

# 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

M.Sc., BIOCHEMISTRY

### SYLLABUS AND REGULATIONS

FOR CANDIDATES ADMITTED FROM 2021-2022  
ONWARDS UNDER AUTONOMOUS CBCS AND OBE  
PATTERN

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

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## COLLEGE VISION AND 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

### 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 visit 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
  - Programming and application skills in Bioinformatics and Drug Designing
  - 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 make the graduates to afford fundamentals and applications of current biochemical concepts at an advanced level.
2. To promote research in the thrust areas of Biochemistry ranging in wide areas like structural biology, gene regulation and to connect various field through Biochemistry
3. To equip with the up-to-date skills of evolving technologies as per industrial forecast

## PROGRAMME SPECIFIC OBJECTIVES (PSO)

1. To provide students with learning experiences that help instill deep interests in learning Biochemistry; develop broad and balanced knowledge and understanding of biomolecules, like biochemical concepts, principles and theories related to Biochemistry and equip students with appropriate tools of analysis and with theoretical technical and analytical skills to tackle issues and problems in the field of Biochemistry.

2. 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 and to provide students with the knowledge and skill base that make them undertake further studies in Biochemistry and related areas or I multidisciplinary areas that help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

3. To expose the students to a wide range of careers that combine biology, plants and medicine and render graduates with some work experience, as summer internship and a research project in a research laboratory to further boost the career prospects.

## PO and Knowledge level

PO No	PROGRAMME OUTCOME	Knowledge Level
PO1	<b>Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.	K2
PO2	<b>Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.	K1
PO3	<b>Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.	K4
PO4	<b>Problem solving:</b> Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.	K3
PO5	<b>Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.	K5
PO6	<b>Research-related skills:</b> A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.	K6
PO7	<b>Cooperation/Team work:</b> Ability to work effectively and respectfully with diverse teams, facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.	K6
PO8	<b>Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.	K4
PO9	<b>Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.	K2
PO10	<b>Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.	K3
PO11	<b>Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.	K6
PO12	<b>Multicultural competence:</b> Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to	K5

	effectively engage in a multicultural society and interact respectfully with diverse groups.	
PO13	<b>Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.	K3
PO14	<b>Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.	K6
PO15	<b>Lifelong learning:</b> Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.	K6

#### ELIGIBILITY FOR ADMISSION

- Candidates seeking admission to the first year M.Sc., Degree Course could have a Bachelors Degree in Science with Biochemistry, Chemistry, Botany, Zoology, Nutrition and dietetics or Food and Nutrition or Food Sciences as the main subject or a Bachelors Degree in Agriculture and Life sciences as main subject of this University or any other qualification accepted as equivalent there to are eligible for admission to M.Sc., Degree course.

#### DURATION OF THE COURSE

The duration of the course is for two academic years consisting of four semesters.

#### EXAMINATIONS

There shall be four semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

#### SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

Theory External marks	=	75
Part A	=	20 Marks (01 x 20)
Part B	=	25 Marks (05 x 05)
Part C	=	30 Marks (03 x 10)

Internal marks	=	25
Total Marks	=	100
Time	=	3 Hrs.

**The following procedure will be followed for Internal Marks**

**Theory - Internal Marks**

Theory best average of two tests	10 Marks
Attendance	5 Marks
Seminar	5 Marks
Assignment	5 Marks
<b>Total</b>	<b>25 Marks</b>

**Practical - Internal Marks**

Practical best average of two tests	25 Marks
Attendance	10 Marks
Observation Note	5 Marks
<b>Total</b>	<b>40 Marks</b>

**Project- Internal Marks**

Presentations [Two reviews 25+25]	50 Marks
Project Report	100 Marks
Viva - Voce	50 Marks
<b>Total</b>	<b>200 Marks</b>

**Break-up Details for Attendance**

Below 75%	No Marks
76 to 80%	01 Marks
81 to 85%	02 Marks
86 to 90%	03 Marks
91 to 95%	04 Marks
96 to 100%	05 Marks

**REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS**

- (i) Candidates shall register their names for the first semester examination after the admission in the PG courses.
- (ii) Candidates shall be permitted to proceed from the first semester up to the final semester irrespective of their failure in any of the semester examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) semester subjects.
- (iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time. Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after

completion of final semester of the course, after paying the fee for the break of study as prescribed by the college from time to time.

### PASSING MINIMUM

- There shall be no Passing Minimum for Internal.
- For External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.
- In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.
- Grading shall be based on overall marks obtained (Internal + External)

### CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the first class. All other successful candidates shall be declared to have passed in second class. Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in first class with distinction, provided they pass all the examinations (theory papers, practical, project and viva-voce) prescribed for the course in the first appearance.

