

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 2019-2020
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.

- 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	K6

	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.	
PO8	Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments.	K4
PO9	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 Assessment 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 has have been prescribed therefore.

X. PROCEDURE IN THE EVENT OF FAILURE

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

XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 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 BIO CHEMISTRY
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	18U1LT01	I	Language-I	Tamil-I	6	3	25	75	100
	18U1LH01			Hindi-I					
	18U1LM01			Malayalam-I					
	18U1LE01	II	English-I	Foundation English I	6	3	25	75	100
	18U1BCC01	III	Core-I	Chemistry of Biomolecules	5	5	25	75	100
	18U1BCCP01		Core-I Practical	Major Practical-I	4	3	40	60	100
	18U1CHA01	III	Allied-I	Allied chemistry I	4	4	25	75	100
				Allied Chemistry Practical I	3	2	-	-	-
18U1VE01	-	-	Value education – (Yoga)	2	2	25	75	100	
Total					30	22	165	435	600
II	18U2LT02	I	Language-II	Tamil-II	6	3	25	75	100
	18U2LH02			Hindi-II					
	18U2LM02			Malayalam-II					
	18U2LE02	II	English-II	Foundation English-II	6	3	25	75	100
	18U2BCC02	III	Core-II	Major- Biochemical Techniques	4	4	25	75	100
	18U2BCCP02		Core-II Practical	Major Practical-II	3	2	40	60	100
	18U2CHA02	III	Allied-II	Allied Chemistry II	4	4	25	75	100
	18U2CHAP01			Allied Chemistry Practical II	3	2	40	60	100
18U2VES01	IV	-	Environmental studies	4	4	25	75	100	
Total					30	22	205	495	700
III	18U3LT03	I	Language - III	Tamil-III	6	3	25	75	100
	18U3LH03			Hindi-III					
	18U3LM03			Malayalam-III					
	18U3LE03	II	English-III	Foundation English-III	6	3	25	75	100
	18U3BCC03	III	Core-III	Enzymes and Enzyme Technology	4	4	25	75	100
	18U3BCN01 18U3BCN02		NMEC I	Health and Hygiene Biochemistry in Diagnosis	2	2	25	75	100
	18U3BCCP03		Core III	Major Practical-III	3	2	40	60	100

			Practical						
	18U3MBP03	III	Allied-III	Allied Microbiology	4	4	25	75	100
	18U3UMB03			Allied Microbiology Practical	3	2	40	60	100
	18U3BCS01	IV	SBEC-I	Biostatistics	2	2	25	75	100
				Total	30	22	230	570	800
IV	18U4LT04	I	Language-IV	Tamil-IV	6	3	25	75	100
	18U4LH04			Hindi-IV					
	18U4LM04			Malayalam-IV					
	18U4LE04	II	English-IV	Foundation English-IV	6	3	25	75	100
	18U4BCC04	III	Core-IV	Intermediary Metabolism	4	4	25	75	100
	18U4BCCP04		Core IV Practical	Major Practical-IV	3	2	40	60	100
	18U4BCN01	III	NMEC II	Biochemistry and Health Molecular basis of human disease	2	2	25	75	100
	18U4BCN02								
	18U4CSA04	III	Allied-IV	Allied Biotechnology	4	4	25	75	100
	18U4CSAP03			Allied Biotechnology Practical	3	2	40	60	100
18U4BCS02	IV	SBEC-II	Computer in Biology	2	2	25	75	100	
				Total	30	22	230	570	800
V	18U5BCC05	III	Core-V	Human Physiology	5	5	25	75	100
	18U5BCC06	III	Core-VI	Molecular Biology	5	5	25	75	100
	18U5BCCP05	III	Core-V Practical	Major Practical-V	6	5	40	60	100
	18U5BCCP06	III	Core-VI Practical	Major Practical-VI	6	5	40	60	100
	18U5BCE01	III	Elective-I	Drug Biochemistry Nutritional Biochemistry	4	3	25	75	100
	18U5BCE02								
18U5BCS03	IV	SBEC-III	Genetic Engineering	2	2	25	75	100	
				Lib and Sports	1	0			
18U5BCPR1	III	-	-	Mini Project	1	1	-	-	-
				Total	30	26	180	420	600
VI	18U6BCC07	III	Core-VII	Immunology and Immunotechniques	5	5	25	75	100
	18U6BCC08	III	Core-VIII	Clinical Biochemistry	5	5	25	75	100
	18U6BCCP07	III	Core-VII Practical	Major Practical-VII	6	5	40	60	100
	18U6BCCP08	III	Core-VIII Practical	Major Practical-VIII	6	4	40	60	100
	18U6BCE03	III	Elective-II	Biochemistry of	4	4	25	75	100

	18U6BCE04			Hormones Cell Biology					
	18U6BCS04	IV	SBEC-IV	Biochemistry in diagnostic medicine	2	2	25	75	100
				Lib and Sports	1	0			
	18U6EX01	-	-	Extension Work	1	1	40	60	100
				Total	30	26	205	495	700
	Overall Total				180	140	1230	2940	4200

CHEMISTRY OF BIOMOLECULES

Paper	: Core I	Total Hours	60
Hours/Week	: 5	Exam Hours	03
Credit	: 5	Internal	25
Paper Code	: 18U1BCC01	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 & K2
CO2	Recall and understand the classification, chemistry and functions of macro and micro nutrients.	K1 & K2
CO3	Imbibe and interpret the chemical reactions of monosaccharides, amino acids and structural organization of various biomolecules.	K1, K2 & k3
CO4	Evolve the physiological functions and significance of macro and micro nutrients.	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	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: Definition, function and examples (glutathione, oxytocin and vasopressin) Protein: classifications based on shape, solubility and composition and function. Protein Architecture: Primary, Secondary(excluding Ramachandran plot), tertiary and quaternary structure of Proteins.

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) .

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).

TEXT BOOKS:

1. Jain, J.L. 2007. **Fundamentals of Biochemistry**. 3rd Revised Edition. S.Chandand Co Ltd, NewDelhi.
2. Satyanarayana, U. (2002). **Biochemistry**.2nd Edition.Books and Allied (P) Ltd.
3. Voet, D. and Voet, G. (2008), **Fundamentals of Biochemistry** – Life at the Molecular level, 2nd Edition, John wiley& Sons. Inc., Newyork.
4. 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. https://en.wikipedia.org/wiki/Nitrogenous_base
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 I
CORE - BIOCHEMISTRY PRACTICAL – I

Paper	: Core Practical I	Total Hours	75
Hours/Week	: 5	Exam Hours	03
Credit	: 3	Internal	40
Paper Code	: 18U1BCCP01	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 I
BIOCHEMICAL TECHNIQUES

Paper	: Core II	Total Hours	60
Hours/Week	: 5	Exam Hours	03
Credit	: 5	Internal	25
Paper Code	: 18U2BCC02	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	S	S	M	S	S	S	M	S	S	S	M	S	S	S
CO2	S	S	S	S	S	M	S	M	M	S	S	S	S	S	S
CO3	S	S	M	M	S	M	L	M	S	L	M	S	L	S	M
CO4	S	M	S	L	S	S	M	L	S	M	S	L	S	M	M
CO5	S	S	S	S	M	S	S	S	L	L	S	M	S	L	S

S- Strong; M-Medium; L-Low

CONTENT**UNIT – I****12 Hours**

pH Scale: methods of calculating pH from Henderson's equation, buffer solutions, buffer systems of blood - protein, bicarbonate 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, Adsorption chromatography, GLC, Ion exchange chromatography, Affinity chromatography and Molecular sieve chromatography

UNIT – III**12 Hours**

Electrophoresis:Principle, instrumentation and applications of Paper electrophoresis, Agarose gel, SDS-PAGE and Isoelectric focusing . Ultracentrifuge- principle and description of Analytical centrifuge, Sedimentation equilibrium density gradient centrifugation, separation of cell organelles by Differential 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, applications of photometry, comparison and advantage of spectrophotometer over colorimeter. Fluorimetry – principle and applications - determination of Thiamine and Riboflavin. Flame photometer - principle and applications.

UNIT – V**12 Hours**

Tracer and Other Techniques:Radioactive decay, units of radioactivity, $t_{1/2}$, detection and measurement of radioactivity, G.M counter, Scintillation counters, Auto radiography. Applications of radioisotopes in biological and medical sciences. Hazards and safety aspects of radioactivity.

TEXT BOOKS

1. Keith Wilson, and John Walker, (2010). Principles and Techniques of Practical Biochemistry. 7th Edition, Cambridge University Press. UK.
2. Avinash Upadhyaye, and Nirmalendhe Nath, (2002). Biophysical Chemistry Principles and Techniques. 3rd Edition, Himalaya Publishers, New Delhi.
3. Keith Wilson and Kenneth, (1994). Goulding A Biologist Guide to Principles and Tecchniques of Biochemistry, EdWard Arnold Publishers. UK.
4. Gurdeep, R. Chatwal, and Sham, K. Aanand, (2006). Instrumental Methods of Chemical Analysis. Himalaya publishing House, New Delhi.

REFERENCE BOOKS

1. Wilson and Walker, (2000). Practical Biochemistry. Principles & Techniques. 5th Edition Cambridge Univ. Press, New York.
2. Pattabhi, V and Gautham, N. (2002). Biophysics. Narosa Publishing House, New Delhi.

WEB SOURCES:

www.centrifugebybeckman.com

www.axis-shield-density-gradient-media.com/training-1new.

<http://hyperphysics.phy-astr.gsu.edu/hbase/nuclear/radact.html>

PEDOGOGY: CHALK and Talk , PPT, Seminar, Models

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	: 18U2BCCP02	External	60

- CO1 To make students learn about titrimetry
- CO2 Analyze and interpret the results of estimation of ascorbic acid
- CO3 Comprehend the principles involved in the estimation of sodium and potassium
- CO4 To make students to prepare buffer reagents and make them learn about pH measurements.
- CO5 Imbibe the usage of paper chromatography, TLC, colorimeter and flame photometry

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

I. QUANTITATIVE ANALYSIS

- Estimation of Aminoacid (Glycine) by Formal titration method.
- Estimation of Ascorbic acid by 2,6 Di Chlorophenol Indophenol Dye method.
- Estimation of Sodium and Potassium by Flame Photometry
- Estimation of DNA by Diphenylamine method.

II. QUALITATIVE EXPERIMENTS

- Preparation of buffer and its pH measurements using pH meter.

- b) Separation of amino acids by Paper Chromatography (Ascending and Descending)
- c) Separation of amino acids by TLC.

REFERENCE BOOKS:

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

YEAR II – SEMESTER I II**ENZYMES AND ENZYME TECHNOLOGY**

Paper	: Core III	Total Hours	60
Hours/Week	: 4	Exam Hours	03
Credit	: 4	Internal	25
Paper Code	: 18U3BCC03	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 & K2
CO2	Apply appropriate methods for determination of catalytic parameters and activity of enzymes and resolve problems	K1 & K2
CO3	Characterize the structure and functions of coenzymes, and the mechanism of enzyme catalysis	K1, K2 & k3
CO4	Explain the regulatory mechanisms of enzyme activity which involve in the maintenance of body's homeostasis	K1 & K2
CO5	Use appropriate enzymes for use in industries for recognizing their potential	K1 & K2

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

CONTENT

Unit I(12 Hours): Enzymology– Introduction, Nomenclature, Enzyme commission numbers and Classification of enzymes.Enzyme characteristics. Holoenzyme,apoenymes, prosthetic group, abzymes, ribozymes and enzyme units and enzyme turnover.**Activesite**– Definition,models of ES complex– lock and key model, induced fit model.

Unit II(12Hours)Enzyme kinetics – Order of reaction, activation Energy, derivation of Michelis – Menton equation, Line – Weaver and Burk plot, Eadie – Hofstee plot. significance of Km and Vmax. Factors affecting the enzyme activity - pH, temp, enzyme and substrate concentration, inhibitors and activators.

