

VIVEKANANDHA

COLLEGE OF ARTS AND SCIENCES FOR WOMEN ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

An ISO 9001: 2008 Certified Institution

(Affiliated to Periyar University, Approved by AICTE, recognized u/s 2 (f) & 12 (B) & Re-accredited with 'A' by NAAC)

Recognized under section 2(f) and 12(B) of UGC Act, 1956

An ISO 9001:2008 (Certificate Institution)



DEPARTMENT OF BIOCHEMISTRY

B.Sc., BIOCHEMISTRY

SYLLABUS AND REGULATIONS

**FOR CANDIDATES ADMITTED FROM 2020-2021
ONWARDS UNDER AUTONOMOUS CBCS AND OBE
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	Disciplinary knowledge: 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	Communication Skills: 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	Critical thinking: 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	Problem solving: ability to closely observe the situation, and apply lateral thinking and analytical skills.	K3
PO5	Analytical reasoning: 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	Research-related skills: 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	Cooperation/Team work: 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	Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas,	K4

	evidence and experiences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments.	
PO9	Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. Ability to see the influence of location –regional, national, global-on critical thinking.	K2
PO10	Information/digital literacy: 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	Self-directed learning: 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	Multicultural competence: 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	Moral and ethical awareness/reasoning: 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	Leadership readiness/qualities: 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	Lifelong learning: 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 trades 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 Assesment Marks (25/40)

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

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
Total		75	Total	60

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

- a) 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.
- b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
- c) 50% and above but below 60% shall be declared to have passed the examinations in second class.
- d) All the remaining successful candidates shall be declared to have passed the examinations in third class.
- e) 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 as 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 2018-19 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018-19 and thereafter.

XII. TRANSITORY PROVISIONS.

Candidates who have undergone the UG Course of study before 2018-19 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 2019-2020. 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
YEAR I													
Semester I							Semester II						
Language I	6	3	3	25	75	100	Language II	6	3	3	25	75	100
English I	6	3	3	25	75	100	English II	6	3	3	25	75	100
Core I	4	4	3	25	75	100	Core II	4	4	3	25	75	100
Core I Practical	3	3	3	40	60	100	Core II Practical	3	3	3	40	60	100
Allied I	4	4	3	25	75	100	Allied II	4	4	3	25	75	100
Allied I Practical	3	-	-	-	-	-	Allied II Practical	3	4	3	40	60	100
Valued added course	2	2	3	25	75	100	Valued added course	2	2	3	25	75	100
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	30	21	18	165	435	600	Total	30	25	21	205	495	700
II YEAR TOTAL									46	39	370	930	1300
YEAR II													
Semester III							Semester IV						
Language III	6	3	3	25	75	100	Language IV	6	3	3	25	75	100
English III	6	4	3	25	75	100	English IV	6	3	3	25	75	100
Core III	4	3	3	25	75	100	Core IV	4	5	3	25	75	100
Core III Practical	3	3	3	40	60	100	Core IV Practical	3	3	3	40	60	100
Allied III	4	3	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
Library	1	0	0	0	0	0	Library	1	0	0	0	0	0
Sports	1	0	0	0	0	0	Sports	1	0	0	0	0	0
Total	30	23	21	205	495	700	Total	30	23	21	205	495	700
II YEAR TOTAL									92	84	780	1980	2800
YEAR III													
Semester V							Semester VI						
Core V	5	5	3	25	75	100	Core VII	5	5	3	25	75	100
Core VI	5	5	3	25	75	100	Core VIII	5	5	3	25	75	100
Core V Practical	5	3	3	40	60	100	Core VII Practical	5	3	3	40	60	100
Core VI Practical	5	3	3	40	60	100	Core VIII Practical	5	3	3	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
Library/Sports	1	0	0	0	0	0	Library/Sports	1	0	0	0	0	0
Mini project	1	1	6	0	0	0	Extension work	1	1	0	0	0	100
Total	30	24	29	245	555	800	Total	30	24	23	205	205	495
TOTAL CREDIT FOR THE COURSE									140	126	1230	2970	4200

Distribution Of Duration And Credit Under Different Papers

Part	Paper	Hours/Week	Weeks/Semester	Hour/Paper	No. of Papers	Credit/Paper	Total Hours	Total credit
I	Language	6	15	60	4	3	240	12
II	English	6	15	60	4	3	240	12
III	Core paper	5	15	75	8	5	600	40
III	Core practical	5	15	75	8	3	600	24
III	Allied	4	15	60	4	4	240	16
III	Allied practical	4	15	60	4	3	240	12
IV	Value Education	1	15	15	2	2	30	4
IV	SBEC	2	15	30	4	2	120	8
III	Elective	4	15	60	2	3	120	6
IV	NMEC	2	15	30	2	2	60	4
IV	Mini project	1	15	15	1	1	15	1
IV	Extension work	1	15	15	1	1	15	1
TOTAL								140

