www.slideshare.net/YESANNA/transamination-deamination](http://www.slideshare.net/YESANNA/transamination-deamination)

**PEDOGOGY: CHALK and Talk, PPT, Seminar, Models**



**YEAR II – SEMESTER VI**  
**BIOCHEMISTRY AND HEALTH**

Paper	NMEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	:20U4BCN03	External	: 75

**Aim**

- Learn the functions of biomolecules.
- Understand the physiological changes of various diseases.
- Know about the nutritional requirements and dietary management of the diseases.

**Objectives:**

Explain about the sources, function of carbohydrates and disorders of carbohydrate metabolism and Expound the dietary sources, recommended daily allowance and over consumption of minerals

Course No	Course Outcome	Knowledge Level
CO1	Familiarize about the definition, occurrence, and types of carbohydrates	K1 & K2
CO2	Recall and understand the classification, chemistry and functions of aminoacids	K1 & K2
CO3	Imbibe and interpret the definition, occurrence, and types of lipids	K1, K2 & k3
CO4	Evolve the physiological functions and significance of vitamins	K1 & K2
CO5	Correlate the need of macro and micronutrients with the metabolic and physiological functions of the human body.	K1 & K2

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M

co3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
co4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
co5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

#### UNIT – I

**06 Hours**

**Carbohydrate:** Sources of carbohydrates, importance of carbohydrates in living organisms, Normal level of sugar in blood, factors influencing blood glucose, renal threshold value, Diabetes mellitus:- Types, Complications, management-monitoring methods of blood glucose level and GTT.

#### UNIT – II

**06 Hours**

**Proteins:** Sources of proteins and amino acids, essential and non-essential amino acids, Importance of proteins in living organisms, normal level of serum proteins, protein deficiency disorders:-Kwashiorkor and Marasmus.

#### UNIT – III

**06 Hours**

**Lipids:** Sources of lipids, essential and non-essential fatty acids, importance of fats and lipids in living organism, role of lipoproteins in human body. Normal levels of cholesterol and TG. Disorders:- Hypertension and Atherosclerosis .

#### UNIT – IV

**06 Hours**

**Vitamins:** Sources, RDA, importance, deficiency disorders of water soluble and fat soluble vitamins in humans.

#### UNIT – V

**06 Hours**

**Minerals:** Sources, Biological importance and deficiency disorders of Na, K, Ca, Mg, P, Fe, Zn, Se and Iodine in humans.

#### TEXT BOOK

1. Deb.A.C., Fundamentals of Biochemistry, 10 th edition, 2011, New central book agency Pvt Ltd.
2. Biochemistry (2013) by U.Satyanarayana and U. Chakrapani, 4th edition, Elsevier.
3. Ambika Shanmugam's Biochemistry for Medical Students by K. Ramadevi, 8th Edition, Wolters kluvel
3. **Medical Biochemistry** (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.

#### REFERENCE BOOK

1. Textbook of medical physiology by C. Guyton, John E. Hall.—12th ed, 2011, Saunders, an

imprint of Elsevier Inc.

2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

### WEB OF REFERENCE

1. <https://www.webmd.com/diabetes/type-2-diabetes-guide/diagnosing-type-2-diabetes#1>

2. <https://www.healthline.com/nutrition/essential-amino-acids>

3. <https://www.ncbi.nlm.nih.gov/pubmed/1694933>

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

### YEAR II – SEMESTER IV CORE PRACTICAL – IV

Paper	: Core Practical IV	Total Hours	: 75
Hours/Week	: 3	Exam Hours	: 06
Credit	: 2	Internal	: 40
Paper Code	: <b>20U4BCCP04</b>	External	: 60

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Remember the approaches to clinical quality control, accuracy and collection and preservation of biological samples such as blood, urine and fluids	K1 & K2
CO2	Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC	K1 & K2
CO3	Apply the knowledge abnormal constituents of urine chemical such as protein, keton bodies, bile pigments and their clinical interpretation	K1, K2 & k3

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M

S- Strong; M-Medium; L-Low

## I. COLORIMETRY

1 .Estimation of Glucose	-	Ortho Toludine Method
2. Estimation of Fructose -	-	Seliwanoff's Method
3. Estimation of Pentose	-	Bial' s Method
4. Estimation of Urea	-	DAM Method
5 .Estimation of Cholesterol	-	Zaks Method
6. Estimation of Protein	-	Biuret Method
7 .Estimation of Phosphorus	-	Fiske Subbarow Method.

## REFERENCES

1. **Medical Laboratory Technology** - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN: 9780070076594 / ISBN:9780070076631
2. **Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests** Vo.II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.
3. **Experimental Biochemistry: A Student Companion** (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi), ISBN: 81-88237-41-8.

**YEAR II – SEMESTER IV  
CORE PRACTICAL – IV**

Paper	: Core Practical IV	Total Hours	: 75
Hours/Week	: 3	Exam Hours	: 06
Credit	: 2	Internal	: 40
Paper Code	: <b>20U4BCCP04</b>	External	: 60

**I. 1** .Estimation of Glucose by Ortho Toludine Method (Or) 15

Marks

2. Estimation of Fructose by Seliwanoff's Method

**II.1**.Estimation of Urea - DAM Method(Or) 15

Marks

2. Estimation of Protein - Biuret Method

Record 10

Spotters 20

**YEAR III – SEMESTER V**  
**HUMAN PHYSIOLOGY**

Paper	: CORE V	Total Hours	: 60
Hours/Week	: 6	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: <b>20U5BCC05</b>	External	: 75

**SUBJECT DESCRIPTION:**

This course present to focus on the understanding the physiological activities and mechanism of various organs and its anatomy.

**OBJECTIVE:**

The objective of the course is to understood clearly on various vital organs and endocrinological activities of human body.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Demonstrate about digestive system and its regulation alimentary parts of human and body fluids body.	K1 & K2
<b>CO2</b>	Discriminate respiratory system and excretory system.	K3
<b>CO3</b>	Types, functions and physiology of muscle, function of heart.	K5
<b>CO4</b>	Assess the Sympathetic parasympathetic nervous system and synaptic transmission	K4
<b>CO5</b>	Interpret about male and female reproductive system and its physiological function, hormonal regulation	K5

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
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CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

### Unit I

**12 Hours**

**Blood Composition and function:** Red blood cells, Hemoglobin, white blood cells and platelets. Mechanism of blood coagulation. **Respiratory System:** Transport and exchange of gases between lungs and tissues,. Lung Volumes -Tidal volume, Inspiratory Reserve Volume, Expiratory Reserve Volume.