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

Unit IV(12 Hours)Catalysis&Co-Enzymes: General acid basecatalysis, covalent catalysis. Multienzyme 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(12Hours) EnzymeTechnology&Applications:- Immobilized enzymes:Types, techniques and applications of enzyme immobilization. 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**. 2ndEdition, OxfordUniversity Press.
2. Trevor Palmer, (2004). **Enzymes**. 5thEdition, 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.Cwebb, (1979). **Enzymes**.3rd Edition, CJRthorne 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.FBucke,C(1990).**Enzyme Technology**.1stEdition, 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	: 18U3BCN01	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	: 18U3BCN02	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 & 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
CO4	Analyse and describe the critical based knowledge collection, preservation, abnormal constituent of stools and microscopy studies.	K1 & K2
CO5	Evaluate and discuss the estimate 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

UNIT – II**06 Hours**

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

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.

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=urinanalysis_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 I II
CORE - BIOCHEMISTRY PRACTICAL – III

Paper	: Core Practical I II	Total Hours	75
Hours/Week	: 5	Exam Hours	03
Credit	: 3	Internal	40
Paper Code	: 18U3BCCP03	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. 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 I V
INTERMEDIARY METABOLISM

Paper	: Core IV	Total Hours	75
Hours/Week	: 5	Exam Hours	03
Credit	: 5	Internal	25
Paper Code	: 18U4BCC04	External	75

AIM: To make the students understand Intermediary metabolism: principles of bioenergetics, catabolism and anabolism, the metabolic pathway. Central metabolic pathways: glycolysis, citric acid cycle, the pentose phosphate pathway, gluconeogenesis. Energy stores: glycogen and fatty acids.. Integration of metabolic pathways.

OBJECTIVES: The aim is targeted with objectives of providing information related to carbohydrate, fat and protein metabolism that takes place in our body. Interrelationship between carbohydrate, fat and protein metabolism. Role of purine and pyrimidines in nucleic acid metabolism. Various disorders related to each metabolism.

OUTCOME:**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Demonstrate the principle and mechanism of working of various energy transfer reactions in living system.	K1 & K2
CO2	Correlate the pathways of carbohydrate metabolism.	K1 & K2
CO3	Explain the synthesis and utilization of lipids in living organisms.	K1, K2 & K3
CO4	Appraise the anabolic and catabolic reactions of amino acids.	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, Phospho lipids (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 aminoacids (Alpha Keto Glutarate, Pyruvate, Aromatic aminoacids) . 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	:18U4BCN03	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 I V
CORE - BIOCHEMISTRY PRACTICAL – IV

Paper	: Core Practical IV	Total Hours	75
Hours/Week	: 5	Exam Hours	03
Credit	: 3	Internal	40
Paper Code	: 18U4BCCP04	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 Toluidine 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.

MOLECULAR BASIS OF HUMAN DISEASE

Paper	: NMEC IV	Total Hours	30
Hours/Week	: 2	Exam Hours	03
Credit	: 2	Internal	25
Paper Code	: 18U4BCN04	External	75

Aim: The aim is decided to be fulfilled with the following objective of studying about basic laboratory practices, disorders of biopolymers, and other clinical disorders and its significance.

Objectives: Biomedical correlation in disease deal with the diagnostic importance of various metabolic disorders and to know the clinical aspects of various metabolic disorders.

CONTENT:**UNIT I- Nutritional disorders** **06 Hours**

Overview of major and minor nutrient components in the diet. Balanced diet and the concept of RDA. Nutrient deficiencies; kwashiorkor and Marasmus, scurvy, beriberi, pellagra and B12 deficiency, xerophthalmia and Night blindness, Vitamin D deficiency, Vitamin K deficiency.

UNIT II- Metabolic and lifestyle disorders **06 Hours**

Obesity and eating disorders like Anorexia nervosa and Bullemia. Diabetes mellitus Cardiovascular disorders and atherosclerosis. Irritable bowel syndrome- biochemistry behind the disorder and the influences of diet.

UNIT III- Multifactorial complex disorders and cancer. **06 Hours**

Cancer-characteristics of a transformed cell , causes and stage of cancer, molecular basic for neoplastic growth and metastatis. Proto-oncogenes and Tumour suppressor genes. Molecular approaches to cancer treatment.

UNIT IV -Diseases due to misfolded proteins **06 Hours**

Introduction to protein folding and proteosomes. Removal of misfolded proteins; etiology and molecular basic for Alzheimers, Sickle cell anemia, Thalassemia.

UNIT V -Monogenic diseases **06 Hours**

In born errors in metabolism: PKU, Alkaptonuria, Maple syrup urine disease; Receptor and transport defects: Cystic fibrosis, familial hypercholesterolemia, Achondroplasia.

Hemoglobinopathies and clotting disorders.

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.

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
3. A.C. Guyton & J.E.Hall, (2006). **Text Book of Medical Physiology** 11th Edition Harcourt Asia.
4. Thomas M.Devlin,(2010). **Text book of biochemistry with clinical correlations** 7th Edition John Wiley & Sons
5. **Praful B. Godkar, Darshan P. Godkar(2014)** Textbook of Medical Laboratory Technology: Clinical Laboratory Science and Molecular Diagnosis 3rd Edition, **Bhalani Publishing House.**

WEB REFERENCE

1. www.medicinenet.com > ... > diabetes az list > diabetes mellitus index
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, Seminar, Models

YEAR III – SEMESTER V**HUMAN PHYSIOLOGY**

Paper	: CORE V	Total Hours	60
Hours/Week	: 5	Exam Hours	03
Credit	: 5	Internal	25
Paper Code	: 17U5BCC05	External	75

Aim:

Human physiology deal with the understanding of biological, physiological activities along with the mechanism of action of various organs and its anatomy.

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.

Outcomes:

Students can be able to learn about the anatomy, biological, physiological activities along with the mechanism of action of various organs and various alimentary parts of human body.

Unit I**12 Hours**

Digestive System: Secretions of digestive tract, digestion, absorption, assimilation of carbohydrates, proteins, fats.

Unit II**12 Hours**

Blood Composition and function: Red blood cells, Hemoglobin, white blood cells and platelets. Blood composition and function. Tidal volume, Vital Capacity, ERV, IRV.

Respiratory System: Transport and exchange of gases between lungs and tissues, Mechanism of blood coagulation.

Unit III**12 Hour**

Cardiac system: Types, functions and physiology of muscle contraction, physiology of cardiac muscle, cardiac cycle and its regulation, ECG and blood pressure.

Unit IV**12 Hour**

Urogenetal System : Structure and functions of kidney, Nephron, Mechanism of urine formation, outline of structure and function of the male and female reproductive organs, spermatogenesis, menstrual cycle, physiology of pregnancy, parturition and lactation.

Unit V**12 Hour**

Nervous System: Classification of nervous system, characteristics of sympathetic and parasympathetic function. Structure of neuron, action potential, Propagation of nerve impulses, Structure of synapse, synaptic transmission.

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*, 24thedition(1996).
4. **Barbara A. Gyls Mary Elen Wedding**, *Medical Terminology Systems*, Davis plus International. 6th edition. 2008.

YEAR III – SEMESTER V
MOLECULAR BIOLOGY

Paper	: CORE VI	Total Hours	60
Hours/Week	:5	Exam Hours	03
Credit	: 5	Internal	25
Paper Code	: 17U5BCC06	External	75

SUBJECT DESCRIPTION : This course presents the basis of gene cloning, vectors, genetic engineering techniques and large scale production of biochemicals by fermentation technology.

GOALS:To enable the students to have a sound knowledge on cloning methods, techniques and applications of genetic engineering and fermentation technology.

OBJECTIVES: On successful completion of the course the student should have

- Understood the basics, vectors, methods of gene cloning.
- Techniques and application of gene technology
- Bioprocess technology – fermentation methods and production of important compounds by using fermentation technology.

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, tryp operon and arab operon, Recombination - Homologous and site specific 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. Ajay Paul,(2009). **Text book of Cell and Molecular Biology**2nd Edition, Books and Allied (P) Ltd, Kolkata.
2. **Asokan.P.,***Molecular biology*, Chinna Publications, Vellore, 1nd edition,2007.

REFERENCE BOOKS

1. **David Freifelder.**, *Molecuilar Biology.*, Jones and Bartlett Publishers, Narosa Publishing House., New Delhi, 2nd edition, Reprint, 1993.
2. **Gardner.E.J., Simmons.M.J and Snustad.P.D.,***Principles of Genetics.*, John Wiley & Sons, New York, 8st edi, 1991.
3. **Lehninger .A.L., Nelson.D.L and Cox .M.M.,** *Principles of biochemistry*, Macmillan Worth Publishers, NewYotk,3rd edi.,2003
4. **Rastogi.S.C.** *Molecular Biology*, India Binding House, U.P., 1st edi. 2006.
5. Weaver,F.,Robert,Hedrick.W.,Philip.,**Genetics,W.C Brown Publishers**, 3rd ed,1997.
6. Lewins genes XI by Jolcelyn E.Krebs,Elliotts.Goldstein,Stephen T.Killpatrick.1st Indian edition 2014.(Jones and Bartlett student edition),Published by Jones and barlett publisher,LLC,Newdelhi.

YEAR III – SEMESTER V**DRUG BIOCHEMISTRY**

Paper	: ELECTIVE I	Total Hours	60
Hours/Week	:4	Exam Hours	03
Credit	: 3	Internal	25
Paper Code	: 17U5BCE01	External	75

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

GOALS: Course provides for the specific needs and interests of students wishing to obtain experience in a modern research program

OBJECTIVES: On successful completion of the course the students should have:

- To understand the development of the traditional and modern methods used for drug discovery; of how molecules interact.
- To learn the fact that the pharmaceutical industry is by far the largest employer of medicine
- To learn and developed 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

Unit I**12Hours**

Introduction: Definitions, 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:** 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: Biochemical mode of action of antibiotics- penicillin and chloramphenicol. Action of alkaloids, antiviral and antimalarial substances. Biochemical mechanism of drug resistance.

Unit V**12Hours**

Drugs of plant origin: 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** 4th Edition Waverks Pvt. Ltd. New Delhi
2. R.S.Satoskar.,S.D.Bhandhakar.,Nirmala.N.Rege(2015)**Pharmacologyand pharmacotherapeutics.**
3. Katzung **Clinical Pharmacology** Basic and 7th Edition Printice Hall, New Delhi
4. Goodman And Gillman **The Pharmacology** Vol I and II- Mc Graw Hill
5. 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. Davies, s, **Molecular Basis of Inherited Diseases** Read, IRL Press
4. Rang, Tale **Pharmacology** 3rd Edition
5. Goodman And Gillman, **The Pharmacology** Vol I and II, Mc Graw Hill
6. Elsevier- **READ ELSEVIER.**,India pvt ltd.

YEAR III – SEMESTER V**NUTRITIONAL BIOCHEMISTRY**

Paper	: ELECTIVE II	Total Hours	60
Hours/Week	:5	Exam Hours	03
Credit	: 3	Internal	25
Paper Code	: 17U5BCE02	External	75

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

GOALS: Course provides the specific needs and interests of students wishing to have sound knowledge in Nutritional Biochemistry

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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.

UNIT – I**12 Hours**

Introduction, Calorific value of foods. Measurement of energy expenditure, respiratory quotients of foodstuffs, specific dynamic action. BMR, Measurement of BMR and factors influencing BMR. The daily energy requirement, importance of energy for various activities.

UNIT – II**12 Hours**

Dietary requirements, recommended dietary allowances for infants, children and adolescent, pregnant and lactating women. Role of dietary fat, fiber, antioxidants. Proteins: Protein content of diets of people in different parts of India.

UNIT – III**12 Hours**

Protein factor in nutrition- Quality of protein and Quantitative aspects. Essential amino acids, Biological value of proteins and nitrogen balance. Protein calorific malnutrition – Aetiology, management of marasmus and kwashiorkor.

UNIT – IV**12 Hours**

Minerals - Nutritional significance of dietary macro minerals (Ca, P, Mg, S, K, Na, Cl) and trace minerals. (Iron, Iodine, Zinc and copper) Disorders related to the deficiency of minerals.

UNIT- V**12 Hours**

Nutrition and body defenses: Effect of drugs on food and nutrients, drug - nutrient interaction nutritionaltherapy, food preparation and management. Role of diet and nutrition in the prevention and treatment of disease.

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. Nutrition: Everyday Choices, 1st Edition; Mary B. Grosvenor, Lori A. Smolin Wiley (2006).
4. Nutrition and Metabolism, 2nd Edn., Lanham S, Mac Donald I and Roche H. The Nutrition Society, London, UK, (2012).