Distribution Of Duration And Content Under Different Papers

S. No.	Hours/Week	Duration/Unit	Topic/Unit
1	1	3	3
2	2	6	6
3	3	9	9
4	4	12	12
5	5	15	15

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)
DEPARTMENT OF BIOCHEMISTRY
CBCS AND OBE PATTERN SYLLABUS - UG
(For candidates admitted from 2018-2019 onwards)

Sem	Subject code	Part	Course	Subjects	Hrs/ week	Credit	Int. marks	Ext. mark	Tot. mark
I	20U1LT01	I	Language-I	Tamil-I	6	3	25	75	100
	20U1LH01			Hindi-I					
	20U1LM01			Malayalam-I					
	20U1LE01	II	English-I	Foundation English I	6	3	25	75	100
	20U1BCC01	III	Core-I	Biomolecules	5	5	25	75	100
	20U1BCP01		Core-I Practical	Major Practical-I	4	3	40	60	100
	20U1CHA01	III	Allied-I	Allied chemistry I	4		25	75	100
				Allied Chemistry Practical I	3	2	-	-	-
20U1VE01	-	-	Value education – (Yoga)	2	2	25	75	100	
				Total	30	20	165	435	600
II	20U2LT02	I	Language-II	Tamil-II	6	3	25	75	100
	20U2LH02			Hindi-II					
	20U2LM02			Malayalam-II					
	20U2LE02	II	English-II	Foundation English-II	6	3	25	75	100
	20U2BCC02	III	Core-II	Major- Biochemical Techniques	4	4	25	75	100
	20U2BCP02		Core-II Practical	Major Practical-II	3	2	40	60	100
	20U2CHA02	III	Allied-II	Allied Chemistry II	4	4	25	75	100
	20U2CHAP01			Allied Chemistry Practical II	3	3	40	60	100
20U2VES01	IV	-	Environmental studies	4	4	25	75	100	
				Total	30	23	205	495	700
III	20U3LT03	I	Language –III	Tamil-III	6	3	25	75	100
	20U3LH03			Hindi-III					
	20U3LM03			Malayalam-III					
	20U3LE03	II	English-III	Foundation 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
	20U3BCP03		Core III Practical	Major Practical-III	3	2	40	60	100
20U3MBP03	III	Allied-III	Allied Microbiology	4	4	25	75	100	

	20U3UMBP03			Allied Microbiology Practical	3	3	40	60	100
	20U3BCS01	IV	SBEC-I	Biostatistics	2	2	25	75	100
				Total	30	23	230	570	800
IV	20U4LT04	I	Language-IV	Tamil-IV	6	3	25	75	100
	20U4LH04			Hindi-IV					
	20U4LM04			Malayalam-IV					
	20U4LE04	II	English-IV	Foundation English-IV	6	3	25	75	100
	20U4BCC04	III	Core-IV	Intermediary Metabolism	4	4	25	75	100
	20U4BCP04		Core IV Practical	Major 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	
				Total	30	23	230	570	800
V	20U5BCC05	III	Core-V	Human Physiology	5	5	25	75	100
	20U5BCC06	III	Core-VI	Molecular Biology	5	5	25	75	100
	20U5BCP05	III	Core-V Practical	Major Practical-V	6	5	40	60	100
	20U5BCP06	III	Core-VI Practical	Major 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
				Lib and Sports	1	0			
	20U5BCPR1	III	-	Mini Project	1	1	-	-	-
				Total	30	26	180	420	600
VI	20U6BCC07	III	Core-VII	Immunology and Immunotechniques	5	5	25	75	100
	20U6BCC08	III	Core-VIII	Clinical Biochemistry	5	5	25	75	100
	20U6BCP07	III	Core-VII Practical	Major Practical-VII	6	5	40	60	100
	20U6BCP08	III	Core-VIII Practical	Major 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
					Lib and Sports	1	0		
	20U6EX01	-	-	Extension Work	1	1	40	60	100

				Total	30	25	205	495	700
Overall Total					180	140	1230	2940	4200

BIOMOLECULES

Paper : Core I	Total Hours : 60
Hours/Week : 5	Exam Hours : 03
Credit : 5	Internal : 25
Paper Code : 20U1BCC01	External : 75

Aim:

To understand the structure, functions and behavioral properties 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 various biomolecules.	K1
CO2	Recall and understand the classification, chemistry and functions of lipids	K2
CO3	Imbibe and interpret the chemical reactions of amino acids and structural organization of various protein.	K2
CO4	Evolve the physiological functions and significance of nucleic acid	K3
CO5	Correlate the need of vitamins and macro, micro minerals with the metabolic and physiological functions of the human body.	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 Hrs.): Carbohydrates – Occurrence, Definition and Classification of

Carbohydrates. Monosaccharides –Structure of aldose and ketoses, stereo isomerism and optical isomerism of sugars, anomers, epimers, enantiomers and mutarotation of sugars. Monosaccharide: linear and cyclic structure of glucose, fructose, galactose, mannose and ribose. Functions and properties Disaccharides – Occurrence, Structure, chemistry and functions of sucrose, lactose, and maltose Homopolysaccharides- structure of starch, glycogen and cellulose. Heteropolysaccharides-structure and function of hyaluronic acid and heparin

Unit II – (12 Hrs.): Lipids - Definition, classification and function of lipids, simple, compound and derived lipids with examples. Simple lipids- classification, nomenclatures, structures of fatty acids, Physical and chemical properties of fatty acids – Saponification number, acid number, Iodine number and RM number and their applications. Compound lipids-Structure and function of phospholipids, glycolipids and lipoproteins. Steroids-Structure and functions of cholesterol.

Unit III – (12 Hrs.): Amino acids and Proteins – Amino acids-Definition, classification based on charge and polarity, structure and properties: stereo and optical isomerism, zwitter ions in aqueous solution, General reactions of amino acids based on carboxyl group, amino group and both carboxyl and amino group. Essential and nonessential and semi essential amino acids. Peptides: Classification and its function (glutathione, oxytocin and vasopressin) Protein: classifications based on shape, solubility and composition and function. Protein Architecture.

Unit IV – (12 Hrs.): Nucleic acids – Introduction, Composition - Structure of Purines and Pyrimidines- Nucleotides and Nucleosides. DNA - Double helix –Watson and Crick model, A, B and Z forms of DNA. RNA – Types (mRNA,tRNA,rRNA and hnRNA) , Unusual Bases. DNA Denaturation, Renaturation.

Unit V – (12 Hrs.): Vitamins and Minerals - Definition, Classification of Fat soluble vitamins(A,D,E,K) and Water soluble vitamins (B complex vitamins & Vitamin C) - Sources, Chemical nature (without structure), functions and deficiency symptoms. Minerals: Requirements, macro and micro minerals (source and functions). Applications of biomolecules in the preparation of nanomaterials.

TEXT BOOKS:

1. Jain, J.L. 2007. **Fundamentals of Biochemistry**. 3rd Revised Edition. S.Chand and Co Ltd, New Delhi.
2. Satyanarayana, U. (2002). **Biochemistry**. 2nd Edition. Books and Allied (P) Ltd.
3. Zubay, G. (1999), **Biochemistry**. 4th Edition, WCB. Mcgraw-Hill, New York.

REFERENCE BOOKS:

1. Nelson, D.L. and Cox, M. M. (2008). **Lehninger's Principles of Biochemistry**. 6th Edition. Freeman Publishers. New York.
2. Stryer, L. and Hall, J.E. (2009). **Biochemistry**: Library of Congress Cataloguing-in

Publication Data, Bery, Jeremy Mark.

3. Robert Murray, Bender, (2012) **Harper's Illustrated Biochemistry**. 29th Edition, McGraw Hill.

4. Voet and Voet, (2016) **Biochemistry**, 5th edition. John Wiley and Sons publications, New York.

WEB SOURCES

1. <http://ull.chemistry.uakron.edu/genobc/>.

2. <http://www.biology.arizona.edu/biochemistry/biochemistry.html>.

3. <http://downloads.hindawi.com/journals/bmri/2018/4012145.pdf>

4. <https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/nucacids.htm>

5. <https://healthy-kids.com.au/food-nutrition/nutrients-in-food/vitamins-minerals/>

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

YEAR I – SEMESTER II
BIOCHEMICAL TECHNIQUES

Paper	: Core II	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	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 % 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. London, 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

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 - BIOCHEMISTRY PRACTICAL – I

Paper	: Core Practical I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: 20U1BCCP01	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:

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.