### Unit II

**12 Hours**

**Digestive System:** Overview of the digestive system, secretions of digestive tract, process of digestion, absorption, assimilation of carbohydrates, proteins, fats, nucleic acids.

### Unit III

**12 Hour**

**Cardiac system:** Structure and function of Heart, cardiac cycle and its regulation, Electrocardiogram and sphygmomanometer. Muscle: Types, functions and physiology of muscle contraction.

### Unit IV

**12 Hour**

**Urogenital and Reproductive System :** Structure and functions of kidney, Nephron, Mechanism of urine formation, Dialysis. Structure and function of the male and female reproductive organs, spermatogenesis, menstrual cycle, physiology of pregnancy, parturition and lactation.

### Unit V

**12 Hour**

**Nervous System:** Organization of the nervous system, concept of central nervous system, peripheral nervous system, Atonomic nervous system, Sympathetic and parasympathetic nervous systems, Structure of neuron, action potential, Structure of synapse, synaptic transmission.

### TEXT BOOKS

1. Chatterjee C, **Human Physiology**, Medical Allied Agency Calcutta., 13<sup>th</sup> edition, (2010).
2. Muthayya.N.M, **Human Physiology**, Jaypee publications, New Delhi, 5<sup>rd</sup>edi., 2011.
- 3.Sathyanarayana, U. **Text book of Biochemistry**, Books and Allied Ltd, Kolkatta, 5<sup>nd</sup>edi.,2019.
- 4.Willam F.Ganong. **Review of medical physiology**(2013),21<sup>ST</sup> Editon, The MC Graw-Hill companies,India.

### REFERENCE BOOKS

1. Guyton, **Text book of Medical Physiology**, W. B. Saunder's Company, 10<sup>th</sup> edition, (2018).
2. Murray, R. K., Granner Mayes and Rod Well, Appleton and Lange,**Harper's Biochemistry**, 32 nd edition(2018).
- 3.Barbara A. Gylys Mary Elen Wedding, **Medical Terminology Systems**, Davis plus

**YEAR III – SEMESTER V  
MOLECULAR BIOLOGY**

Paper	: CORE VI	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 20U5BCC06	External	: 75

**SUBJECT DESCRIPTION:**

Molecular Biology deal with the central dogma of life and its regulation.

**OBJECTIVE:**

To make the students understood the synthesis of genetic material, RNA and proteins, gene repair mechanism and gene mutation. To make the students learn about the techniques used in identifying gene mutation.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	The course will provide detailed molecular mechanism of DNA replication process	K2
CO2	To understand transcription and post transcriptional modifications of RNA	K2
CO3	To obtain knowledge about the decoding process of mRNA for protein designing principle	K3
CO4	Course will advance the knowledge of students on regulation of gene expression and Recombination	K4
CO5	Categorize the different types of DNA mutation and repair mechanisms	K4

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L
CO2	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L



co3	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
co4	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L
co5	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L

S- Strong; M-Medium; L-Low

### UNIT – I

**12 Hours**

**Replication:** Overview of Central dogma. Evidences for DNA as genetic material–Frederick Griffith Experimental proof. Types of replication, Semiconservative mechanism and experimental proof, Mechanism of DNA replication in prokaryotes and Eukaryotes–Initiation, Elongation, Termination, Telomere replication in eukaryotes, enzymes involved in replication, inhibitors of DNA replication.

### UNIT – II

**12 Hours**

**Transcription :** Basic features of RNA synthesis, E. Coli RNA polymerases, Characteristics of promoter and enhancer sequences. RNA synthesis mechanism in Prokaryotes and Eukaryotes: Initiation, elongation and termination, Inhibitors of transcription. RNA processing: 5'-Capping, Poly 'A' tail addition, RNA splicing and processing of mRNA.

### UNIT – III

**12 Hours**

**Translation:** Genetic code and its features, Wobble hypothesis and its importance, composition of prokaryotic and Eukaryotic ribosomes, mechanism of initiation, elongation and termination of protein synthesis in prokaryotes and eukaryotes, Post translational modifications , Inhibitors of protein synthesis.

### UNIT – VI

**12 Hours**

**Regulation of gene expression in prokaryotes and Recombination:** Hierarchical levels of gene regulation, Prokaryotic gene regulation –lac, trp and araboperon, Recombination: - Mechanism; forms of recombination, Holliday model for homologous recombination.

### UNIT – V

**12 Hours**

**DNA damage and repair:** Types of mutation– Base substitution, insertion, deletion, inversion, duplication, translocation, types of mutagens. DNA Repair mechanisms– thymine dimer, light activation, excision, recombinational, SOS and mismatch repair.

### TEXT BOOKS

1. Text Book of Cell and Molecular Biology Dr. Ajay Paul, 2015, ArunabhaSen, Books & Allied (P) Ltd.,
2. David Freifelder, Molecular Biology, Reprint, 2020, Narosa Publishing House,

### REFERENCE BOOKS

1. Lehninger, A.L., Nelson, D.L., Cox, M.M., Principles of Biochemistry, W H Freeman

Publishers, 7th Edition, 2017

2. Harvey Lodish, David Baltimore – Molecular Cell Biology, 4th Edition, Freeman & Co., New York, 2000.

3. Robert F. Weaver, Molecular Biology, The McGraw – Hill Companies, 5th Edition 2012

4. Jolcelyn E. Krebs, Elliotts. Goldstein and Stephen T. Killpatrick, Lewins genes XII, Jones and Bartlett Publishers, 12th Revised edition edition, 2017

### WEB REFERENCES

1. <https://microbenotes.com/prokaryotic-dna-replication-enzymes-steps-and-significance/>

2. <https://microbenotes.com/rna-splicing/>

3. <https://www.sparknotes.com/biology/molecular/translation/section3/>

4. <https://www.khanacademy.org/science/biology/gene-regulation/gene-regulation-in-bacteria/a/the-trp-operon>

### YEAR III – SEMESTER V DRUG BIOCHEMISTRY

Paper	: ELECTIVE I	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 20U5BCE01	External	: 75

### SUBJECT DESCRIPTION:

This course presents to focus on the bioactive principles used for drug discovery and it also covers human biology where ever relevant.

### OBJECTIVE:

The objective of the course is to understand the development of the traditional and modern methods used for drug discovery; of how molecules interact.