REFERENCE BOOKS

1. Biochemistry Ed. Donald Voet & Judith G. Voet, John Wiley & Sons, Inc.(2010).
2. Lehninger- Principles of Biochemistry; D.L.Nelson and M.M. Cox, 6th Edn. MacMillan Publications (2012).
3. Biochemistry Ed. Donald Voet & Judith G. Voet, John Wiley & Sons, Inc.(2010).
4. Introduction to Human Nutrition, 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK, (2012).
5. Public Health Nutrition. Gibney M, Margetts B, Kearney J and Arab L. The Nutrition Society, London, UK, (2012).

YEAR III – SEMESTER V
GENETIC ENGINEERING

Paper	: SEBC III	Total Hours	30
Hours/Week	: 2	Exam Hours	03
Credit	: 2	Internal	25
Paper Code	: 17U5BCS03	External	75

Objective: On successful completion of the course the student should have understood the basics, vectors, methods of gene cloning. Techniques and application of gene technology.

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, *in situ* hybridization, 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. Balasubramaniam, D., Bryce. C. F. A., Dharmalingam. K., Green. J., Kunthala Jayaraman, *Concepts in Biotechnology*, COSTED -IBN University press, Hyderabad, 1st edi., 1996.
2. Kumaresan. V., *Biotechnology*, Saras Publication, Kanyakumari, Revised edition, 2005.
3. Sathyanarayana, U. *Text book of Biotechnology*, Books and Allied Ltd, Kolkatta, 2nd edi., 1999.
4. T.A. Brown & genomes (2018) published by Garland science, Taylor & Francis Group, LLC, an informa business, New York.

REFERENCE BOOKS

1. **Robert J. Brooker (2012)** Genetic analysis and principles. 4th edition published by MC GRAW Hill education (India) pvt ltd, New Delhi.
2. **Brown, T.A.** *Gene cloning - An introduction*, Chapman and Hall, 3rd ed, 1995.
3. **Glazier. N., Alexander, Hiroshnikaido,** *Microbial biotechnology*, W.H. Freeman & co., New York, 1st edi., 1995.
4. **Glick. R, Bernard and Pasternak J. Jack,** *Molecular Biotechnology*, Asm press, Washington D .C. 1st edi., 1994.

YEAR III – SEMESTER V**HEALTH AND HYGIENE**

Paper	: NMEC I	Total Hours	30
Hours/Week	: 2	Exam Hours	03
Credit	: 2	Internal	25
Paper Code	: 17U5BCN01	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

UNIT I**6 Hrs**

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.

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

Paper	: NMEC II	Total Hours	30
Hours/Week	: 2	Exam Hours	03
Credit	: 2	Internal	25
Paper Code	: 17U5BCN02	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.

GOALS The students will have the knowledge about the basic functions in clinical lab test and their interpretations.

OBJECTIVES

After the completion of this course the student would have understood

- The aim and objective of various clinical laboratory test
- The significance of various test and interpretation in diseased conditions.

UNIT – I**06 Hours**

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

UNIT – II**06 Hours**

Hematology: Composition and functions of blood, Haemoglobin, PCV, ESR, RBC count, WBC count, Platelet count, Differential count, ESR and PCV.

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.
3. Sabitri Sanyal, Clinical pathology, B.I.Churchill Livingstone(P)Ltd, New Delhi.2000.

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.

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	: 17U5BCCP05	External	60

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.

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

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	: 17U5BCCP06	External	60

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

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

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	: 17U6BCC07	External	: 75

OBJECTIVES: On successful completion of the course the students will be able to:

- understood the overview of immune system in our body.
- learnt the antigen and antibody reactions and immunotechniques.
- Learn how much immune system health and disease.

UNIT-I **12 Hours**

Introduction to Immunology: Immunity, types, mechanism of immunity, immune response, types, cells involved in immune response. Primary and secondary lymphoid organs. Structure and function of T, B and NK cells.

UNIT-II **12 Hours**

Antigens And Antibody: Properties, Specificity, Immunogenicity, antigenic determinants, haptens, adjuvants. Properties, Structure, Classes and Subclasses of Immunoglobins, Monoclonal antibodies - Production and applications. Complement component. Cytokines and their junctions.

UNIT-III **12 Hours**

Antigen Antibody interactions: Agglutination, Precipitation, Complement fixation, and Neutralization, Opsonization. Immunofluorescence, ELISA and RIA. Immuno electrophoresis and electro immuno diffusion.

UNIT-IV **12 Hours**

Hypersensitivity & Autoimmunity: Hypersensitivity I, II, III, IV, Autoimmunity: organ specific, systemic type, treatment – Immunologic tolerance.

UNIT-V **12 Hours**

Transplantation Immunology: MHC, HLA- mechanism of graft acceptance and rejection, immune suppressors, Immune deficiency disorders, Primary and secondary disorders, Vaccines: live vaccines, inactive vaccines, DNA vaccines, Benefits and adverse effects of vaccination.

TEXT BOOKS

1. **Dulsy Fatima, Arumugam, N.,** *Immunology*, Saras Publication, Nagercoil, revised edi. 1996.
2. **Tizard I.R.,** *Immunology - An Introduction*, Thomson, USA, 4th edi, 1995.
3. **Ananthanarayanan, R. and Jayaraman panikar,** *Text book of microbiology*, 1996.

4. **Roitt Ivann**, *Essential immunology*, Black well Scientific Publication, 8th edi. 1994.

REFERENCE BOOKS

1. **Janis Kuby et al.**, *Immunology*, W.H.Freeman and Company, New York, 5th edi. 2003.

2. **Roitt Ivann, Jonathan Brostoff, David male**, *Immunology*, Mosby Publication, London, 6th edi. 2001.

YEAR III – SEMESTER VI

CLINICAL BIOCHEMISTRY

Paper	CORE VIII	Total Hours	60
Hours/Week	:4	Exam Hours	03
Credit	: 3	Internal	25
Paper Code	: 17U6BCC08	External	75

Objective:

This course would have made the students understand the significance of diagnostic bio chemistry.

UNIT I**12 Hours**

Disorders in carbohydrate metabolism: Introduction, blood glucose regulation, hypo and hyperglycaemia, renal threshold value. GTT, 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 phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia, clinical significance of non – protein nitrogen – urea, uric acid and creatinine. Metabolism of bilirubin, types of jaundice and thier 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 nucleic acid metabolism: Gout, types,aetiology and clinical features.

UNIT IV**12 Hours**

Organ function tests:Liver function test- Detoxification and its interpretation. Renal function test: Urea clearance and its interpretation. 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. Clinical significance of SGOT, SGPT, ALP and ACP.

TEXT BOOKS

- 1.N.W.Teitz, (1994)., *Textbook of ClinicalChemistry 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. Marshall and Stephen K. Bangert, (1995). **Clinical Biochemistry – Metabolic and clinical aspects**, Pearson Professional Ltd

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	: 17U6BCE03	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

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.

YEAR III – SEMESTER VI**CELL BIOLOGY**

Paper	: ELECTIVE IV	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 17U6BCE04	External	: 75

OBJECTIVES:

The objective of the course is to understand the relationship between cellular organization and biological function of normal cell, prokaryotic and eukaryotic cells. To learn about various cell organelles with their functions and actions. To learn about the application of cellular biology in research.

UNIT I **12 Hours**

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

UNIT II **12 Hours****Cell Organelles:**

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

UNIT III **12 Hours****Chromosome Organization:**

Structure of chromatin, types of euchromatin and heterochromatin, structure of chromosome, special types of chromosome.

UNIT IV **12 Hours****Cell Cycle :**

Stages of cell cycle, cell division - various stages and significance of mitosis and meiosis, difference between mitosis and meiosis.

UNIT V **12 Hours****Extracellular matrix (ECM), Cell – ECM and 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.

YEAR III – SEMESTER VI

BIOCHEMISTRY IN DIAGNOSTIC MEDICINE

Paper	SBEC IV	Total Hours	: 30
Hours/Week	: 2	Exam Hours	: 03
Credit	: 2	Internal	: 25
Paper Code	: 17U6BCS04	External	: 75

OBJECTIVES

After the completion of this course the student would have understood

- The aim and objective of various clinical laboratory test
- The significance of various test and interpretation in diseased conditions.

Unit I

06 Hours

Laboratory Care and Instrumentation: Code of conduct for laboratory personnel - safety measures in the laboratory-chemical/Reagents, labeling, storage and usage. First Aid in laboratory accidents - Precautions and first aid equipments. Reporting laboratory tests and keeping records. General approach to quality control, Internal and External quality control.

Unit II

06 Hours

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

Unit III

06Hours

Clinical Hematology: Collection of blood - Anticoagulant, preservation, Estimation of Glycosylated haemoglobin, PCV, WBC, RBC, Platelets, ESR. Clotting time, bleeding time - normal value and clinical interpretation.

Unit IV

06 Hours

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

Stool Examination: Specimen collection- inspection of faeces- odour, pH, Interfering substance. Test for occult blood, faecal fat, microscopic examination of stool specimen.

Unit V

06 Hours

Body fluids: Cerebrospinal fluid Composition and Analysis. Semen analysis, sputum examination, pregnancy test - Interpretation.

Endocrine function test: Laboratory methods of evaluation of endocrine disorder- Thyroid function test, Clinical disorder- diagnosis of T₄, I¹³¹ uptake, TSH Stimulation test.

TEXTBOOKS

1. Ramnik Sood **Laboratory practices in CMC procedure**, Clinical CMC, Vellore.
2. Kanai L.Mukherjee, **Medical Laboratory Technology** Vol. I.Tata McGrawHill 1996,New Delhi.
3. Judith Ann Lewis, **Illustrated guide to diagnostic tests**-students version,Springhouse Corporation, Pennsylvenia, 1994.
4. M.N. Chatterjee and Rane Sinde **Text book of medical Biochemistry**

REFERENCE

1. L. Mukherjee **Medical Laboratory Technology** -Vol. I, II, III. Tata Mcgraw - Hill Publishing Company Limited
2. Harold Varley, **Practical Clinical Biochemistry**, 4th Edition, CBS Publication and Distributors, New Delhi.

YEAR III – SEMESTER VI**HEALTH AND FITNESS**

Paper	NMEC III	Total Hours	30
Hours/Week	: 4	Exam Hours	03
Credit	: 3	Internal	25
Paper Code	:17U6BCN03	External	75

OBJECTIVES: On successful completion of the course the students will acquire knowledge about

- The concepts of health and disease.
- Ayurvedic view of nutrition
- Nutrition and Health.
- Maternal and child health care.

UNIT I **6 Hrs**

Improving health of the individual: Balanced diet and Ayurvedic view of nutrition. Physical fitness: Exercise, Aerobics and *yoga*. Stress management- Sleep and relaxation.

UNIT – II **6 Hrs**

Nutrition and Health – Definition of Food and Nutrition. Nutrients – Sources and functions of Proteins, fats, carbohydrates, vitamins and minerals.

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**

Environment and Health – Basic health requirements in the environment. Water – Sources and uses of water. Water pollution and its related diseases. Purification of water. Air – Composition. Air pollution – Sources and need for proper ventilation.

UNIT – IV **6 Hrs**

Maternal and child Health-Mother and child-Intra natal and Post natal care. Complications of post partum 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 – V **6 Hrs**

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

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.
4. **Patil. R.S.**, *Practical Community Health*, Vora medical publishers, New Delhi, 1st edi 1995.

REFERENCE BOOKS

1. **Prabhakara. G. N.**, *Preventive and social medicine*, Jaypee Publications., New Delhi, 1st edi, 2003.
2. **Sridhar Rao. B.**, *Community Health Nursing*, A.I.T.B.S. Publishers, New Delhi, 1st edi 2006, Revised reprint 2009.

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	: 17U6BCCP07	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	: 17U6BCCP08	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.

REFERENCES

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.

**YEAR III – SEMESTER V
HUMAN PHYSIOLOGY**

Paper : CORE V	Total Hours : 60
Hours/Week : 5	Exam Hours : 03
Credit : 5	Internal : 25
Paper Code : 18U5BCC05	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 parasympathetic 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. Gyls Mary Elen Wedding, *Medical Terminology Systems*, Davis plus International. 6th edition. 2008.