YEAR I – SEMESTER I
CORE - BIOCHEMISTRY PRACTICAL – I

Paper	: Core Practical I	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 20U1BCCP01	External	: 60

I. a) Qualitative analysis of carbohydrate (Or) 15 Marks
b) Qualitative analysis of aminoacids

II. a) Analysis of lipids (Oil) (Or)
b) Analysis of lipids unsaturated fatty acids 15 Marks

Record 10
Spotters 20

YEAR I – SEMESTER II
CORE - BIOCHEMISTRY PRACTICAL – II

Paper	: Core Practical II	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: 20U2BCCP02	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 Ascorbic acid by 2,6 Di Chlorophenol Indophenol Dye method.
- 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 I – SEMESTER II
CORE - BIOCHEMISTRY PRACTICAL – II

Paper	: Core Practical II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 20U2BCCP02	External	: 60

I. a) Estimation of Aminoacid (Glycine) by Formal titration method (Or) 15 Marks
b) Estimation of DNA by Diphenylamine method.

II. a) Separation of amino acids by Paper Chromatography (Ascending and Descending) (Or)
b) Separation of amino acids by TLC. 15 Marks

Record 10

Spotters 20

YEAR II – SEMESTER III

ENZYMES AND ENZYME TECHNOLOGY

Paper	: Core III	Total Hours	: 60
Hours/Week	:4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 20U3BCC03	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	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(12 Hours): Enzymology– Introduction, enzyme numbering and Nomenclature, Enzyme commission numbers and Classification of enzymes. Enzyme characteristics. Holoenzyme, apoenzymes, prosthetic group, abzymes, ribozymes and enzyme units and enzyme turnover. **Active site**– Definition, models of ES complex– lock and key model, induced fit

model. Ordered binding and random binding of substrate.

Unit II (12 Hours) Enzyme kinetics – Order of reaction, activation Energy, derivation of Michaelis – Menton equation, Lineweaver and Burk plot, Eadie – Hofstee plot. significance of K_m and V_{max} . Factors affecting the enzyme activity - pH, temp, enzyme and substrate concentration, inhibitors and activators. Enzyme turnover.

Unit III (12 Hours) Enzyme inhibition – Reversible & irreversible inhibition, Feedback inhibition and covalent modification - Allosteric enzymes- properties, and models positive and negative cooperativity (aspartate transcarbamylase). Isoenzymes (Lactate dehydrogenase). Role of metal ions in enzyme catalysis

Unit IV (12 Hours) Catalysis & Co-Enzymes: General acid base catalysis, covalent catalysis. Proximity orientation. Multi-enzyme Complex: Pyruvate dehydrogenase complex. Mechanism of action of Lysozyme and chymotrypsin. Coenzymes: Definition, structure and functions of TPP, NAD, NADP, FAD, FMN, coenzyme A and biotin.

Unit V (12 Hours) Enzyme Technology & Applications: - Immobilized enzymes: Types, techniques and applications of enzyme immobilization, Effects of enzyme immobilisation. Isolation, extraction (dialysis, ultracentrifugation, Affinity Chromatography) and purification of enzymes. Enzymes as therapeutic agents, analytical reagents & diagnosis and enzymes in industries.

TEXT BOOKS

1. Nicholas., C. Price, (1998). **Fundamentals of Enzymology**. 2nd Edition, Oxford University Press.
2. Trevor Palmer, (2004). **Enzymes**. 5th Edition, Affiliated East – West press (P) Ltd.
3. Gary Walsh, Denis, and Headon, (2002). **Protein Biochemistry and Biotechnology**. John Wiley and Sons Ltd, USA.

REFERENCES BOOKS

1. Dixon, E. C. Webb, (1979). **Enzymes**. 3rd Edition, C. J. R. Thorne and K. F. Tipton, Longmans Green & Co, London and Academic Press, New York.
2. Ashok Pandey, Colin Webb, Carlos Ricardo Soccol, Christian, (2005). **Enzyme technology**, Asiatech Publishers, Inc., Delhi.
3. Chapline, M. F. Bucke, C. (1990). **Enzyme Technology**. 1st Edition, Cambridge University

Press.New York.

WEB RESOURCES

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

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

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	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 20U3BCN01	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 portal period, restoration of mother to optimum health. Breast feeding; Family planning methods –definition, Natural methods (BBT, Cervical and mucous methods). Artificial methods – Hormonal contraceptives, gonadal steroids, oral pills and Depot formulations.

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 – Types and causes of mental illness – Preventive aspects; Alcoholism, Drug dependence – Commonly abused drugs. Health in Old age – Aging, caring for older people, care of bedridden.

TEXT BOOKS

1. **Ahmed. M. N.**, *Hygiene and health*, Anmol publications, New Delhi, 15th edi., 2005.
2. **Ashtekar. S.**, *Health and Healing –A Manual of Primary health care*, Orient Longmans publishers. 2001.
3. **Park. K.**, *Social and preventive medicine* , Bhanot publishers, Japalpur, 18th edition, 2005.