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	To understand the development of the traditional and modern methods used for drug discovery; of how molecules interact.	K2
CO2	Explain the pharmaceutical industry is by far the largest employer of medicine	K3
CO3	Analyze the skills in the use of reaction mechanisms and how knowledge of reaction mechanisms can aid in understanding the mode of action of a drug, and the method by which it can be synthesized, and developed	K4

<b>CO4</b>	Knowledge of reaction mechanisms can aid in understanding the mode of action of a drug	K6
<b>CO5</b>	Categorize the learnt method by which it can be synthesized, and developed.	K5

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

### Unit I

**12Hours**

Introduction and Definition of drug.Sources of drugs(Plant,Animal,Microbial,Mineral and Human). Classification of drugs. Dosage forms of drugs (Definition and Types). Routes of drug administration and factors affecting drug administration.

### Unit II

**12Hours**

#### Pharmacokinetics:

Absorption and bioavailability of drugs.Distribution and site of action of drugs. Half life, C max and T max of drug. Factors affecting drug absorption and distribution. Elimination of drugs.

**Pharmacodynamics:** Definition. Drug receptors-Definition and types.Drug - receptor interactions- Receptor mediated and Non-receptor mediated drug action. Placebo effects. Factors modifying drug action.

**Biotransformation:** Definition and Types. Mechanism of phase I and Phase II metabolic reactions. Factors affecting drug metabolism.

### Unit III

**12Hours**

**Adverse Drug Reactions and Toxicology:** Pharmacologic ADRs, Non-pharmacological ADRs, disease- related ADRs, multiple drug reactions. Acute poisoning: -

General principles and management. Drug dependence, drug tolerance and intolerance.

#### **Unit IV**

**12Hours**

**Antibiotics & Chemotherapy:** Antibiotics- Types, mode of action and resistance of antibacterial, antiviral and anti fungal drugs.

**Chemotherapy:** Definition and Types. Mode of action of chemotherapeutic drugs. Immuno suppressive therapy.

#### **Unit V**

**12Hours**

**Drug discovery and Plant Therapeutics:** Random screening.Molecular modeling in drug design and Computer aided drug design.Phases of drug development. Overview and role of DCGI, FDA, ICMR and FSSAI. Role of Phytochemicals in therapeutics-Secondary metabolites- Definition and types.Role of phytomedicine in various diseases.

#### **TEXT BOOKS**

1. Foye's , 2013 **Principles of Medicinal Chemistry** 7<sup>th</sup>Edition Lippincott Williams and Wilkins publishers. New Delhi
- 2.Padamaja udayakumar 2017, **Medical pharmacology** 5<sup>TH</sup> Edition .,CBS publishers and distributors pvt.ltd, Newdelhi.
- 4.A Text book of Pharmaceutical Chemistry by Dr Jayashree Ghosh revised Edition 2014 Chan Publication PVT Ltd

#### **REFERENCE BOOKS.**

- 1.Burger's **Medicinal Chemistry and Drug Discovery:** 2021, principles and practice – 8<sup>th</sup> Edition Wolf, John Wiley
- 2.Nirmala, N., Rege, R.S., Santoskar, S.D. and Bhandarkar (2015), Pharmacology and Pharmacotherapeutics, 24rd edition, CBS Publishers and Distributors Pvt. Ltd.
- 4.Tripathi, K.D. (2013) Essentials of Medical Pharmacology 7th dition, Jaypee brothers,Medical publishers, New Delhi

#### **WEB REFERENCES**

- 1.<https://www.msmanuals.com/professional/clinical-pharmacology/adverse-drug-reactions/adverse-drug-reactions>
2. <https://en.wikipedia.org/wiki/Pharmacodynamics>
3. <https://www.healthline.com/health/chemotherapy>

**YEAR III – SEMESTER V**

**NUTRITIONAL BIOCHEMISTRY**

Paper	: <b>ELECTIVE II</b>	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: <b>20U5BCE02</b>	External	: 75

**SUBJECT DESCRIPTION:**

This course presents to focus on the nutritional requirement in physiological and malnutrition status in diseased status. It is an important paper making the students to have placement as nutritionist in hospitals and dietetians.

**OBJECTIVE:**

To acquire detailed knowledge regarding the biological basis of nutrition and the mechanisms by which diet can influence health. This includes a basic understanding of metabolism, physiology, molecular genetics, epidemiology and biostatistics.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Explore scientific basis of nutrients and knowledge of nutritional biochemistry	K2,K1
CO2	Capable of describing chemical composition of nutritional worth of food	K3

<b>CO3</b>	Understood the Effects of methods Nutrient analysis and energy content	K2
<b>CO4</b>	Understood the scientific active constituents micro and macro nutrients	K2
<b>CO5</b>	Understood the components of foods based on knowledge of nutrients in diet and health	K2

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

### UNIT – I

**12 Hours**

**Introduction of food:** Definition and Units of energy-Kilocalories, food groups, functions of food, food in relation to health, specific dynamic action. Estimation of energy requirement and Energy values of food, Basal Metabolic rate- Measurement of BMR and factors influencing BMR. Regulation of Body Temperature and Energy needs, Total energy requirement for various activities

### UNIT – II

**12 Hours**

**Balance of Diet:** Definition, Dietary requirements, recommended dietary allowances for infants, children and adolescent, pregnant and lactating women. Role of dietary fat, fiber, antioxidants. Carbohydrates in nutrition

### UNIT – III

**12 Hours**

**Proteins:** Essential and non-essential amino acids, Protein content of diets various ages in Indians. Quality and Quantitative aspects of protein - Protein nutritional Nitrogen balance, Protein calorific malnutrition – marasmus and kwashiorkor- Aetiology, symptoms and management.

### UNIT – IV

**12 Hours**

**Mineral And Vitamin Nutrition** Vitamins: Definition, classification, sources, distribution, abnormalities, minimum requirements and optimum allowances, Deficiency and excess. Minerals : Nutritional significance of dietary micro and macro-minerals. minimum requirements and optimum allowances, disorders related to the deficiency of minerals.

#### **UNIT- V**

**12 Hours**

**Nutrition And Body Defenses:** Nutritional therapy- stress, anemia, obesity, diabetes mellitus and allergy, Role of diet and nutrition in the prevention and management. Effect of drugs on nutrients, food production, storage and management. Online nutrition counseling.

#### **TEXT BOOKS**

1. Swaminathan, M. (2014) **Advanced text book on Food and Nutrition**, Volume I and II  
Second edition, The Bangalore printing and publishing co., ltd.
2. Srilakshmi B (2022) **Food science** 8<sup>th</sup> edition New age international (P) LTD publisher.
3. Sumathi R Mudambi, Rajagopal MV (2022) **Fundamentals of foods, Nutrition and diet therapy** 7<sup>th</sup> edition New age International (P) LTD, Publishers.
4. Shakuntala Manay N, Shadaksharaswamy M (2022) **Foods facts and principles**. 4 th edition New age international (P) LTS, Publishers.