WEB REFERENCES

1. <https://nptel.ac.in/courses/127/106/127106001/> 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
 Hours/Week : 5
 Credit : 5
 Paper Code : 18U5BCC06

Total Hours : 60
 Exam Hours : 03
 Internal : 25
 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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1. <https://microbenotes.com/prokaryotic-dna-replication-enzymes-steps-and-significance/>
2. <https://microbenotes.com/rna-splicing/>
3. <https://www.sparknotes.com/biology/molecular/translation/section3/>
4. <https://www.khanacademy.org/science/biology/gene-regulation/gene-regulation-in-bacteria/a/the-trp-operon>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5474181/>

YEAR III – SEMESTER V

DRUG BIOCHEMISTRY

Paper	: ELECTIVE I	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U5BCE01	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** 4th Edition 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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1. <https://www.msdmanuals.com/professional/clinical-pharmacology/adverse-drug-reactions/adverse-drug-reactions>
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	: 18U5BCE02	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 aminoacids, 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.

WEB REFERENCES

1. https://onlinecourses.swayam2.ac.in/nce20_sc01/preview
2. https://nptel.ac.in/content/syllabus_pdf/126104004.pdf
3. https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumptionbmi?qid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from_search=4
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	: 18U5BCS03	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 rember 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.

WEB REFERENCES

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

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	: 18U5BCCP05	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	: 18U5BCCP06	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	: 18U6BCC07	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 understand 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.,

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

2. David Male, Jonathan Brostoff, David Roth and Ivan Roitt.(2013). Immunology. 8th Edition. Elsevier Saunders. U.S., 2ndedi. 2010.

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

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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/>

QPCODE: 18U6BCC07

VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES COLLEGE FOR WOMEN
(Autonomous)

PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY

MODEL EXAMINATIONS –APRIL– 2020

Programme(s)	Title of the Paper	Semester
III-B.SC BIOCHEMISTRY	IMMUNOLOGY & IMMUNOTECHNIQUES	VI

Time: 3 Hrs.

Max. Marks : 75

Section A

Answer all questions (20 x 1 = 20)

1	Who is Father of immunology				CO1	K2
	A	Edward Jenner	B	Benjamin Jesty		
	C	Mary Wortley	D	Louis Pasteur		
2	The name of antibody was coined by				CO1	K2
	A	Von Bohring	B	Jules Bordet		
	C	Stewart Doughlass	D	Koch.		
3	Which of these is NOT a characteristic feature of adaptive immunity?				CO1	K2
	A	Immunogenic memory	B	Antigen non-specific		
	C	Self/ non-self-recognition	D	Diversity		
4	Humoral immunity is also called as				CO1	K2
	A	Antibody mediated immunity	B	Nonspecific immune response		
	C	Antigen mediated immunity	D	All of these		
5	B-cells differentiate to form				CO2	K2
	A	Plasma cell	B	Effector cells		
	C	Plasma cells & Memory B-cells	D	None of these		
6	CD4 T cells are generally restricted by				CO2	K2
	A	CD1 Cells		MHC CLASS II		
	C	MHC CLASS I		β 2 microglobulin		

7	T cells recognise antigen				CO2	K2
	A	In a 3 dimensional form	B	In solution in the plasma		
	C	When presented on the surface of antigen presenting cells	D	Following presentation by pattern recognition receptors		
8	Activation of naïve T lymphocytes is best achieved by which antigen presenting cell ?				CO2	K2
	A	Macrophages	B	Neutrophils		
	C	Mast cells	D	Dendritic cells		
9	Who discovered the structure of immunoglobulin by treating it with beta-mercaptoethanol?				CO3	K3
	A	Nisonoff	B	Porter		
	C	Edelman	D	Whittekar		
10	Weil-Felix reaction is based on sharing of antigens between				CO3	K3
	A	sheep RBCs and EB virus	B	mycoplasma and human O group RBCs		
	C	rickettsial antigens and antigens of certain strains of Proteus	D	none of these		
11	The reaction of soluble antigen with antibody is known as				CO3	K3
	A	Agglutination	B	Precipitation		
	C	Flocculation	D	Complement fixation		
12	How much of the reagent should be added to the suspension while preparing immunofluorescence staining?				CO3	K3
	A	20ml	B	2µl		
	C	20µl	D	A drop		
13	What is a major advantage of ELISA in comparison to other biological quantification techniques?				CO4	K4
	A	detection of a molecule at a low concentration	B	inexpensive		
	C	low specificity	D	easily available		
14	Pollen would most likely evoke which type of hypersensitivity response?				CO4	K4
	A	Immediate type (Type I)	B	Cell Mediated (Type IV)		
	C	Cytotoxic (Type II)	D	Immune complex (Type III)		
15	Rheumatoid arthritis is andisease that affects the.....				CO4	K4
	A	Autoimmune/ joints	B	Allergic/ cartilage		

	C	Autoimmune/nerves	D	Immunodeficiency/ muscles		
16	An example of a type III immune complex disease is:				CO4	K4
	A	Serum sickness	B	Atopy		
	C	Contact dermatitis	D	Graft rejection		
17	T helper cell mediated hypersensitivity is				CO5	K4
	A	Type IV hypersensitivity	B	Type II hypersensitivity		
	C	Type I hypersensitivity	D	Type III hypersensitivity		
18	Monoclonal antibodies are produced by				CO5	K4
	A	hybridomas.	B	lymphocytes.		
	C	myeloma cells.	D	plasma cells.		
19	Opsonization refers to				CO5	K4
	A	Adherence to mucosal epithelial cells.	B	Antibody mediated viral inactivation.		
	C	Coating of microorganisms or other particles by antibody and/or complement.	D	Parasitic lysosomal degranulation.		
20	Which of the following is used for typing when a patient is being prepared for an organ transplant?				CO5	K4
	A	MHC class I molecules	B	MHC class II molecules		
	C	MHC class III molecules	D	All the above		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Write short note on phagocytosis?			CO1	K2
		OR				
	B	Discuss about structure and function of T cell?			CO1	K2
22	A	Write short note on haptens?			CO2	K2
		OR				
	B	Discuss about structure and properties of immunoglobulin?			CO2	K2
23	A	Write short note on Opsanization?			CO3	K3
		OR				
	B	Discuss about structure and properties of RIA?			CO3	K3

24	A	Write a short note on cytokines and its functions.	CO4	K4
		OR		
	B	How cell mediated cytotoxicity executed?	CO4	K4
25	A	Write short note on Autoimmune disorders?	CO5	K4
		OR		
	B	Write benefits and adverse effects of vaccination?	CO5	K4
Section C Answer ANY THREE Questions (3 x 10 = 30)				
26		Explain about classification of immune response?	CO1	K2
27		Detailed account on classes and sub classes of immunoglobulins?	CO2	K2
28		Explain about electro immunodiffusion?	CO3	K3
29		Explain about T cell mediated cytotoxicity.	CO4	K4
30		Detailed account on Recombinant vaccine.	CO5	K4

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	7	0	0	0	0	7
II	0	7	0	0	0	0	7
III	0	0	7	0	0	0	7
IV	0	0	0	7	0	0	7
V	0	0	0	7	0	0	7
Total	0	14	7	14	0	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	24	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	0	24	0	0	0	24
IV	0	0	0	24	0	0	24
V	0	0	0	24	0	0	24
Total	0	28	14	28	0	0	120

YEAR III – SEMESTER VI
CLINICAL BIOCHEMISTRY

Paper	CORE VIII	Total Hours	: 60
Hours/Week	: 4	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18U6BCC08	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, Hypertriglyceridemia, 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. Marshall and Stephen K. Bangert, (1995). **Clinical Biochemistry** – Metabolic and clinical aspects, Pearson Professional Ltd

WEB REFERENCE

1. www.medicinenet.com › ... › *diabetes az list* › *diabetes mellitus index*
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

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	: 18U6BCE03	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., Stewler 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

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN
(AUTONOMOUS)
MODEL QUESTION PAPER B.Sc. BIOCHEMISTRY
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	: 18U6BCE03	External	: 75

Section A **Answer all Questions**

1	Hormones				CO1	K2
	A	Act as coenzyme	B	Act as enzyme		
	C	Influence synthesis of enzymes	D	Belong to B-complex group.		
2	Hormone that binds to intracellular receptor is				CO1	K2
	A	Adreno corticotropic hormone	B	Thyroxine		
	C	Follicle stimulating hormone	D	Glucagon		
3	A hormone secreted from anterior pituitary is				CO1	K2
	A	Growth hormone	B	Vasopressin		
	C	Oxytocin	D	Epinephrine		
4	Acromegaly results due to excessive release of				CO1	K2
	A	Thyroxine	B	Growth hormone		
	C	Insulin	D	Glucagon		
5	The normal serum level of thyroxine (T4) is				CO2	K2
	A	2.0–4.0 µg/100 ml	B	5.5–13.5 µg/100 ml		
	C	14.0–20.3 µg/100 ml	D	20.0–25.0 µg/100 ml		
6	Excess secretion of thyroid hormones causes				CO2	K2
	A	Hyperthyroidism	B	Myxoedema		
	C	Cretinism	D	Cushing syndrome		
7	Insufficient free T3 and T4 results in				CO2	K2
	A	Grave's disease	B	Myxedema		
	C	Cushing syndrome	D	Gigantism		
8	Calcitonin causes				CO2	K2
	A	Calcinuria and phosphaturia	B	Decrease in urinary calcium		

	C	Decrease in urinary phosphorous	D	Increase in blood calcium level		
9	β- islet of langerhans of the pancreas secrete				CO3	K1
	A	Insulin	B	Glucagon		
	C	Somatostatin	D	Pancreatic Polypeptide		
10	Deficiency of insulin results in				CO3	K2
	A	Rapid uptake of sugar	B	Low blood glucose level		
	C	Decrease urine output	D	Presence of glucose in urine		
11	The α-cells of pancreas produce				CO3	K1
	A	Insulin	B	Glucagon		
	C	Somatostatin	D	Pancreatic Polypeptide		
12	Serum progesterone level during pregnancy is				CO3	K2
	A	<12ng/ml	B	>12ng/ml		
	C	<20ng/ml	D	>24ng/ml		
13	Androgens are produced by				CO4	K1
	A	Cells of sertoli	B	Leydig cells		
	C	Rete testis	D	Efferent ductules		
14	The leyding cell activity is controlled by				CO4	K2
	A	Interstitial cell stimulating hormone	B	Adernocortex stimulating hormone		
	C	Thyroid stimulating hormone	D	Melanocyte stimulating hormone		
15	The production of progesterone by corpus				CO4	K2
	A	LH	B	TSH		
	C	ACTH	D	MSH		
16	The precursor of testosterone is				CO4	K1
	A	Aldosterone	B	Methyl testosterone		
	C	Estrone	D	Pregnenolone		
17	The hormone present in urine durin pregnancy is				CO5	K2
	A	Anterior pituitary luteinizing hormone	B	Androgen		
	C	Progesterone	D	Choroinic gonadotropin		
18	The number of amino acids in the peptidehormone calcitonin is				CO5	K1

	A	16	B	24		
	C	32	D	40		
19	The enzyme catalyzing conversion of androstenedione to testosterone is a				CO5	K1
	A	Oxygenase	B	Dehydrogenase		
	C	Isomerase	D	Decarboxylase		
20	Stature is increased in				CO5	K2
	A	Gigantism	B	Acromegaly		
	C	Simmond's disease	D	Cushing's disease		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Explain the hypothalamic hormones			CO1	K3
		OR				
	B	Classification of hormones			CO1	K3
22	A	Write about secretion and functions of thyroid hormones			CO2	K3
		OR				
	B	Structure and functions of para thyroid gland			CO2	K3
23	A	Explain the functions of pancreatic hormones			CO3	K3
		OR				
	B	Discuss the secretion and release of GI hormones			CO3	K3
24	A	Functions of adrenal medullary hormones			CO4	K3
		OR				
	B	Functions of adrenal cortex			CO4	K3
25	A	Functions of progesterones			CO5	K3
		OR				
	B	Explain the chemical nature of testes and ovaries			CO5	K3
Section C						
Answer ANY THREE Questions (3 x 10 = 30)						
26		Explain the role of secondary messengers in hormonal action			CO1	K4
27		Write in detail about parathyroid hormones			CO2	K4
28		Explain secretin and cholecystokinin			CO3	K4

29	Explain the hormones of adrenal glands	CO4	K4
30	Write about testes and ovaries	CO5	K4

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	4	2	1	0	0	07
II	0	4	2	1	0	0	07
III	2	2	2	1	0	0	07
IV	2	2	2	1	0	0	07
V	2	2	2	0	0	0	06
Total	4	14	10	4	0	0	34

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	4	10	10	0	0	24
II	0	4	10	10	0	0	24
III	2	2	10	10	0	0	24
IV	2	2	10	10	0	0	24
V	2	2	10	10	0	0	24
Total	6	14	50	50	0	0	120

YEAR III – SEMESTER VI

CELL BIOLOGY

Paper : **ELECTIVE IV**
Hours/Week : 4
Credit : 3
Paper Code : **18U6BCE04**

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	: 18U6BCS04	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 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.
3. Sabitri Sanyal, Clinical pathology, B.I.Churchill Livingstone(P)Ltd, New Delhi.2000.
3. Tietz Fundamentals of Clinical Chemistry- (5th edition) C.A. Burtis, E.R. Ashwood (eds) Saunders WB Co.