REFERENCE BOOKS

1. **Patil. R.S.**, *Practical Community Health*, Vora medical publishers, New Delhi, 1st edi 1995.
2. **Prabhakara. G. N.**, *Preventive and social medicine*, Jaypee Publications., New Delhi, 1st edi, 2003.
3. **Sridhar Rao. B.**, *Community Health Nursing*, A.I.T.B.S. Publishers, New Delhi, 1st edi 2006, 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/>
4. <https://www.webmd.com/mental-health/mental-health-types-illness#1>

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

YEAR II – SEMESTER III
BIOCHEMISTRY IN DIAGNOSIS

Paper	: NMEC II	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 20U3BCN02	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 steatorrhoea. 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://fbt.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
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, Seminar, Models

YEAR II – SEMESTER III
CORE - BIOCHEMISTRY PRACTICAL – III

Paper	: Core Practical III	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	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. Buffer Preparation
2. Starch from Potato
3. Lecithin from Egg Yolk
4. Casein from Milk

II. ENZYME ASSAY

1. Estimation of Protein by Lowry's Methods
2. Optimization of pH, temperature, substrate concentration and Enzyme concentration of Salivary Amylase, Catalase.
3. Evaluation of Enzyme kinetics K_m , V_{max} , K_{cat} from crude enzyme

4. To determine specific activity of alkaline phosphatase enzyme.

III. EXTRACTION (Group Experiment)

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

REFERENCES

1. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2nd Edition .New Age International (P) Limited. New Delhi
2. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2nd 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	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 20U4BCC04	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. 5th Edition, W.H. Freeman and Co., New York.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). Fundamentals of Biochemistry, 3rd 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. 4th 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

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

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	: 4	Exam Hours	: 03
Credit	: 3	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 micro nutrients 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 - BIOCHEMISTRY PRACTICAL – IV

Paper	: Core Practical IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 20U4BCCP04	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

VoI.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 III – SEMESTER V

HUMAN PHYSIOLOGY

Paper	: CORE V	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 20U5BCC05	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
CO1	Distinguish the anatomy, biological, physiological activities along with the mechanism of action of eyes and muscles.	K1 & K2
CO2	Demonstrate about digestive system and its regulation alimentary parts of human and body fluids body.	K3
CO3	Discriminate respiratory system and excretory system.	K5
CO4	Assess the Sympathetic parasymphathetic nervous system and synaptic transmission	K4
CO5	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
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

Digestive System: Secretions of digestive tract, digestion, absorption, assimilation of carbohydrates, proteins, fats, Structure and function of ear, nose, teeth and eyes and their types.

Unit II

12 Hours

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

Unit III

12 Hour

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

Unit IV

12 Hour

Nervous System: Gross anatomy of brain, organization of the nervous system, concept of central nervous system, peripheral nervous system, autonomic nervous system, sympathetic and parasympathetic nervous systems, spinal cord, Structure of neuron, action potential, Propagation of nerve impulses, Structure of synapse, synaptic transmission. electroencephalogram.

Unit 5

12 Hour

Urogenetal System :Structure and functions of kidney, Nephron, Mechanism of urine formation, Renal Transplantation, Dialysis. Structure and function of the male and female reproductive organs, spermatogenesis, menstrual cycle, physiology of pregnancy, parturition and lactation. Sexual Dysfunction in Men and Women -reasons, therapy and treatment.

TEXT BOOKS

1. Chatterjee, C., *Human Physiology*, Medical Allied Agency Calcutta., 11th edition, (1992).
2. Muthayya.N.M, *Human Physiology*, Jaypee publications, New Delhi, 3rdedi., 2002.
3. Sathyanarayana, U. *Text book of Biochemistry*, Books and Allied Ltd, Kolkatta, 2ndedi., 1999.
4. Willam F. Ganong. *Review of medical physiology*(2003), 21ST EDITION, The MC Graw-Hill companies, India.

REFERENCE BOOKS

1. Carola.R. *et al*, *Human Anotomy and Physiology*, International edi.
2. Guyton, *Text book of Medical Physiology*, W. B. Saunder's Company, 8th edition, (1991).
3. Murray, R. K., Granner Mayes and Rod Well, *Appleton and Lange, Harper's Biochemistry*, 24th edition (1996).
4. Barbara A. Gylys Mary Elen Wedding, *Medical Terminology Systems*, Davis plus International. 6th edition. 2008.