#### **REFERENCE BOOKS**

1. Meyer L.H (2004) Food Chemistry I Edition CBS Publishers and distributors.
2. Srilakshmi B (2022) **Food science** 8<sup>th</sup> Edition New age international (P) LTD publisher.
3. Srilakshmi B (2021) Dietetics 8<sup>th</sup> Edition New age International (P) limited publishers
4. Mohtab S Bamji. Kamala Krishnaswamy, GNV Brahman (2019) 1<sup>st</sup> edition, Text book of Human nutrition, CBS Publishers and distributors.

#### **WEB REFERENCES**

1. [https://onlinecourses.swayam2.ac.in/nce20\\_sc01/preview](https://onlinecourses.swayam2.ac.in/nce20_sc01/preview)
2. [https://nptel.ac.in/content/syllabus\\_pdf/126104004.pdf](https://nptel.ac.in/content/syllabus_pdf/126104004.pdf)
3. [https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumptionbmi?qid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from\\_search=4](https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumptionbmi?qid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from_search=4)
4. [https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1\\_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf)

**YEAR III – SEMESTER V  
GENETIC ENGINEERING**

Paper	: SBEC III	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 20U5BCS03	External	: 75

**SUBJECT DESCRIPTION:**

Genetic Engineering deal with the basis of gene cloning, vectors, genetic engineering techniques and large scale production.

**OBJECTIVE:**

The objective of the course is to learn about the basics, vectors, methods of gene cloning.

Techniques and application of gene technology.

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
CO1	Course material will help to remember the basic principles of gene cloning and about uses of restriction endonucleases in rDNA technology	K1
CO2	Understanding of construction of vectors and hybridization techniques	K2
CO3	Understand suitable methods for isolation and purification of DNA and the mechanism of various gene transfer methods	K2



<b>CO4</b>	Apply the knowledge gained about gene amplification and advances in sequencing techniques	K3
<b>CO5</b>	Explore recombinant DNA technology in the field of medicine, agriculture, industry and environment	K4

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	M	S	L	M	L	L	L	M	M	M	L	L	M	L	L
CO2	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L
CO3	S	M	M	M	L	L	L	M	S	M	L	L	M	L	L
CO4	M	M	M	S	M	M	L	M	M	S	L	L	S	L	L
CO5	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L

S- Strong; M-Medium; L-Low

#### UNIT – I

**06 Hours**

Introduction to genetic engineering: Basic steps of gene cloning, enzymes used in genetic engineering. Basis of gene cloning; Restriction endonucleases – Types and Features; Ligations; Linkers and Adaptors.

#### UNIT – II

**06 Hours**

Cloning vectors: Plasmids, Cosmids, Phages, Phagemids, Yeast vectors, Shuttle vectors, Ti Plasmids and Ri plasmids. Hybridization probes- Southern, Northern and Western blotting techniques.

#### UNIT – III

**06 Hours**

Methods of gene transfer. Isolation and purification of cellular and plasmid DNA. Transformation, transfection and conjugation – Synthesis of genes- chemical synthesis of tRNA genes, gene synthesis machine.

#### UNIT – IV

**06 Hours**

Amplification of DNA by PCR technique and applications, RT PCR- Principles, Techniques and applications, DNA sequencing – Maxam and Gilbert's method and Sanger's method – DNA chip and Microarray

#### UNIT – V

**06 Hours**

**Genomic and cDNA Libraries:** Methods of generating genomic and cDNA library, comparison between two types of libraries, advantages and disadvantages of cDNA library. Applications of gene technology- Recombinant insulin and Recombinant growth hormones production.

#### TEXT BOOKS

1. R.W. Old & S.B. Primrose, Principles of Gene manipulation: An Introduction to Genetic Engineering, Black well scientific publications, 5<sup>th</sup> ed., 1994
2. Sandy B. Primrose, Richard Twyman, Principles of Gene manipulation & Genomics, Wiley-Blackwell publisher, 7<sup>th</sup> ed., 2013

## REFERENCE BOOKS

1. T.A. Brown, Gene cloning and DNA Analysis- An introduction, Chapman and Hall, 2016, 7 th Edition.
2. Glick.R, Bernard and Pasternak.J, Jack, Molecular Biotechnology, Asm press, Washington D.C, 3 rd Edition 2002.
3. Glazier. N. Alexander, Hiroshnikaido, Microbial Biotechnology, W.H. Freeman & co., New york, 2nd Edition 2007.
4. Molecular Cloning: A Laboratory Manual (3 Volume Set): 4th Edition – 2013 by Michael R Green, Joseph Sambrook; Publisher: Viva Books Private Limited.

## WEB REFERENCES

- 1.<http://www.hixonparvo.info/Gene%20Cloning.pdf>
- 2.<https://thebiologynotes.com/vectors-characteristics-classification-features-types/>
- 3.<https://geneticeducation.co.in/gene-transfer-techniques-horizontal-vertical-physical-and-chemical/>
4. <https://microbenotes.com/polymerase-chain-reaction-pcr-principle-steps-applications/>
5. [https://en.wikipedia.org/wiki/Gene\\_therapy](https://en.wikipedia.org/wiki/Gene_therapy)

## YEAR III – SEMESTER V CORE PRACTICAL – V

Paper	: Core Practical V	Total Hours	: 75
Hours/Week	: 6	Exam Hours	: 06
Credit	: 5	Internal	: 40
Paper Code	: 20U5BCCP05	External	: 60

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the Qualitative analysis of secondary phytochemicals in medicinal plants	K1 & K2
CO2	Estimate the amount of Total Alkaloids, flavonoids	K1 & K2
CO3	Learn the Ash content from the plant sources	K1,K2 & k3

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

1. Qualitative analysis of secondary phytochemicals in medicinal plants
2. Extraction and confirmation
  - a. Pectin from orange peel
  - b. Caffeine from tea
  - c. Solanine from potato
3. Estimation of total alkaloids
4. Estimation of total flavonoids
5. Estimation of chlorophyll in leaves
6. Determination of Ash content from plant source
7. Determination of H<sub>2</sub>O<sub>2</sub> radical scavenging assay.

### TEXT BOOKS

1. **An Introduction to Practical Biochemistry.** David, T. Plummer, (1988). 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.