REFERENCE BOOK

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

WEB OF REFERENCE

- 1.<https://onlinelibrary.wiley.com/doi/abs/10.1002/0470869526.ch3>
- 2.<http://fbt.cz/en/skripta/v-krev-a-organy-imunitniho-systemu/1-slozeni-krve/>

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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

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	: 18U6BCCP07	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 Mannual 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	: 18U6BCCP08	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.

REFERENCES

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.

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

PART – A (20 X 1=20 marks)

Multiple Choice Questions

PART – B (5 X 5 = 25 marks)

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

PART – C (3 X 10 = 30 marks)

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

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	: 17U6BCCP07	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 Mannual 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.

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

PART – A (20 X 1=20 marks)
Multiple Choice Questions

PART – B (5 X 5 = 25 marks)
1. Either or Type
2. From each unit two questions

PART – C (3 X 10 = 30 marks)
1. Any three out of five (open choice)
2. From each unit one question

(For the candidates admitted from 2018 Onwards)
VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)
HUMAN PHYSIOLOGY
III B.Sc., (BIOCHEMISTRY)-V Semester

Time: 3 Hrs

Maximum marks:75
(20X1=20)

Answer all questions

PART A

1	Which of these can cause heartburn?		CO1	K2
	A	Being overweight	B	Lying down soon after eating a large meal
	C	Eating high-fat foods	D	All of the above
2	What is the enzyme that breaks down lactose?		CO2	K2
	A	Lipase enzymes	B	Pepsin
	C	Lactase	D	Amylase
3	Which of these best maintains intestinal health?		CO3	K1
	A	Vitamins	B	Fiber
	C	Starches	D	Fat
4	Which is the readily available source of energy in the body?		CO2	K1
	A	Protein	B	Vitamins
	C	Carbohydrates	D	Lipids
5	How is Na ⁺ reabsorbed?		CO2	K2
	A	By diffusion	B	By active transport using ATP
	C	By facilitated diffusion	D	By receptor-mediated endocytosis
6	Which substance would NOT normally be expected in urine?		CO2	K2
	A	Chloride	B	Sodium
	C	Protein	D	Nitrogenous waste
7	Which of the following controls the normal breathing process?		CO1	K2
	A	Amino acids	B	Ventral respiratory group
	C	Cholesterol	D	Dorsal respiratory group
8	How many oxygen molecules bound to hemoglobin to give 50% saturation?		CO1	K1
	A	6	B	7
	C	2	D	4
9	Which of the following is NOT the function of the respiratory system?		CO1	K1
	A	Regulate blood pH	B	Protection against blood loss
	C	Helps in gaseous exchange	D	Contains receptors for the sense of smell

10	Which of the following is NOT associated with primary nocturnal enuresis?			K3
	A	Females over the age of 60 years	B	Inadequate nocturnal ADH production
	C	A small bladder capacity	D	Unusually sound sleep
11	Which of the following does NOT occur during skeletal muscle contraction?		CO3	K3
	A	Calcium binds to myosin heads	B	Myosin heads bind to actin
	C	Calcium concentration in the sarcoplasm increases	D	ATP is hydrolyzed
12	Which of the following substances is the standard substance used to measure the GFR?		CO3	K3
	A	Inulin	B	Glucose
	C	Urea	D	Creatinine
13	Which of the following statements about smooth muscle is true?		CO3	K3
	A	Fibers are small and spindle-shaped.	B	Smooth muscle is striated and involuntary.
	C	It has branching fibers	D	Nuclei are peripherally located in the fibers
14	Where the heart is specifically located?		CO4	K4
	A	Thoracic cavity	B	Pleural cavity
	C	Mediastinum	D	Ventral cavity
15	Which fiber system is the first to depolarize in a cardiac cycle?		CO4	K2
	A	Atrioventricular node	B	Purkinje fibers
	C	Sinoatrial node	D	Bundle of His
16	What is a common neurotransmitter?		CO4	K5
	A	Acetylcholine	B	All of the above
	C	GABA	D	Serotonin
17	How do neurons communicate with one another?		CO4	K2
	A	Electrically	B	Chemically
	C	A and B	D	Through weak, radio-wave-like impulses
18	Which of the following is a genetic disease that causes neurons in the brain to waste away and die?		CO4	K1
	A	Multiple sclerosis	B	Encephalitis
	C	Polio	D	Huntington's disease
19	Which of the following statement is correct about Cerebellum?		CO5	K5
	A	It regulates the muscular movement for locomotion.	B	It is a part of brain.
	C	Both A and B	D	Neither A nor B
20	Which nerves are attached to the brain and emerge from the skull?		CO5	K2

	A	Cranial Nerves	B	Sacral Nerves		
	C	Spinal Nerves	D	Thoracic Nerves		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Write a detailed account on Gastrointestinal tract			O2	4
		OR				
	B	Write a detailed note on accessory organs			CO4	K3
22	A	Brief a note on structure and function of red blood cells			CO5	K4
		OR				
	B	Write a detailed account on structure and function of lung			CO2	K2
23	A	Brief a detailed account on heart and significance of electrocardiogram			CO4	K3
		OR				
	B	What is nephron? Brief a detailed note on kidney			CO2	K4
24	A	What is neuron? Give a detailed note on central nervous system			CO1	K6
		OR				
	B	What are neurotransmitters? Brief a detailed note on synaptic transmission			CO1	K5
25	A	Brief a detailed note on female reproductive organs			CO1	K2
		OR				
	B	Brief a detailed note on menstrual cycle			CO3	K4
Section C						
Answer ANY THREE Questions (3 x 10 = 30)						
26	A	What is a secretion? brief a detailed note on digestive system			CO1	K5
27	A	Brief a detailed note on blood composition and function			CO4	K3
28	A	Write a detailed note on cardiac cycle and its regulation			CO2	K4
29	A	What is synapse? Brief a detailed note on nerve impulses			CO4	K2
30	A	What is meant by pregnancy? Give briefly note on mechanism of urine formation			CO5	K1

Table of specifications – Unit wise - Knowledge level – Number of questions (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	7	0	0	0	0	7
II	0	7	0	0	0	0	7

III	0	0	7	0	0	0	7
IV	0	0	0	7	0	0	7
V	0	0	0	7	0	0	7
Total	0	14	7	14	0	0	35

Table of specifications - Marks wise - Knowledge level - (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	24	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	0	24	0	0	0	24
IV	0	0	0	24	0	0	24
V	0	0	0	24	0	0	24
Total	0	48	24	48	0	0	120

18U5BCC06

(For the candidates admitted from 2018 Onwards)

VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN

(AUTONOMOUS)

MOLECULAR BIOLOGY**III B.Sc., (BIOCHEMISTRY)-V Semester****Time: 3 Hrs****Maximum marks:75****Answer all questions****PART A****(20X1=20)**

1	Mode of DNA replication in E.Coli is		CO1	K2
	A	Conservative and unidirectional	B	semiconservative and unidirectional
	C	Conservative and bidirectional	D	semi conservative and bidirectional
2	In case of eukaryotes, the replication initiates at _____		CO1	K2
	A	TATA	B	C ^P G islets
	C	AUG	D	ARS
3	Which DNA polymerase removes RNA primers in DNA synthesis?		CO1	K2
	A	Polymerase I	B	Polymerase II
	C	Polymerase III	D	none of these
4	Telomeres are usually rich in which nucleotide?		CO1	K2
	A	Adenine	B	Guanine
	C	Thymine	D	Cytosine
5	In both eukaryotes and prokaryotes, a promoter region that is rich in AT bases is called as		CO2	K2
	A	CATT	B	Shine Dalgarno region
	C	TATA box	D	SV40 region
6	In eukaryotes, there are three different RNA polymerases. The RNA polymerase		CO2	K2
	A	RNA polymerase I	B	RNA polymerase II
	C	RNA polymerase III	D	none of these
7	Process in which introns are removed from messenger RNA precursor and exons are re-joined is referred to as		CO2	K2
	A	Splicing	B	capping
	C	polyadenylation	D	replication
8	The largest class of introns which are found in nuclear mRNA primary transcript is		CO2	K2
	A	Spliceosomal introns	B	Group I introns
	C	Group II introns	D	Group IV introns
9	During translation, the role of enzyme peptidyl transferease is		CO3	K3

	A	transfer of phosphate group	B	amino acid activation		
	C	peptide bond formation between adjacent amino acids	D	binding of ribosome subunits to mRNA		
10	In prokaryotes, the ribosomal binding site on mRNA is called			CO3	K3	
	A	Hogness-sequence	B	Shine-Dalgarno sequence		
	C	Pribnow-sequence	D	TATA box		
11	In prokaryotes, the termination codon UAA & UAG is recognized by			CO3	K3	
	A	RF3	B	RF2		
	C	RF1	D	eRF		
12	Which of the following is not a type of post translational modification?			CO3	K3	
	A	Proteolysis	B	Protein folding		
	C	Glycosylation	D	Lipid addition		
13	Which of the following acts as the inducer of lac operon is?			CO4	K4	
	A	Glucose	B	lactose		
	C	galactose	D	Allolactose		
14	The gene product of lacA gene in lac operon is			CO4	K4	
	A	β -galactoside permease	B	β -galactoside isomerase		
	C	β -galactosidase	D	β -galactoside		
15	The trp operon is a			CO4	K4	
	A	negatively inducible operon	B	Positively inducible operon		
	C	Positively repressible operon	D	negatively repressible operon		
16	Which of these Ara genes is a mode of feedback autoregulation?			CO4	K4	
	A	ara A	B	Ara B		
	C	Ara C	D	ara D		
17	In SOS repair system cleavage of LexA and UmuD is mediated by			CO5	K4	
	A	ecB	B	RecA		
	C	RecC	D	uvrA		
18	Which of the following mechanisms will remove uracil and incorporate the correct base?			CO5	K4	
	A	direct repair	B	Base excision repair		

	C	Mismatch repair	D	Nucleotide excision repair		
19		The DNA polymerase involved in base excision repair is			CO5	K4
	A	DNA polymerase α	B	DNA polymerase β		
	C	DNA polymerase σ	D	DNA polymerase γ		
20		The enzyme of E.coli is a nuclease that initiates the repair of double stranded DNA breaks by homologous recombination			CO5	K4
	A	DNA glycosylase	B	DNA ligase		
	C	DNA polymerase	D	RNA polymerase		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Explicate evidence for DNA as the genetic material by transformation experiment			CO1	K2
		OR				
	B	Write a note on semi conservative replication and experimental proof			CO1	K2
22	A	Write a note on inhibitors of transcription			CO2	K2
		OR				
	B	Explicate E.Coli RNA polymerase			CO2	K2
23	A	Describe the composition of prokaryotic and eukaryotic ribosomes			CO3	K3
		OR				
	B	Narrate inhibitors of translation			CO3	K3
24	A	Illustrate arabinose operon			CO4	K4
		OR				
	B	Explain about site specific recombination			CO4	K4
25	A	Give a short notes on base substitution mutation			CO5	K4
		OR				
	B	Explicate SOS repair			CO5	K4
Section C						
Answer ANY THREE Questions (3 x 10 = 30)						
26		Describe briefly about mechanism of prokaryotic replication			CO1	K2