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- 2.<https://nptel.ac.in/courses/127/106/127106001/>
- 3.<https://nptel.ac.in/content/storage2/courses/122103039/pdf/mod3.pdf>
- 4.<https://www.vedantu.com/biology/human-excretory-system>

YEAR III – SEMESTER V

MOLECULAR BIOLOGY

Paper	: CORE VI	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	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: Experimental evidence to prove DNA as genetic material, Types of replication, Semi conservative replication and experimental proof, mechanism of replication in prokaryotic and Eukaryotes- Initiation, Elongation, Termination, Enzymes involved in replication, inhibitors of DNA replication.

UNIT – II**12 Hours**

Transcription : Basic features of RNA synthesis, E.Coli RNA polymerases, Prokaryotic and eukaryotic mechanism of initiation, chain elongation and termination (Rho-dependent and Independent), RNA splicing and processing of mRNA, Inhibitors of transcription.

UNIT – III**12 Hours**

Translation: Genetic code and its features, composition of prokaryotic and Eukaryotic ribosomes, mechanism of initiation, elongation and termination of protein synthesis in prokaryotes and eukaryotes, inhibitors of protein synthesis, post translational modifications of proteins.

UNIT – VI**12 Hours**

Regulation of gene expression and Recombination: Operon model in prokaryotes – lac operon- Positive and Negative Control; tryp operon- Repression and attenuation and arab operon, 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, mutagens. DNA Repair mechanisms- Excision repair, mismatch repair, photo activation, SOS repair.

TEXT BOOKS

1. Ajoy Paul,(2015). Text book of Cell and Molecular Biology 4th Edition, Books and Allied (P) Ltd, Kolkata.
2. Rastogi.S.C. Cell and Molecular Biology, India Binding House, U.P., 2nd edi. 2010.

REFERENCE BOOKS

1. Freifelder. D., Essentials of Molecular Biology, Jones and Bartlett Publications Inc., London 3rd Edition, , 1998.
2. Gardner, E.J., Simmons, M.J. and Snusted, D.P., Principles of Genetics, John Wiley and Sons, New York, 8th ed., 2002.
3. David L. Nelson and Michael Cox, Lehninger Principles of Biochemistry, WH Freeman Publisher, 7th ed. 2017
4. Robert F. Weaver, Philip W. Hedrick, Genetics, W.C Brown Publishers, 3rd ed, 1997.
5. Jolcelyn E.Krebs, Elliotts.Goldstein and Stephen T.Killpatrick, Lewins genes XII, Jones and Bartlett Publishers, 12th Revised edition edition, 2017

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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>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5474181/>

YEAR III – SEMESTER V

DRUG BIOCHEMISTRY

Paper : ELECTIVE I
Hours/Week : 4
Credit : 3
Paper Code : 20U5BCE01

Total Hours : 60
Exam Hours : 03
Internal : 25
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
CO4	Knowledge of reaction mechanisms can aid in understanding the mode of action of a drug	K6
CO5	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: Definitions, ligand, receptor, Historical development, Sources of drugs, dosage forms of drug (Types alone), routes of drug administration, Classification of drugs.

Unit II **12Hours**

Pharmacokinetics:

Absorption and bioavailability of drugs, distribution of drugs, Site of action, Drugs distribution and elimination. **Pharmacodynamics:** Xenobiotic, Definition, Biotransformation Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism. Drug receptors, drug - receptor interactions, Receptor mediated and non-receptor mediated drug action, Placebo effects, Factors modifying drug action.

Unit III **12Hours**

Adverse Responses and Side Effects of Drugs: Allergy, Drug intolerance, Drug addiction, drugs abuses and their biological effects and drug dependence Adverse drugs reactions in man.

Unit IV **12Hours**

Chemotherapy: Anti- bacterials mode of action and resistance to penicillin, streptomycin, tetracycline and chloramphenicol. Antibacterial, Antiviral and antimalarial drugs.

Unit V **12Hours**

Drugs of plant origin: Action of alkaloids, glycoside, Drug dependents and abuse – management of self-poisoning. Cancer chemotherapy- cytotoxic drugs. Immunosuppressive drug therapy.

TEXT BOOKS

1. Willam.O.Foye, (1995) **Principles of Medicinal Chemistry** 4thEdition Waverks Pvt. Ltd. New Delhi
2. Nirmala, N., Rege, R.S., Santoskar, S.D. and Bhandarkar (2011), Pharmacology and Pharmacotherapeutics, 23rd edition, CBS Publishers and Distributors Pvt. Ltd.
3. Padamaja udayakumar(2017) **Medical pharmacology** 5TH Edition .,CBS publishers and distributors pvt.ltd(Textbook),Newdelhi.

REFERENCE BOOKS.