### REFERENCES

1. **Laboratory Manual in Biochemistry.** Pattabiraman, T.N. (1998). 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.
2. **Laboratory Manual in Biochemistry.** Jayaraman, S. (2003). 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
3. **Biochemical Methods.** Sadasivam S and Manickam P. (2004) 2<sup>nd</sup> Edition. New Age

**YEAR III – SEMESTER V**  
**CORE - BIOCHEMISTRY PRACTICAL – VI**

Paper	: Core Practical VI	Total Hours	: 75
Hours/Week	: 6	Exam Hours	: 06
Credit	: 5	Internal	: 40
Paper Code	: 20U5BCCP06	External	: 60

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Isolation and identification of genomic DNA from animal and plant tissue	K1 & K2
CO2	Learn about Bacterial Transformation method	K1 & K2
CO3	Explore Restriction enzyme digestion and DNA Ligation Process	K1, K2 & K3

**Mapping with Programme Outcomes**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
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CO1	S	M	M	S	S	S	S	M	M	L	M	M	M	M	M
CO2	S	M	M	S	M	S	M	M	L	L	M	L	L	S	S
CO3	S	S	M	M	S	M	M	M	L	L	M	L	L	S	M

S- Strong; M-Medium; L-Low

1. Isolation of genomic DNA from bacteria
2. Isolation of genomic DNA from plant
3. Isolation and identification of genomic DNA from animal tissue
4. Isolation of plasmid DNA
5. Restriction enzyme digestion
6. Transformation
7. DNA Ligation
8. SDS-PAGE - Demo

### TEXT BOOKS

1. **An Introduction to Practical Biochemistry**. David, T. Plummer, (1988). 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Molecular Cloning – Sambrook and Russel, Cold Spring Harbor, Laboratory Press 2001

### REFERENCES

1. Experiments in molecular Biology, R.J Slater, Humana Press 1986
2. Experimental Procedures in Life Sciences, S.Rajan and R.Selvi Christy, CBS Publishers & Distributors Pvt Ltd, 2018
3. Experimental Biochemistry – B.S.Roa and V.Deshpande, I.K. International Pvt Ltd.

### YEAR III – SEMESTER VI

#### IMMUNOLOGY AND IMMUNOTECHNIQUES

Paper	: CORE VII	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 20U6BCC07	External	: 75

#### **SUBJECT DESCRIPTION:**

Immunology deals with the immune system and it is an important branch in medical sciences. The immune system protects us from infection through various lines of defense. The immunotechnology is a technology based on applications of cells and molecules of the immune system.

#### **OBJECTIVE:**

To make the students understood the overview of immune system in our body. To make the student learn about antigen and antibody reactions and techniques related to it. To make the students to describe the roles of the immune system in both maintaining health and in diseased condition.

#### **COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	The course will provide detail about overview of immune system and about the cells and organs of immune system	K2
CO2	To understand about the antigens and antibodies and its classification	K2

<b>CO3</b>	To obtain knowledge about the interaction between antigen and antibody and techniques about its detection in physiological and diseased state	K3
<b>CO4</b>	The next level of understanding of cell mediate responses and cytotoxicity responses was dealt and predicted	K4
<b>CO5</b>	Regulation of immunity, immunosuppressive chemical messengers was covered Immunity during diseased state was discussed and analysed	K4

#### Mapping with Programme Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	S	L	S	L	M	S	M	L	L	M	L	L
CO2	S	M	S	M	L	L	L	M	S	M	L	L	M	L	L
CO3	S	M	M	S	M	M	L	M	M	S	M	L	S	L	L
CO4	S	L	S	M	S	L	L	S	M	M	L	M	M	L	L
CO5	M	L	S	M	M	L	L	S	M	M	L	M	M	L	L

S- Strong; M-Medium; L-Low

#### UNIT-I

**12 Hours**

**Overview and Cells & organs of immune system:** Overview of immune system, Immunity, types, mechanism of immunity, immune response, phagocytosis, hematopoiesis, Cells and its functions – T and B cells, mononuclear phagocytes, granulocytes, Organs of immune system – primary, secondary and cutaneous associated lymphoid tissue.

#### UNIT-II

**12 Hours**

**Antigens And Antibody:** immunogenicity and antigenicity, Antigens - Properties, Specificity, Immunogenicity, antigenic determinants, haptens, adjuvants. Epitopes, Antibodies - Properties, Structure, Classes Immunoglobins, functions of antibodies, Monoclonal antibodies - Production and functions-.

#### UNIT-III

**12 Hours**

**Immunotechniques:** Strength of Antigen –antibody interaction, Agglutination, Precipitation, Complement fixation, and Neutralization, Oponization. Immunofluorescence, ELISA and RIA. Immuno electrophoresis and electroimmunodiffusion.

#### UNIT-IV

**12 Hours**

**Immune effector mechanisms:** MHC, Cell mediated response – effector T cells, cytotoxic T cells, natural killer cells, antibody dependent cell mediated cytotoxicity, inflammatory process and anti-inflammatory agents, Cytokines and their functions.

#### UNIT-V

**12 Hours**

**Immune system in health and disease:** Immune response to viral infections, Vaccines: whole organism vaccine, purified macromolecules as vaccines, DNA vaccines, Hypersensitivity I, II, III, IV, Autoimmunity: organ specific, systemic type, treatment. Transplantation – Basis of graft rejection, immunosuppressive therapy, oncogenes and cancer induction, tumour antigens, cancer immunotherapy

### **TEXT BOOKS**

1. Rastogi (2016). Razdan .M.K (2018). **Elements of Immunology**. 3<sup>rd</sup> Edition, CBS Publishers & Distributors Pvt Ltd.

2. Janeway Jr. Paul., (2001). The immune System in Health and Disease. Travels and Co.,

### **REFERENCE BOOKS**

1. JenniPunt, SharonStranford, Patricia Jones and Judy Owen. Kuby Immunology. 8<sup>th</sup> Edition. Macmillan Publications, NY.

2. David Male, Jonathan Brostoff, David Roth and Ivan Roitt. (2013). Immunology. 8<sup>th</sup> Edition. Elsevier Saunders. U.S., 2<sup>nd</sup> edi. 2010.