27	Write a brief note on post transcriptional processing of pre-mRNA	CO2	K2
28	Describe briefly about the mechanism of translation in prokaryotes	CO3	K3
29	Explicate positive and negative regulation mechanism of lac operon	CO4	K4
30	Illustrate mismatch repair mechanism	CO5	K4

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	7	0	0	0	0	07
II	0	7	0	0	0	0	07
III	0	0	7	0	0	0	07
IV	0	0	0	7	0	0	07
V	0	0	0	7	0	0	07
Total	0	14	7	14	0	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	24	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	0	24	0	0	0	24
IV	0	0	0	24	0	0	24
V	0	0	0	24	0	0	24
Total	0	48	24	48	0	0	120

(For the candidates admitted from 2018 Onwards)
VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)

III B.Sc., BIOCHEMISTRY- DRUG BIOCHEMISTRY - V Semester

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A

(20X1=20)

1	Which one of the following is not a route of administration?		CO1	K1
	A	A macrolide	B	A cephalosporin
	C	A penicillin	D	A tetracycline
2	Which one of the following is not a route of administration?		CO1	K1
	A	Intravenous (IV)	B	Oral
	C	Topical	D	Dissolution
3	Which form of drug formulation has disintegration time?		CO1	K2
	A	Injections	B	Syrups
	C	Capsules and Tablets	D	Only tablets
4	Which of the following reactions is not a Phase I metabolic transformation?		CO1	K2
	A	Reduction of ketones	B	Ester hydrolysis
	C	Conjugation to alcohols	D	Oxidation of alkyl groups
5	Which of the following is one of the rules in Lipinski's rule of five?		CO1	K1
	A	A calculated logP value less than +5	B	A molecular weight equal to 500
	C	No more than 10 hydrogen bond donor groups	D	No more than five hydrogen bond acceptor groups
6	Which of the following is an important factor in substance abuse??		CO2	K1
	A	Whether the substances are regularly used by other family members	B	Whether you are a twin
	C	Whether the family environment is rural or urban	D	Whether you are born in the winter
7	Which of the following is NOT a characteristic of addiction??		CO2	K2
	A	Loss of control	B	Denial
	C	Habitual behavior	D	Negative consequences
8	Which of the following is the pharmacodynamics method of studying bioavailability?		CO2	K2
	A	Acute pharmacologic response	B	Urinary excretion studies
	C	Plasma-level time studies	D	Stool excretion studies
9	Which of the following drugs blocks opiate receptors?		CO2	K3
	A	Phenobarbitone	B	Naloxone

	C	Haloperidol	D	Chlordiazpoxide		
10	What are soft drugs?				CO2	K3
	A	Drugs given to babies	B	Nutrients which kill the gut harmful microbes		
	C	Chemical drugs which are already found in the body	D	Anything that is not nutrients and enters the body through different routes		
11	Which of the following are natural local anesthetics?				CO2	K3
	A	Cocaine	B	Benzyl alcohol		
	C	Benzocaine	D	Clove oil		
12	Who is discovered the first antibiotic?				CO2	K3
	A	Alexander Fleming	B	Francis Crick		
	C	Louis Pasteur	D	Kary Mullis		
13	Which type of route is used to administrate a drug just beneath the top layer of the skin?				CO4	K5
	A	Intradermal	B	Intravenous		
	C	Subcutaneous	D	Intramuscular		
14	Which one of the following is the principal organ for drug excretion?				CO4	K5
	A	Lungs	B	Sweat glands		
	C	Liver	D	Kidneys		
15	What is meant by ADME in pharmacokinetics?				CO4	K5
	A	Affinity, dosage, marketing, efficacy	B	Agonism, dependence, mobility, efficiency		
	C	Absorption, distribution, metabolism, excretion	D	Antagonism, deficiency, mean, efflux		
16	Which diffusion is depends on distribution of drugs into the Central Nervous System?				CO4	K5
	A	Aqueous diffusion	B	Lipid diffusion		
	C	Activetransport	D	Facilated transport		
17	Which of the following is an example of salicylates?				CO5	K4
	A	ASA	B	Ibuprofen		
	C	Phenylbutazone	D	Indomethacin		
18	What is the definition of pharmacology?				CO5	K4
	A	The study of formulation of drugs	B	The study of pharmacy		
	C	The study of farming techniques	D	The study of drugs including their actions and effect		

19	Which of these body systems causes allergic reactions??		CO5	K4
	A	Endocrine	B	Nervous
	C	Immune	D	Autonomic
20	Which of the following is classified as a stimulant?		CO5	K4
	A	Alcohol	B	LSD
	C	Marijuana	D	Methamphetamine
Section B				
Answer All questions (5 x 5 = 25)				
21	A	Write a detailed account on drug administration	O5	6
		OR		
	B	Write a detailed note on sources of drugs	CO4	K4
22	A	Brief a note on cancer treatments drugs	CO5	K6
		OR		
	B	Write a detailed account on immunosuppressive drugs	CO4	K6
23	A	Brief a detailed account on antimalarial drugs of action	CO2	K4
		OR		
	B	What is an antibiotic? Brief a detailed note on chloramphenicol	CO2	K5
24	A	What is pharmacodynamics? Give a detailed note on pharmacodynamics	CO5	K4
		OR		
	B	What is metabolism? Brief a detailed note on elimination of drugs	CO4	K5
25	A	Brief a detailed note on drug intolerance and abuses	CO4	K6
		OR		
	B	Brief a detailed note on allergy reaction of drugs	CO5	K6
Section C				
Answer ANY THREE Questions (3 x 10 = 30)				
26	A	What is a drug? brief a detailed note on classification of drugs	CO1	K5
27	A	Brief a detailed note on alkalioids and glycoside	CO3	K3
28	A	Write a detailed note on anti bacterial drugs of action	CO5	K6
29	A	What is BBB? Brief a detailed note on drug addiction	CO4	K2
30	A	What is meant by pharmacokinetics? Give briefly note on mechanism of biotransformation	CO2	K4

Table of specifications – Unit wise - Knowledge level – Number of questions (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	7	0	0	0	0	7
II	0	7	0	0	0	0	7
III	0	0	7	0	0	0	7
IV	0	0	0	7	0	0	7
V	0	0	0	7	0	0	7
Total	0	14	7	14	0	0	35

Table of specifications - Marks wise - Knowledge level - (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	24	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	0	24	0	0	0	24
IV	0	0	0	24	0	0	24
V	0	0	0	24	0	0	24
Total	0	48	24	48	0	0	120

18U5BCE02

(For the candidates admitted from 2018 Onwards)

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)**

III B.Sc., BIOCHEMISTRY-VI Semester- NUTRITIONAL BIOCHEMISTRY

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A

(5X2=10)

1	What does Basal metabolic rate measures?				Co1	K2
	A	how fast chemical reactions occur	B	number of enzymes required		
	C	the time lapse between eating and passing stool	D	number of active sites		
2	How Basal metabolic rate of a child should be when compared to than an old person?				Co1	K4
	A	higher	B	same		
	C	lower	D	all of these		
3	What is the value of carbohydrates per gram ?				Co1	K1
	A	17KJ/g	B	27KJ/g		
	C	77KJ/g	D	19KJ/g		
4	Which is the main suppliers for our body?				Co1	K1
	A	Protein	B	Carbohydrates		
	C	Fats	D	All the above		
5	Which of the following has the highest dynamic action(SDA)?				Co2	K1
	A	Egg	B	Mango		
	C	Potato	D	Corn Oil		
6	Which of the following is not a component of dietary fiber?				Co2	K1
	A	Cellulose	B	Agar		
	C	Pectin	D	Lignin		
7	What is the chemical score of gelatin?				Co2	K2
	A	0	B	60		
	C	44	D	42		
8	Which Vitamin in large amounts harms the bones?				Co2	K4
	A	A	B	C		
	C	B	D	D		
9	Which among the following is a non-essential amino acid?				Co3	K2
	A	Serine	B	Lysine		
	C	Threonine	D	Histidine		
10	Which of the following catalyzes reactions that incorporate nitrogen derived from				Co3	K3

	glutamine?				
	A	Glutamine amidotransferase	B	Adenyl transferase	
	C	Glutamine synthase	D	Glutamate synthase	
11	What is Marasmus?			Co3	K1
	A	a disease resulting from a lack of vitamin C	B	a form of severe malnutrition caused by the lack of nearly all nutrients	
	C	the state of being grossly fat or overweight.	D	a form of minor malnutrition caused by the lack of all nutrients	
12	Which of the following has not at one point in the past few decades been considered as a cause of the oedema of kwashiorkor?			Co3	K2
	A	Altered composition of intestinal bacteria	B	Low intake of antioxidant nutrients	
	C	Sudden weaning from the breast	D	Iron deficiency	
13	Which of the following mineral is involved in protein metabolism and oxidation reactions?			Co4	K1
	A	Molybdenum	B	Magnesium	
	C	Manganese	D	Calcium	
14	Which of the following is not a function of iron?			Co4	K1
	A	Oxygen transport	B	Brain function	
	C	Gene regulation	D	Immune function	
15	Which of the following is a mineral nutrient?			Co4	K2
	A	Carbon	B	Hydrogen	
	C	Nitrogen	D	Oxygen	
16	Which of the following is deficiency symptom of magnesium?			Co4	K2
	A	Chlorosis in young leaves	B	Elongated stem	
	C	Chlorosis in older leaves	D	Spindly and woody stem	
17	Which of the following is a factor that affects the storage stability of food?			Co5	K2
	A	Type of raw material used	B	Quality of raw material used	
	C	Method/effectiveness of packaging	D	All of the mentioned	
18	Which of the following sentence is true with respect to food storage/preservation?			Co5	K3
	A	Each food type has a potential storage life	B	The mechanical abuse that food has received during storage/distribution does not affects its storage stability	
	C	All of the mentioned	D	None of the mentioned	
19	Which of the following do health experts recommend you avoid together when taking medicine?			Co5	K2
	A	Green tea	B	Milk shake	

	C	Alcoholic beverage	D	None of the above		
20		When taking an ACE inhibitor, such as captopril, avoid excessive amounts of potassium, found in?			Co5	K2
	A	Banana	B	Kale		
	C	Orange	D	All the above		
Section B-Answer All questions (5 x 5 = 25)						
21	A	Define R.Q mention the significance of R.Q?			Co1	K1
		OR				
	B	Describe the importance of energy for various activities.			Co1	K1
22	A	Describe the calorific value of food.			Co2	K2
		OR				
	B	Write about the role of fibre and antioxidants			Co2	K3
23	A	Write about essential amino acids.			Co3	K2
		OR				
	B	Write about the biological value of protein and nitrogen balance.			Co3	K3
24	A	Write about disorders related to deficiency of minerals.			Co4	K4
		OR				
	B	Write about trace minerals.			Co4	K4
25	A	Write about effects of drugs on food and nutrients.			Co5	K4
		OR				
	B	Write about food preparation and management.			Co5	K3
Section C-Answer ANY THREE Questions (3 x 10 = 30)						
26		Define BMR. How it is determined? Describe the factors affecting the BMR. Mention the significance of BMR?			Co1	K1
27		Describe the daily energy requirement? Importance of energy for various activity?			Co2	K3
28		Write detailly about marasmus and kwashoirkar			Co3	K5
29		Write detailly about macro elements.			Co4	K2
30		Describe detailly about role of diet and nutrition in prevention and treatment of disease.			Co5	K1

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	5	1	0	1	0	0	7
II	3	1	2	1	0	0	7
III	1	3	2	0	1	0	7
IV	2	3	0	2	0	0	7
V	1	3	2	1	0	0	7
Total	12	11	6	5	1	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	22	1	0	1	0	0	24
II	2	6	15	1	0	0	24
III	2	6	6	0	10	0	24
IV	2	12	0	10	0	0	24
V	10	3	6	5	0	0	24
Total	38	28	27	17	10	0	120

YEAR III – SEMESTER V
CORE - BIOCHEMISTRY PRACTICAL – V

Paper	: Core Practical V	Total Hours	: 75
Hours/Week	:5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U5BCCP05	External	: 60

I. 1. Extraction of Pectin from orange peel (Or) 15 Marks

2. Estimation of total flavonoids

II. 1. Estimation of chlorophyll (Or) 15 Marks

2. Extraction of Caffeine from tea

Record 10

Spotters 20

YEAR III – SEMESTER V
CORE - BIOCHEMISTRY PRACTICAL – VI

Paper	: Core Practical VI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U5BCCP06	External	: 60