1. Burger's **Medicinal Chemistry and Drug Discovery:** principles and practice – Wolf, John

Wiley

2. Glick, Pasternak, (2002) **Molecular Biotechnology** 2nd Edition ak, Panima Publishers,

3. R.S. Satoskar., S.D. Bhandhakar., Nirmala. N. Rege (2015) **Pharmacology and pharmacotherapeutics.**

4. Tripathi, K.D. (2013) 'Essentials of Medical Pharmacology' 7th edition, Jaypee brothers, Medical publishers, New Delhi

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2. <https://en.wikipedia.org/wiki/Pharmacodynamics>
3. <https://www.healthline.com/health/chemotherapy>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3560124/>

YEAR III – SEMESTER V

NUTRITIONAL BIOCHEMISTRY

Paper	: ELECTIVE II	Total Hours	: 60
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 20U5BCE02	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 dietitians.

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
CO3	Understood the Effects of methods Nutrient analysis and energy content	K2
CO4	Understood the scientific active constituents micro and macro nutrients	K2
CO5	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, Respiratory quotients of foodstuffs, 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.

TEXT BOOKS

1. Nutrition: Science and Applications, 3rd Edn. Lori A. Smolin, Mary B. Grosvenor, Wiley (2013).
2. Introduction to Human Nutrition, 2nd Edn. Michael J. Gibney, Susan A. Lanham-New, Aedin Cassidy, Hester H. Vorster, Wiley-Blackwell (2009).
3. Swaminathan, M. (2010) Essentials of Food and Nutrition, Volume I and II Ganesh and Co., Madras

REFERENCE BOOKS

1. Introduction to Human Nutrition, 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK, (2012).
2. Srilakshmi. E .(2016) Nutrition Science, New Age International Publishers
3. Gopalan, C., Ramasastry, B.V and Balasubramanian, S. (2007). Nutritive Value of Indian Foods, National Institute of Nutrition, Hyderabad.

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4. 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 it 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
CO4	Apply the knowledge gained about gene amplification and advances in sequencing techniques	K3
CO5	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.

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.

UNIT – V

06 Hours

Applications of gene technology- Recombinant insulin and Recombinant growth hormones production, Gene therapy- Methods and applications

TEXT BOOKS

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

REFERENCE BOOKS

1. T.A. Brown, Gene cloning and DNA Analysis- An introduction, Chapman and Hall, 2016, 7th Edition.
2. Glick.R, Bernard and Pasternak.J, Jack, Molecular Biotechnology, Asm press, Washington D.C, 3rd 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.

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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

YEAR III – SEMESTER V
CORE - BIOCHEMISTRY PRACTICAL – V

Paper	: Core Practical V	Total Hours	: 75
Hours/Week	:5	Exam Hours	: 06
Credit	: 3	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 H₂O₂ radical scavenging assay.

TEXT BOOKS

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

REFERENCES

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

YEAR III – SEMESTER V
CORE - BIOCHEMISTRY PRACTICAL – VI

Paper	: Core Practical VI	Total Hours	: 75
Hours/Week	:5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: 20U5BCCP06	External	: 60

COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand Practice on basics Immunological assay	K1 & K2
CO2	Estimate the Isolation and identification of genomic DNA from animal and plant tissue	K1 & K2
CO3	Learn the transformation methods	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. 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). 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.

REFERENCES

1. Laboratory Manual in Biochemistry. Pattabiraman, T.N. (1998). 3rd Edition. All India Publishers and Distributors. Chennai.
2. Experimental Procedures in Life Sciences, S.Rajan and R.Selvi Christy, CBS Publishers & Distributors Pvt Ltd, 2018
3. Biochemical Methods. Sadasivam S and Manickam P. (2004) 2nd Edition. New Age

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
CO3	To obtain knowledge about the interaction between antigen and antibody and techniques about its detection in physiological and diseased state	K3
CO4	The next level of understanding of cell mediate responses and cytotoxicity responses was dealt and predicted	K4
CO5	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, Opsonization. Immunofluorescence, ELISA and RIA. Immuno electrophoresis and electroimmunodiffusion, flow cytometry, western blotting.

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, Complement component. 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. Immunologic tolerance. 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**. 3rd 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. 8th Edition. Macillan Publications, NY.
2. David Male, Jonathan Brostoff, David Roth and Ivan Roitt.(2013). Immunology. 8th Edition. Elsevier Saunders. ouse, U.P., 2ndedi. 2010.
3. Ian R. Tizard. (1994). Immunology: An Introduction. 4th Edition. Books/Cole Publizers.

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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
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	: 4	Exam Hours	: 03
Credit	: 3	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.