3. Ian R. Tizard. (1994). Immunology: An Introduction. 4<sup>th</sup> Edition. Books/Cole Publishers.

### **WEB REFERENCES**

1. <https://www.msdmanuals.com/en-in/professional/immunology-allergic-disorders/biology-of-the-immune-system/overview-of-the-immune-system>
2. <https://www.sinobiological.com/resource/antibody-technical/antibody-structure-function>
3. [https://link.springer.com/protocol/10.1007/978-1-0716-0134-1\\_7](https://link.springer.com/protocol/10.1007/978-1-0716-0134-1_7)
4. <https://medcraveonline.com/MOJI/cytokines-and-their-role-in-health-and-disease-a-brief-overview.html>
5. <https://courses.lumenlearning.com/microbiology/chapter/autoimmune-disorders/>



**YEAR III – SEMESTER VI**

**CLINICAL BIOCHEMISTRY**

Paper	CORE VIII	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 20U6BCC08	External	: 75

**SUBJECT DESCRIPTION:**

Advanced Clinical Biochemistry deal with the diagnostic importance of various metabolic disorders and to know the clinical aspects of various metabolic disorders.

<b>Course No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Recognize the disorder of carbohydrate metabolism and its disease	K1 & K2
<b>CO2</b>	Execute disorders of protein metabolism and its disease	K3
<b>CO3</b>	Distinguish about disorders of lipid and nucleic acid metabolism	K4
<b>CO4</b>	Interpret the Renal function test, Liver function test, Gastric function test, Cerebrospinal fluid	K3 & K4

<b>CO5</b>	Categorize clinically important enzymes- Significant of marker enzymes	K4 & K6
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### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	L	M	S	L	S	S	M	M	S	L	L
CO2	S	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	S	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	S	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

#### UNIT I

**12 Hours**

**Disorders in carbohydrate metabolism:** Introduction, Homeostasis and its disorder- Hypo and hyperglycaemia, Renal threshold value, Galactosemia, Fructosuria, Diabetes mellitus : Types, Clinical features, metabolic effects, complications, Glycogen storage diseases.

#### UNIT II

**12 Hours**

**Disorders in amino acid metabolism:** Introduction, etiology and clinical features of Aromatic amino acid-Phenylketonuria, Alkaptonuria, Tyrosinemia. Clinical significance of non – protein nitrogen (NPN) – urea, uric acid and creatinine. Metabolism of bilirubin and its disorder- jaundice and their clinical features.

#### UNIT III

**12 Hours**

**Disorders in lipid and nucleic acid metabolism:** Introduction, Hyperlipoproteinaemia, Atherosclerosis – aetiology, clinical features and complication. Lipid storage diseases, fatty liver. Disorders of Uric acid metabolism- Gout, types, aetiology and clinical features.

#### UNIT IV

**12 Hours**

**Organ function tests:** Liver function test, Renal function test, Gastric function test - Collection of gastric contents, examination of gastric residuum, FTM, stimulation test, tubeless gastric analysis.

#### UNIT V

**12 Hours**

**Clinically Important enzymes:** Mechanism responsible for abnormal level in serum. Enzyme level on the onset of myocardial infarction and hepatobiliary diseases. Marker Enzymes and its clinical significance of SGOT, SGPT, ALP and ACP,.

#### TEXT BOOKS

1. N.W. Teitz, (1994), *Textbook of Clinical Chemistry and Molecular Diagnostics* Fifth Edition W.B. Saunders company
2. Harold Varley (1988). **Practical Clinical Biochemistry**, Volume I and II 4<sup>th</sup> Edition, CBS Publishers New Delhi
3. Foye, O.W., Lemke, J.L. and William D.A. (1995). **Medicinal Chemistry**, B.I. Waverly Pvt. Ltd., New Delhi.

4. Praful B. Godkar, Darshan P. Godkar(2014) Textbook of Medical Laboratory Technology Clinical Laboratory Science and Molecular Diagnosis 3<sup>rd</sup> Edition, Bhalani Publishing House

### REFERENCE BOOKS

1. Philip. D. Mayne (1994). **Clinical Biochemistry in Diagnosis and Treatment** 6<sup>th</sup> Edition ELBS Publication
2. William J. Marshall and Stephen K. Bangert, (1995). **Clinical Biochemistry – Metabolic and clinical aspects**, Pearson Professional Ltd

### WEB REFERENCE

1. [www.medicinenet.com](http://www.medicinenet.com) > ... > diabetes az list > diabetes mellitus index
2. [www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...](http://www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...)
3. [www.niams.nih.gov](http://www.niams.nih.gov) >
4. [www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf](http://www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf)
5. [www.arup.utah.edu/education/automation.php](http://www.arup.utah.edu/education/automation.php)

**PEDOGOGY: CHALK and Talk , PPT**

## YEAR III – SEMESTER VI

### BIOCHEMISTRY OF HORMONES

Paper	: ELECTIVE III	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: <b>20U6BCE03</b>	External	: 75

### OBJECTIVE:

On successful completion of the course the students should have: Understood clearly on various alimentary parts of human body. Learnt more specific on the endocrinal activities Learnt the mechanisms and actions of vital organs

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Remember about the hormones, hormone secretion; understand the mechanism of hormone action I and II and also communication between the endocrine glands and target organs.	K1 & K2
CO2	Illustrate the thyroid and parathyroid gland, type of hormones, physiological response and pathophysiology of gland.	K1 & K2
CO3	Understand and remember the hormonal actions of pancreas and GIT	K1, K2 & K3
CO4	Apply the knowledge of hormonal synthesis, chemistry and action of supra renal gland.	K1 & K2

<b>CO5</b>	Illustrate the male and female reproductive system, synthesis of hormones, significance and pathophysiology of gonads.	K1 ,K2 &K3
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### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
CO4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
CO5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

#### UNIT – I

**12 Hours**

Introduction to Endocrine System: Hormones as messengers, classification of hormones, circulating and local hormones, receptors of hormones, mechanism of action, Second messengers: - Role of cAMP, cGMP, IP3, DAG, Ca<sup>2+</sup> ions and calmodulin in hormonal action. Hormones of the hypothalamus Anterior Pituitary hormone(Tropic hormone)-Posterior Pituitary (Oxytocin, Vasopressin)

#### UNIT – II

**12 Hours**

Hormones of the thyroid & parathyroid-chemical nature, secretion, function & disorders of thyroid & parathyroid hormones.Calcitriol biosynthesis and functions.Hyper and hypoparathyroidism, Paget's disease, Ricket's and osteomalacia.

#### UNIT – III

**12 Hours**

Pancreatic & G.I. Tract hormones Chemical nature & functions of Insulin, Glucagon. Secretion, release, chemical nature and functions of Gastrin, Enterogastin, Secretin & Cholecystokinin.