I. 1. Isolation of DNA from plant (Or) 15 Marks
2. Isolation of DNA from plant

II. 1. Restriction digestion of DNA (Or) 15
Marks

2. Isolation and separation of chromosomal DNA

Record 10
Spotters 20

18U5BCS03

(For the candidates admitted from 2018 Onwards)

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)**

III B.Sc., (BIOCHEMISTRY)-VI Semester- GENETIC ENGINEERING

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A**(20X1=20)**

1	The term endonuclease refers to cutting DNA sequence from		CO1	K1
	A	Only within the polynucleotide chain not at the ends	B	Anywhere in the chain
	C	The ends of the chain	D	Exactly in the middle of the chain
2	How restriction endonuclease protect its own DNA from cleaving and cleaving the foreign DNA alone?		CO1	K1
	A	By methylation of foreign DNA by restriction enzyme	B	By phosphorylation of foreign DNA by restriction enzyme
	C	By methylation of self DNA by restriction enzyme	D	By phosphorylation of foreign DNA by restriction enzyme
3	Choose the incorrect sentence about the Linkers		CO1	K1
	A	These are short chemically synthesized molecules that contain a particular restriction enzyme site within the sequence	B	They are ligated to staggered ended insert molecules by T4 DNA ligase
	C	They are blunt ended molecules	D	After treatment with enzyme, both the ends of the linker are staggered
4	. Molecules having new combination of sequences that were not present before are called		CO1	K1
	A	Intermolecular ligands	B	Couplers
	C	Recombinants	D	Intramolecular ligands
5	Which of the following characteristics is not present generally in a plasmid?		CO2	K2
	A	Multiple cloning site	B	Antibiotic resistance gene
	C	Origin of replication	D	Beta galactose gene
6	Which of the following statement is true about plasmid?		CO2	K2
	A	Bacterial plasmids are linear in nature	B	Insertion of DNA into plasmid allows it to be propagated in

			host cells and they are known as vectors		
	C	They are single stranded	D	They are not capable of replication in bacteria	
7	The difference between the cells that have taken up the vector and that have not is done by using			CO2	K2
	A	Multiple cloning site	B	High copy number	
	C	Origin of replication	D	Selectable marker	
8	What is used for lysing of bacterial cells and denaturing of DNA?			CO2	K2
	A	Exonuclease	B	Sodium hydroxide	
	C	Sulphuric acid	D	Heat	
9	Transformation efficiency is defined as			CO3	K2
	A	Ratio of transformed colonies by microgram of sample DNA that is to be inserted	B	Ratio of transformed colonies by microgram of plasmid DNA	
	C	Ratio of transformed colonies by amount of sample DNA that is to be inserted	D	Ratio of transformed colonies by amount of plasmid DNA	
10	Introduction of DNA molecules into the recipient organism is termed as			CO3	K2
	A	Transformation	B	Transduction	
	C	Translation	D	Transcription	
11	Which of the following statement hold true for conjugation?			CO3	K2
	A	It is the natural process of transferring DNA from one species to another	B	Plasmids are transferred from one cell to another by chemical means	
	C	It is the artificial process of transferring DNA from one species to another	D	All of the above	
12	The correct statement about F plasmid is			CO3	K2
	A	It encodes the factor which is transferred from one cell to another	B	It is transferred from one cell to another by filament	
	C	The factor encoded by F plasmid is called as filamentous factor	D	The bacteria must belong to same species to carry out the conjugation	
13	The process of amplification of specific DNA sequence by an enzymatic process is termed as			CO4	K3
	A	Amplification	B	Translation	
	C	Polymerase Chain Reaction	D	Microarrays	

14	What is the half life cycle of Taq polymerase?	CO4	K3
	A 80 minutes	B 40 minutes	
	C 60 minutes	D 10 minutes	
15	Which type of DNA cleavage is done in Maxam Gilbert method?	CO4	K3
	A Edge	B Base specific	
	C Interstitial	D Gene specific	
16	The samples in Sanger's method after reaction are separated using	CO4	K3
	A AGE	B PFGE	
	C PAGE	D 2D gel electrophoresis	
17	The first genetically engineered insulin was called	CO5	K4
	A Humalin	B R Insulin	
	C Inulin	D None of the above	
18	Insulin is made up of	CO5	K4
	A 2 polypeptide chains	B 4 polypeptide chains	
	C 3 polypeptide chains	D More than 4 polypeptide chains	
19	Gene therapy in humans was first practiced to cure	CO5	K4
	A Cystic fibrosis	B Thalassemia	
	C Hemophilia	D Severe Combined Immunodeficiency	
20	The common gene delivery system for invivo gene therapy is	CO5	K4
	A Micro injection	B Adeno viral vector	
	C Lipofection	D Electroporation	
Section B			
Answer All questions (5 x 5 = 25)			
21	A list out and write a note on the enzymes used in genetic engineering.	CO1	K1
	OR		
	B Write a short note on Linkers and Adaptors.	CO1	K1
22	A What are vectors ? Give its types.	CO2	K2
	OR		
	B Explain the T plasmid	CO2	K2

23	A	How will you perform transformation?	CO3	K2
		OR		
	B	Explain the conjugation of DNA.	CO3	K2
24	A	Explain Sanger's method of DNA sequencing.	CO4	K3
		OR		
	B	Write a short note on In situ hybridization.	CO4	K3
25	A	What is gene therapy? Give its applications.	CO5	K4
		OR		
	B	What is recombinant technology? Mention its applications.	CO5	K4
Section C				
Answer ANY THREE Questions (3 x 10 = 30)				
26		Explain the basic steps involved in Gene cloning.	CO1	K1
27		Describe Southern blotting technique.	CO2	K2
28		How to purify the Plasmid DNA?	CO3	K2
29		Explain PCR technique with principle, procedure and applications.	CO4	K3
30		How to produce insulin by r DNA technology?	CO5	K4

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	7	0	0	0	0	0	07
II	0	7	0	0	0	0	07
III	0	7	0	0	0	0	07
IV	0	0	7	0	0	0	07
V	0	0	0	7	0	0	07
Total	7	14	7	7	0	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	24	0	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	24	0	0	0	0	24
IV	0	0	24	0	0	0	24
V	0	0	0	24	0	0	24
Total	24	48	24	24	0	0	120

18U6BCC08

(For the candidates admitted from 2018 Onwards)

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)**

III B.Sc., (BIOCHEMISTRY)-VI Semester- CLINICAL BIOCHEMISTRY

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A**(20X1=20)**

1	The probability that a test result falls within the reference interval in the absence of disease is called the test		CO1	K1
	A	Efficiency	B	Negative predictive value
	C	Specificity	D	Sensitivity
2	Causes of a prolonged thrombin time include all of the following except		CO1	K1
	A	D.I.C.	B	Afibrinogenemia
	C	Decreased factor	D	Hypofibrinogenemia
3	Which of the following is not a cause of hyperuricemia?		CO1	K1
	A	Lesch-Nyhan syndrome	B	renal retention
	C	organic acidemia	D	defects in pyrimidine metabolism
4	Which of the following should not be included in the differential diagnosis of hypercalcemia?		CO1	K1
	A	vitamin D intoxication	B	vitamin D-dependent rickets
	C	excess absorption secondary to the "milk alkali syndrome"	D	primary hyperparathyroidism
5	Total RBC count for Women is?		CO2	K2
	A	4.4 -6	B	. 4.2-5
	C	4.0-5.0	D	4.2-5.2
6	What is the major metabolically available storage form of iron in the body?		CO2	K2
	A	Hemosiderin	B	Ferritin
	C	Transferrin	D	Hemoglobin
7	Type 1 diabetes is what percentage of all diabetes mellitus?		CO2	K2
	A	>20%	B	5-10%
	C	16-20%	D	11-15%
8	An important renal response to acidemia is		CO2	K2

	A	Increased potassium excretion	B	decreased excretion of $H_2PO_4^-$		
	C	increased production of ammonia	D	increased production of HPO_4^{2-}		
9	Hyperamylasemia is commonly caused by administration of				CO3	K2
	A	antibiotics	B	diuretics		
	C	opiates	D	anticonvulsants		
10	Elevation in total CSF protein may be seen in all the following states except				CO3	K2
	A	epilepsy	B	brain tumor		
	C	CNS trauma	D	stroke		
11	β_2-Microglobulin levels are least useful in patients with				CO3	K2
	A	cadmium poisoning	B	skeletal muscle disease		
	C	rejected kidney transplant	D	acute leukemia		
12	In diabetes mellitus, glucagon levels are				CO3	K2
	A	elevated due to high insulin	B	lowered due to high conversion to glucose		
	C	lowered due to low insulin	D	elevated and not suppressed by carbohydrate loading		
13	Which of the following proteins is the best indicator of hemolysis?				CO4	K3
	A	ceruloplasmin	B	hemosiderin		
	C	transferrin	D	haptoglobin		
14	14. Which of the following can cause urine to have a purple color?				CO4	K3
	A	homogentisic acid	B	bilirubin		
	C	hemoglobin	D	myoglobin		
15	Microalbuminuria is				CO4	K3
	A	excretion of albumin metabolites	B	albumin concentrations that are slightly above normal urine		
	C	albumin concentrations below the reference intervals	D	high serum albumin, low urine albumin		
16	Patients with porphyria cutanea tarda have a deficiency of				CO4	K3
	A	protoporphyrinogen oxidase	B	uroporphyrinogen decarboxylase		
	C	coproporphyrinogen oxidase	D	ferrochelatase		
17	An Lp(a) concentration exceeding 300 mg/l indicates				CO5	K4

	A	high genetic risk for coronary heart disease	B	high acquired risk for coronary heart disease		
	C	high risk when present in the elderly	D	normal value		
18	The presence of which cast has the least clinical significance?				CO5	K4
	A	red cell	B	epithelial		
	C	waxy	D	granular		
19	Which of these is characterized by increased blood viscosity, Bence Jones proteins, and enlarged lymph nodes and spleen?				CO5	K4
	A	hepatoma	B	multiple myeloma		
	C	Wilson's disease	D	Waldenstrom's macroglobulinemia		
20	A positive urine for bilirubin can be caused by the presence of				CO5	K4
	A	unconjugated bilirubin	B	any of these compounds		
	C	conjugated bilirubin	D	delta bilirubin		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Write about GTT			CO1	K1
OR						
	B	Discuss about galactosemia			CO1	K1
22	A	Explain Alkaptonuria			CO2	K2
OR						
	B	Write about mode of action-cholesterol.			CO2	K2
23	A	Discuss about jaundice (Or)			CO3	K2
OR						
	B	Explain tyrosinemia and haemophilia			CO3	K2
24	A	Write about metabolism of bilirubin			CO4	K3
OR						
	B	Discuss about tubeless gastric analysis.			CO4	K3
25	A	Write about liver damage			CO5	K4
OR						
	B	Explain about myocardial infarction			CO5	K4

Section C				
Answer ANY THREE Questions (3 x 10 = 30)				
26	A	Explain about diabetes mellitus.	CO1	K1
27	A	Discuss about phenyl ketonuria, cystinuria, alkaptonuria.	CO2	K2
28	A	Explain about lipidosis and atherosclerosis	CO3	K2
29	A	Write about liver function test.	CO4	K3
30		Discuss about clinical importance of enzymes	CO5	K4

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	7	0	0	0	0	0	07
II	0	7	0	0	0	0	07
III	0	7	0	0	0	0	07
IV	0	0	7	0	0	0	07
V	0	0	0	7	0	0	07
Total	7	14	7	7	0	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	24	0	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	24	0	0	0	0	24
IV	0	0	24	0	0	0	24
V	0	0	0	24	0	0	24
Total	24	48	24	24	0	0	120

YEAR III – SEMESTER VI
CORE - BIOCHEMISTRY PRACTICAL – VII

Paper	: Core Practical VII	Total Hours	: 75
Hours/Week	:5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U6BCCP07	External	: 60

I . 1 . Estimation of uric acid by caraways method (Or) 15 Marks

2. Estimation of Blood Glucose by Asatoor and King method

II.1. Estimation of Creatinine by alkali picrate method (Or) 15 Marks

2. Estimation of chloride by vanslykes method

Record 10

Spotters 20

YEAR III – SEMESTER VI
CORE - BIOCHEMISTRY PRACTICAL – VIII

Paper	: Core Practical VIII	Total Hours	: 75
Hours/Week	:5	Exam Hours	: 03
Credit	: 3	Internal	: 40
Paper Code	: 18U6BCCP08	External	: 60