Course No	Course Outcome	Knowledge Level
CO1	Recognize the disorder of carbohydrate metabolism and its disease	K1 & K2
CO2	Execute disorders of protein metabolism and its disease	K3
CO3	Distinguish about disorders of lipid and nucleic acid metabolism	K4
CO4	Interpret the Renal function test, Liver function test, Gastric function test, Cerebrospinal fluid	K3 & K4
CO5	Categorize clinically important enzymes- Significant of marker enzymes	K4 & K6

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, GTT, Galactosemia, Fructosuria, Diabetes mellitus : Types, Clinical features, metabolic effects, complications, Glycogen storage diseases.

UNIT II

12 Hours

Disorders in protein metabolism: Introduction, etiology and clinical features of Aromatic aminoacid-Phenylketonuria, Alkaptonuria, Albinism and 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, Hypertriacylglyceridemia, 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 4th 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 3rd Edition, **Bhalani Publishing House**

REFERENCE BOOKS

- 1.Philip. D. Mayne (1994). **Clinical Biochemistry in Diagnosis and Treatment** 6th Edition
ELBS Publication
2. William J.Marashall and Stephen K bangert, (1995).**Clinical Biochemistry** – Metabolic and clinical aspects, Pearson Professional Ltd

WEB REFERENCE

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2. www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...
3. www.niams.nih.gov ›
4. www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf
5. 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	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 20U6BCE03	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
CO5	Illustrate the male and female reproductive system, synthesis of hormones, significance and pathophysiology of gonads.	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
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, classification of hormones. Role of second messengers in hormonal action. Cyclic AMP, Role of G-proteins. Calcium, calmodulin. Mechanism of action of Group I and

Group II hormones. 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 Corticoid 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**, 28th Ed, Appleton & Lange Stamford, Connecticut.
2. Guyton, A.C. and Hall, J.E (2006), **Textbook of Medical Physiology**, 11th 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** 5th 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**. 4th Edition, The Macmillan Company, London.

WEB OF RESOURCE:

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

www.medicinenet.com > ... > thyroid az list > medterms medical dictionary az list

www.btf-thyroid.org > Info

www.healthline.com/human-body-maps/pituitary-gland

PEDOGOGY: CHALK and Talk , PPT

YEAR III – SEMESTER VI

CELL BIOLOGY

Paper : **ELECTIVE IV**

Hours/Week : 4

Credit : 3

Paper Code : **20U6BCE04**

Total Hours : 60

Exam Hours : 03

Internal : 25

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:

Course No	Course Outcome	Knowledge Level
CO1	Discuss the cell organization and the cell structures	K2
CO2	Illustrate the cell organelles structure and functions such as nucleus, chloroplast, mitochondria, endoplasmic reticulum and ribosome lysosome etc.,	K3
CO3	Apply the knowledge chromosome organization and its types	K4
CO4	Evaluate the stages of cell cycle and its regulation of cells	K5
CO5	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 Organization: Introduction, cell theory, types of cell – Prokaryotic and eukaryotic cell structure, difference between plant and animal cell.

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, Chromosome aberrations, special types of chromosome- Prokaryotic Nucleoids Polytene Chromosomes, Lampbrush Chromosomes

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

Cell – 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 and 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, 3rd edition, 1994.
2. **lodish.h, baltimore, bert.a *et.al.***, *molecular cell biology*, 3rd edition. 1995.

WEB OF RESOURCE:

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

www.medicinenet.com › ... › thyroid az list › medterms medical dictionary az list

www.btf-thyroid.org › Info

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	: 20U6BCS04	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
CO4	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
CO5	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

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. First aid equipment in laboratory accident- Precautions and first aid equipment sensitivity, linearity, calibration, Biomedical waste disposals

UNIT – II

06 Hours

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

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.
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.

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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 - BIOCHEMISTRY PRACTICAL – VII

Paper	: Core Practical VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: 20U6BCCP07	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). 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. **Laboratory Manual in Biochemistry.** Pattabiraman, T.N. (1998). 3rd Edition. All India Publishers and Distributors. Chennai.
3. **Laboratory Manual in Biochemistry.** Jayaraman, S. (2003). 2nd Edition. New Age International (P) Limited. New Delhi
4. **Biochemical Methods.** Sadasivam S and Manickam P. (2004) 2nd Edition. New Age International (P) Limited. New Delhi.

YEAR III – SEMESTER VI
CORE - BIOCHEMISTRY PRACTICAL – VIII

Paper	: Core Practical VIII	Total Hours	: 45
Hours/Week	:5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 20U6BCCP08	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. Isolation and purification of IgG serum by column chromatography techniques
8. Dissection and identification of thymus, spleen and lymph node from rat.
9. Antigen Antibody reaction- Pregnancy and WIDAL Test.

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