#### UNIT – IV

**12 Hours**

Hormones of the Adrenal gland – chemical nature & functions of Adrenal medullary & Cortex hormones.Adrenal Corticol hormones- Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Adrenal medullary hormones-Catecholamines: biosynthesis and biological

effects.

## UNIT – V

**12 Hours**

Gonadal hormones- Androgens and estrogens. Hormones of the testes and ovaries – chemical nature & functions of Androgens, Estrogens and Progesterone.

### TEXT BOOKS

1. Murray, K.R., Granner, K.D., Mayes, P.A. and Rodwell, W.V. (2009) **Harper's Biochemistry**, 28<sup>th</sup> Ed, Appleton & Lange Stamford, Connecticut.
2. Guyton, A.C. and Hall, J.E (2006), **Textbook of Medical Physiology**, 11<sup>th</sup> Edition, Saunders Co. Pennsylvania.
3. Donald Voet , Judith G. Voet , Charlott W. Pratt , , **Fundamentals of Biochemistry** upgrade edition John Willey & Sons. Inc,
4. Francis Sreenspan , Gordon J. 1997–**Basic & Clinical Endrocrinology** 5<sup>th</sup> Ed., Strewler Prentice – Hall International Inc.

### REFERENCE BOOKS

1. Foye, O.W., Lemke, J.L. and William D.A. (1995), **Medicinal Chemistry**, B.I. Waverly Pvt. Ltd., New Delhi.
2. West, E.S., Todd, W.R., Mason, H.S. and Van Brugge, T.J. (1966), **Biochemistry**. 4<sup>th</sup> Edition, The Macmillan Company, London.

### WEB OF RESOURCE:

[https://en.wikipedia.org/wiki/Endocrine\\_system](https://en.wikipedia.org/wiki/Endocrine_system)  
[www.medicinenet.com](http://www.medicinenet.com) > ... > thyroid az list > medterms medical dictionary az list  
[www.btf-thyroid.org](http://www.btf-thyroid.org) > Info  
[www.healthline.com/human-body-maps/pituitary-gland](http://www.healthline.com/human-body-maps/pituitary-gland)

**PEDOGOGY: CHALK and Talk , PPT**

### **YEAR III – SEMESTER VI**

#### **CELL BIOLOGY**

Paper	: <b>ELECTIVE IV</b>	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: <b>20U6BCE04</b>	External	: 75

#### **SUBJECT DESCRIPTION:**

This course presents to focus on the different cellular organelles and organization its biochemistry.

#### **OBJECTIVES:**

The objective of the course is to understand the relationship between cellular organelles and molecules signaling in research.

#### **OUTCOME:**

<b>Course No</b>	<b>Course Outcome</b>	<b>Knowledge Level</b>
<b>CO1</b>	Discuss the cell organization and the cell structures	K2
<b>CO2</b>	Illustrate the cell organelles structure and functions such as nucleus, chloroplast, mitochondria, endoplasmic reticulum and ribosome lysosome etc.,	K3
<b>CO3</b>	Apply the knowledge chromosome organization and its types	K4

<b>CO4</b>	Evaluate the stages of cell cycle and its regulation of cells	K5
<b>CO5</b>	Describes the critical based knowledge of cell -cell interactions and their molecules	K6

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	S	S	L	M	L	L	M	L	S	S	M	L	L	M
CO2	M	M	M	M	S	M	M	S	L	M	M	M	L	L	M
CO3	S	S	L	M	L	M	L	S	L	M	L	M	S	S	S
CO4	S	S	L	M	M	M	S	L	M	L	M	S	M	L	L
CO5	L	M	L	S	M	M	M	M	M	L	M	M	M	S	S

S- Strong; M-Medium; L-Low

#### UNIT I:

**12 Hours**

**Cell:** Introduction, cell theory, types of cell - Prokaryotic cell and eukaryotic cell structure, difference between plant cell and animal cell. Structure, composition, functions of cell membrane, bacterial cell wall and plant cell wall.

#### UNIT II:

**12 Hours**

**Cell Organelles:** Structure and functions of nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, peroxisomes and cytoskeleton.

#### UNIT III:

**12 Hours**

**Chromosome Organization:** Structure of chromatin, types of euchromatin and heterochromatin, structure of chromosome, special types of chromosome.

#### UNIT IV:

**12 Hours**

**Cell Cycle:** Stages of cell cycle, cell division – various stages and significance of Mitosis and Meiosis, difference between Mitosis and Meiosis.

#### UNIT V:

**12 Hours**

**Extracellular Matrix and Cell Interactions:** ECM: - Collagen, Elastin, Fibronectin, Laminins, Cell – ECM interactions: - Integrins, Focal adhesions, Hemidesmosomes. Cell – cell interactions: - Cadherins, IgSF, Selectins, Intracellular junctions: Gap junctions, tight junctions, adherens junction, desmosomes.

#### TEXT BOOK

1. Cell Biology by T. Devasena, 2012, Oxford University press.
2. VK Agarwal and PS Varma Cytology (Cell Biology and Molecular Biology), 2000

4/e S Chand & Company, New Delhi.

3. Cell and Molecular Biology by Prakash S Lohar, 2007, MJP publishers.

4. The Cell, a molecular approach by Geoffrey M Cooper, 5 th Edition, 2009, ASM press, Washington.

#### REFERENCE BOOK

1. **Bruce Albert *et al.***, *Molecular biology of the cell*, Garland publications, New York & London, 3<sup>rd</sup> edition, 1994.

2. **lodish.h, baltimore, bert.a *et.al.***, *molecular cell biology*, 3<sup>rd</sup> edition. 1995.

#### WEB OF RESOURCE:

[https://en.wikipedia.org/wiki/Endocrine\\_system](https://en.wikipedia.org/wiki/Endocrine_system)

[www.medicinenet.com](http://www.medicinenet.com) > ... > thyroid az list > medterms medical dictionary az list

[www.btf-thyroid.org](http://www.btf-thyroid.org) > Info

[www.healthline.com/human-body-maps/pituitary-gland](http://www.healthline.com/human-body-maps/pituitary-gland)

#### PEDOGOGY: CHALK and Talk , PPT

### YEAR III – SEMESTER VI

#### BIOCHEMISTRY IN DIAGNOSTIC MEDICINE

Paper	: SBEC	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: <b>20U6BCS04</b>	External	: 75

#### SUBJECT DESCRIPTION:

This course presents about the techniques, diagnostic values and significance and the interpretation of various enzymes, bio-chemical parameters, hormones and immunoglobulins.

#### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Remember the approaches to clinical quality control, accuracy, collection and preservation of biological samples such as blood, urine and fluids	K1 & K2
CO2	Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC	K1 & K2
CO3	Apply the knowledge on abnormal constituents of urine such as protein, keton bodies, bile pigments and their clinical interpretation	K1,K2 & k3



<b>CO4</b>	Analyse and describe the to know about the critical based stool collection, preservation, and analyse the abnormal constituent of stools and microscopy studies.	K1 & K2
<b>CO5</b>	Evaluate and discuss clinical significance of the biochemical GTT, SGOT, SGPT and LDH etc	K1 & K2

### Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	L	S	M	M	M	M	L	S	L	M	S	M	L
CO2	L	M	M	S	L	L	L	M	M	S	S	M	L	S	M
CO3	S	M	M	M	M	S	L	M	S	L	L	M	L	S	M
CO4	S	M	L	M	S	M	L	M	S	S	L	M	L	M	M
CO5	S	L	M	M	M	S	S	L	S	M	L	L	S	M	S

S- Strong; M-Medium; L-Low

#### UNIT – I

**06 Hours**

Laboratory Care and Instrumentation: Code of conduct for laboratory personnel – safety measures in the laboratory – chemical/Reagents, labeling, storage and usage. First Aid in laboratory accidents – precautions and first aid equipments. Reports laboratory tests and keeping records. General approach to quality control, internal and external quality control.

#### UNIT – II

**06 Hours**

Blood Banking: Blood grouping – ABO system, Rh typing, Coomb's test, Blood transfusion – blood donors, donor screening, drawing of blood, compatibility testing, cross matching, blood transfusion complications.

#### UNIT – III

**06 Hours**

Clinical Hematology: Collection of blood – Anticoagulant, preservation, glycosylated haemoglobin, PCV, WBC, RBC, platelets, ESR, clotting time, bleeding time – normal value and clinical interpretation – molecular diagnostics of SARS CoV 2 by RT PCR

#### UNIT – IV

**06 Hours**

Urine Analysis: Composition, collection, preservation, gross examination, interfering factors and chemical examination, significance of sugar ketone bodies, bile pigments, hematuria, uric acid in urine. Microscopic

examination of the urinary sediment and hematuria. Stool Examination: Specimen collection - inspection of faeces - odour, pH, interfering substance, test for occult blood, faecal fat, microscopic examination of stool specimen.

#### **UNIT – V**

**06 Hours**

Body fluids: Cerebrospinal fluid composition and analysis, semen analysis, sputum examination, pregnancy test - interpretation. Laboratory methods of evaluation of endocrine disorder - thyroid function test: clinical disorder - diagnosis of T4, I <sup>131</sup> uptake, TSH stimulation test.

#### **TEXT BOOK**

1. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.
3. Sabitri Sanyal, Clinical pathology, B.I.Churchill Livingstone(P)Ltd, New Delhi.2000.
3. Tietz Fundamentals of Clinical Chemistry- (5th edition) C. A. Burtis, E. R. Ashwood (eds) Saunders WB Co.

#### **REFERENCE BOOK**

1. Textbook of medical physiology by C. Guyton, John E. Hall.—12th ed, 2011, Saunders, an imprint of Elsevier Inc.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

#### **WEB OF REFERENCE**

- 1.<https://onlinelibrary.wiley.com/doi/abs/10.1002/0470869526.ch3>
- 2.<http://fblt.cz/en/skripta/v-krev-a-organy-imunitniho-systemu/1-slozeni-krve/>
- 3.[https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis\\_microscopic\\_exam](https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis_microscopic_exam)
- 4.<https://www.webmd.com/a-to-z-guides/what-is-a-stool-culture#1>
- 5.<https://www.webmd.com/diabetes/guide/glycated-hemoglobin-test-hba1c>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR III – SEMESTER VI**  
**CORE PRACTICAL – VII**

Paper	: Core Practical VII	Total Hours	: 75
Hours/Week	: 6	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: <b>20U6BCCP07</b>	External	: 60

**A. Urine Analysis**

1. Physical properties of urine : Microscopic and visual observation for

- normal and abnormal constituents, color, density, crystals and pH etc
2. Determination of Creatine and Creatinine in urine - Alkali-Picrate method
  3. Estimation of Uric acid - Caraway's method
  4. Determination Chloride by VanSlyke's method

### **B. Blood Analysis**

1. Estimation of blood glucose by Asatoor and King method.
2. Estimation of serum creatine and creatinine by - Alkali-Picrate method.
3. Estimation of Determination of Total proteins in whole blood - Biuret method
4. Determination of Bilirubin [ Conjugated & Unconjugated] in serum

### **C. HAEMATOLOGY**

1. Estimation of Hemoglobin
2. Enumeration of RBC/WBC
3. Differential count
4. Determination of blood grouping
5. Bleeding time, clotting time
6. ESR

### **REFERENCES**

1. **An Introduction to Practical Biochemistry.** David, T. Plummer, (1988). 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. **Laboratory Manual in Biochemistry.** Pattabiraman, T.N. (1998). 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.
3. **Laboratory Mannual in Biochemistry.** Jayaraman, S. (2003). 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
4. **Biochemical Methods.** Sadasivam S and Manickam P. (2004) 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

## **YEAR III – SEMESTER VI CORE PRACTICAL – VIII**

Paper	: Core Practical VIII	Total Hours	: 45
Hours/Week	: 6	Exam Hours	: 03
Credit	: 4	Internal	: 40
Paper Code	: <b>20U6BCCP08</b>	External	: 60

### **Immunology**

1. Immunodiffusion – Single radial and double diffusion
2. Immunoelectrophoresis
3. Rocket immunoelectrophoresis
4. Haemagglutination and passive hemagglutination
5. Identifying blood group and Rh typing
6. Direct and Indirect ELISA method
7. Antigen Antibody reaction- Pregnancy and WIDAL Test.

## **REFERENCES**

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.
3. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
4. Sadasivam S and Manickam P. (2004) **Biochemical Methods** 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

**B.Sc., BIOCHEMISTRY**  
**QUESTION PAPER PATTERN**  
**MAXIMUM MARKS – 75 marks**  
**DURATION – 3 hours**

### **PART – A (20 marks)**

1. Multiple choice questions

**PART – B (5 X 5 = 25 marks)**

2. Either or Type
3. From each unit two questions

**PART – C (3 X 10 = 30 marks)**

1. Any three out of five (open choice)
2. From each unit one question