I . 1 .Single radial immunodiffusion (Or) 15 Marks
2. Rocket Immunodiffusion

II.1.Identify Blood groups and report the result (Or) 15 Marks
2. Separation of Antigen and antibodyImmuno-electrophoresis

Record 10
Spotters 20

18U6BCE04

(For the candidates admitted from 2018 Onwards)

VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)
CELL BIOLOGY

III B.Sc., (BIOCHEMISTRY)-VI Semester

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A

(20X1=20)

1	Which of the following is not a major class of chromatin proteins?		Unit – III	K1	CO-2
	A	Histones	B	SMC proteins	
	C	Topoisomerases	D	Cohesins	
2	Which region of chromatin is transcriptionally attenuated?		Unit – III	K2	CO-3
	A	Nucleotide	B	Centromere	
	C	Euchromatin	D	Heterochromatin	
3	Which of the sister chromatids separate and move to opposite poles of the cell		Unit – III	K2	CO-1
	A	Prophase	B	Metaphase	
	C	Telophase	D	Anaphase	
4	Why are chromosomes condensed?		Unit – III	K1	CO-4
	A	To facilitate accommodation	B	Always condensed	
	C	To facilitate cell division	D	To facilitate distribution in daughter cells	
5	Which of the following is a possible offspring in a mating between grasshoppers?		Unit – III	K3	CO-2
	A	XO female	B	XO male	
	C	XX female	D	XO male and XX female	
6	Which of the following is an X-linked disorder in human beings?		Unit – IV	K1	CO-2
	A	Hemophilia	B	Color blindness	
	C	HIV	D	Hemophilia and Color blindness	
7	Which of the following statement is TRUE as for as the prokaryotic systems are concerned?		Unit – IV	K2	CO-2
	A	DNA but no histones	B	Both DNA and histones	
	C	Neither DNA nor histones	D	Either DNA or histones	
8	Which of the following discovered chromosomes in the second half of the nineteenth century?		Unit – III	K5	CO-1
	A	Thomas Morgan	B	Calvin Bridges	
	C	W. Waldeyer	D	Gregor Mendel	
9	Which of the following is not the part of interphase in the cell cycle?		Unit – IV	K1	CO-3
	A	S phase	B	G1 phase	
	C	G2 phase	D	M phase	

10	How many hours does the M phase take to complete a cycle?		Unit – IV	K6	CO-4
	A	8hr	B	1hr	
	C	4 hr	D	11 hr	Unit – V
11	Which of the following is used by cells to interact with other cells?				
	A	Cell junctions	B	Cell adhesions	
	C	Cell detectors	D	Cell tubules	
12	Which of the following is the continuous channel formed by the cell membranes?		Unit – V	K6	CO-3
	A	Desmosomes	B	Peroxisomes	
	C	Annulus	D	Integrins	
13	Which of the following contains tight junctions?		Unit – V	K6	CO-4
	A	Chordates	B	Arthropods	
	C	Nematodes	D	Molluscs	
14	Which of the following cells do not reside in the extracellular matrix?		Unit – V	K6	CO-3
	A	Mesenchymal stem cells	B	Fibroblasts	
	C	Hepatocytes	D	Adipose cells	
15	Which of the following filaments bind to the cadherin and catenin complex?		Unit – IV	K6	CO-4
	A	Myosin	B	Actin	
	C	Globulin	D	Albumin	
16	What is extravasation?		Unit – IV	K4	CO-5
	A	Movement of leukocytes to tissues	B	Movement of leukocytes to blood	
	C	Lysis of leukocytes	D	Formation of leukocytes	
17	What is the name of the region where double-stranded single circular DNA is found in the prokaryotic cell		Unit – I	K4	CO-5
	A	Protonucleus	B	Nucleus	
	C	Nucleoid	D	Nucleoplasm	
18	Which of these is a characteristic of prokaryotic cells?		Unit – I	K4	CO-5
	A	Absence of cell organelles	B	Absence of nucleus	
	C	Presence of 70S ribosomes	D	All of these	
19	The flagella of prokaryotic and eukaryotic cell vary in		Unit – I	K4	CO-5
	A	Mode of functioning and location in cell	B	Types of movement and placement in cell	
	C	Microtubular organization and function	D	Microtubular organization and type of movement	
20	In prokaryotes, the hair-like outgrowths which attach to the surface of other bacterial cells is		Unit – I	K4	CO-5
	A	Flagella	B	Pili	
	C	Capsule	D	Plasmids	

Section B**Answer All questions (1 x 5 = 25)**

21	A	Elaborate the structure of chromatin	Unit – III	K6	CO-5
		OR			
	B	Explain the polytene chromosome?	Unit – III	K4	CO-4
22	A	Explain the stages of cell cycle and their check point?	Unit – IV	K6	CO-5
		OR			
	B	Elaborate the significance of mitosis	Unit – IV	K6	CO-4
23	A	Explain the collagen and its use?	Unit – V	K4	CO-5
		OR			
	B	Short note on desmosomes.	Unit – V	K5	CO-5
24	A	Discusses the structure and functions of nucleus	Unit – II	K4	CO-4
		OR			
	B	Short note on ribosomes and its use	Unit – II	K5	CO-5
25	A	Distinguish between plant and animal cell	Unit – I	K6	CO-3
		OR			
	B	Explain the bacterial cell wall membranes	Unit – I	K6	CO-4
Section C					
Answer ALL Questions (3x 10 = 30)					
26		Explain the significance of mitosis and meiosis	Unit – IV	K5	CO-3
27		Discuss about the euchromatin and heterochromatin	Unit – III	K6	CO-5
28		Shot notes on structure of mitochondria and function	Unit – II	K6	CO-5
29		Brief notes on cell-cell interactions	Unit – V	K5	CO-4
30		Discuss about the Prokaryotic and eukaryotic cell structure	Unit – I	K6	CO-5

Table of specifications – Unit wise - Knowledge level – Number of questions (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	7	0	0	0	0	7
II	0	7	0	0	0	0	7
III	0	0	7	0	0	0	7
IV	0	0	0	7	0	0	7
V	0	0	0	7	0	0	7
Total	0	14	7	14	0	0	35

Table of specifications - Marks wise - Knowledge level - (Including Choice)

Knowledge level / Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	0	24	0	0	0	0	24
II	0	24	0	0	0	0	24
III	0	0	24	0	0	0	24
IV	0	0	0	24	0	0	24
V	0	0	0	24	0	0	24
Total	0	48	24	48	0	0	120

18U6BCS04

(For the candidates admitted from 2017 Onwards)

**VIVEKANANDHA COLLEGE OF ARTS & SCIENCE FOR WOMEN
(AUTONOMOUS)**

**BIOCHEMISTRY IN DIAGNOSTIC MEDICINE
III B.Sc., (BIOCHEMISTRY)-VI Semester**

Time: 3 Hrs

Maximum marks:75

Answer all questions

PART A

(5X2=10)

1	Quality control is		CO1	K1
	A	running known and unknown controls	B	for accuracy and precision
	C	insuring control values are within 2 SD(standard devients),	D	all of the above.
2	A condition in which red blood cells and hemoglobin are decreased		CO1	K1
	A	AIDS	B	polycythemia
	C	anemia	D	leukemia
3	Which is not a type of WBC:		CO1	K1
	A	reticulocyte	B	basophil
	C	eosinophil	D	monocyte
4	The specific gravity of urine		CO1	K1
	A	measures the pH	B	measures nitrates
	C	measures the concentrating ability of the kidneys	D	measures bacterial contaminante
5	Quality control in a laboratory is		CO2	K1
	A	a formal surveillance process directed at personnel	B	a formal surveillance process directed at equipment
	C	a forma lsurveillance process directed at materials	D	All the above
6	Quality control may include all of the following except		CO2	K1
	A	using standards and controls	B	performing tests in duplicate
	C	rechacking with reference example	D	terminal disposal of test reagent solutions.
7	Meaning of infarction is		CO2	K1
	A	aorta death	B	Artery death
	C	Tissue death	D	Muscle death
8	Heart attack occurs when there is blood clotting in		CO2	K1
	A	Renal arteries	B	Mesenteric arteries
	C	hepatic arteries	D	coronary arteries

9	Myocardial infarction is also known as		CO3	K2
	A	diabetes	B	cholesterol
	C	hypertension	D	Heart attack
10	What is the main function of the liver		CO3	K2
	A	Oxidation	B	reduction
	C	production	D	detoxification
11	Which is the best test for diagnosing acute pancreatitis in renal failure?		CO3	K2
	A	Serum trypsinogen	B	Serum amylase
	C	Serum lipase	D	None of the above
12	Considering kidney dialysis, space around gut is known as		CO3	K2
	A	peritoneal cavity	B	abdominal cavity
	C	Renal cavity	D	Vertebral cavity
13	Total RBC count for Women is?		CO4	K3
	A	4.4 -6	B	4.2-5
	C	4.0-5.0	D	4.2-5.2
14	What is the major metabolically available storage form of iron in the body?		CO4	K3
	A	Hemosiderin	B	Ferritin
	C	TrANS ferrind	D	Hemoglobin
15	What is the life span of RBC		CO4	K3
	A	120	B	100
	C	200	D	80
16	At which month of fetal development does the bone marrow become the primary site of hematopoiesis?		CO4	K3
	A	2nd	B	5th
	C	End of 6th month	D	End of 7th month
17	The most common type of protein found in the cell membrane is		CO5	K3
	A	Lipoprotein	B	Mucoprotein
	C	Glycoprotein	D	Nucleoprotein
18	Chronic excretion of large amounts of urine of low specific gravity is indicative of			
	A	diabetes innocens	B	diabetes insipidus
	C	diabetes intermittens	D	diabetes mellitus
19	Elevated glucose levels, especially in obese persons, may be due to		CO5	K3
	A	diabetic acidosis	B	glucose intolerance

	C	insulin resistance	D	insulin shock		
20		What are the most common clinical signs?			CO5	K3
	A	Lethargy and alopecia	B	Weight gain and PU/PD		
	C	Alopecia and weight gain	D	All the above.		
Section B						
Answer All questions (5 x 5 = 25)						
21	A	Explain the precaution and first aid equipments			CO1	K1
	B	Explain about ESR			CO1	K1
22	A	Discuss about physical examination in urine			CO2	K1
	B	Write about general approach to quality control			CO2	K1
23	A	Explain analysis of microscopic examination of urine sample			CO3	K2
	B	Give the interpretation of GTT			CO3	K2
24	A	What are the composition of urine and how it is preserved?			CO4	K3
	B	Explain the test for occult blood and faecal fat.			CO4	K3
25	A	Explain about SGOT and SGPT			CO5	K3
	B	Explain the procedure of PCV			CO5	K3
Section C						
Answer ANY THREE Questions (3 x 10 = 30)						
26	A	Explain in detail stool examination			CO1	K1
27	A	Write in detail about the biochemical components in blood			CO2	K1
28	A	Discuss on ketone bodies and bile pigments in urine.			CO3	K2
29	A	Explain the collection of blood and preservatives			CO4	K3
30	A	Explain the procedure of RBC & WBC count			CO5	K3

TYPES OF SPECIFICATION (Question wise-no of questions)

Outcome/ Unit	K1 (Remembering)	K2 (Understanding)	K3 (Applying)	K4 (Analyzing)	K5 (Evaluating)	K6 (Creating)	Total
I	7	0	0	0	0	0	07
II	7	0	0	0	0	0	07
III	0	7	0	0	0	0	07
IV	0	0	7	0	0	0	07
V	0	0	7	0	0	0	07
Total	14	7	14	0	0	0	35

TYPES OF SPECIFICATION (Marks wise-Total marks)

Outcome/	K1	K2	K3	K4	K5	K6	Total
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Unit	(Remembering)	(Understanding)	(Applying)	(Analyzing)	(Evaluating)	(Creating)	
I	24	0	0	0	0	0	24
II	24	0	0	0	0	0	24
III	0	24	0	0	0	0	24
IV	0	0	24	0	0	0	24
V	0	0	24	0	0	0	24
Total	48	24	48	0	0	0	120