### GRADING SYSTEM

The term grading system indicates a 7 point scale of evaluation of the performances of students in terms of marks obtained in the Internal and External examination, grade points and letter grade.

### SEVEN POINT SCALE (As per UGC notification, 1998)

GRADE	GRADE POINT	PERCENTAGE EQUIVALENT
'O' = Outstanding	5.50 – 6.00	75 – 100
'A' = Very Good	4.50 – 5.49	65 – 74
'B' = Good	3.50 – 4.49	55 – 64
'C' = Average	3.00 – 3.49	50 – 54
'D' = Below Average	1.50 – 2.99	35 – 49
'E' = Poor	0.50 – 1.49	25 – 34
'F' = Fail	0.00 – 0.49	00 – 24

### RANKING

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking / Distinction. Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the first appearance will not be eligible for ranking.

**PATTERN OF QUESTION PAPER**

PART A (Objective): Answer All the Questions	01 x 20 = 20 Marks
PART B (200 words): Answer All the Questions (Internal choice)	05 x 05 = 25 Marks
PART C (500 words): Answer All the Questions (Internal choice)	03 x 10 = 30 Marks

**PROCEDURE IN THE EVENT OF FAILURE**

If a candidate fails in particular subjects, she may reappear for the examination in the concerned subject in subsequent semester and shall pass the examination.

**COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2017-18 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2017-18 and thereafter.

**TRANSITORY PROVISION**

Candidates who were admitted to the PG course of Microbiology before 2018 – 2019 shall be permitted to appear for the examinations under those regulations for a period of two years i.e., upto and inclusive of the examination of Apr/May 2019. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

**DEPARTMENT OF BIOCHEMISTRY**  
**SCHEME OF CURRICULUM – M.Sc. BIOCHEMISTRY**  
**(For the candidates admitted during the academic year 2021-2022 onwards)**

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Sem	Subject code	Course	Subject title	Hrs/week	Credit	Int. marks	Ext. marks	Tot. marks
I	21P1BC01	Core – I	Biopolymers	6	5	25	75	100
	21P1BC02	Core – II	Cellular Biochemistry	5	5	25	75	100
	21P1BC03	Core – III	Enzymology and Enzyme technology	5	5	25	75	100
	21P1BCP01	Practical - I	Core Practical - I	5	3	40	60	100
	21P1BCP02	Practical - II	Core Practical - II	5	3	40	60	100
	21P1BCE01/ 21P1BCE02	Elective – I	Analytical Biochemistry Plant Biochemistry and Plant Biotechnology	4	4	25	75	100
<b>Total</b>				<b>30</b>	<b>25</b>	<b>180</b>	<b>420</b>	<b>600</b>
II	21P2BC04	Core – IV	Intermediary Metabolism and Regulation	6	5	25	75	100
	21P2BC05	Core – V	Molecular Biology	5	5	25	75	100
	21P2BC06	Core – VI	Immunology and Immunotechnology	5	5	25	75	100
	21P2BCP03	Practical III	Core Practical- III	5	3	40	60	100
	21P2BCP04	Practical IV	Core Practical- IV	5	3	40	60	100
	21P2BCE03/ 21P2BCE04	Elective – II	Pharmaceutical Biochemistry and toxicology Endocrinology	4	4	25	75	100
<b>Total</b>				<b>30</b>	<b>25</b>	<b>180</b>	<b>420</b>	<b>600</b>
III	21P3BC07	Core – VII	Advanced Clinical Biochemistry	5	5	25	75	100
	21P3BC08	Core – VIII	Research Methodology	5	5	25	75	100
	21P3BC09	Core – IX	Genetic Engineering and Fermentation Technology	5	5	25	75	100
	21P3BCP05	Practical- V	Core Practical-V	5	3	40	60	100

	21P3BCP06	Practical- VI	Core Practical-VI	4	2	40	60	100
	21P3BCE05/ 21P3BCE06	Elective -III	Neuroscience Microbial Biochemistry	4	4	25	75	100
	21P3BCED01	EDC	Diagnostic Biochemistry	2	1	25	75	100
	21P3HR01		Human rights	1	1	25	75	100
			Internshp	1	1			
			<b>Total</b>	<b>32</b>	<b>27</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>IV</b>	21P4BC10	Core – X	Human Physiology	5	5	25	75	100
	21P4BC11	Core XI	Bioinformatics and Nanotechnology	4	4	25	75	100
	21P4BCPR01	Core – VII	Project work	10	5	50	150	200
			Project review	9	-	-	-	-
			<b>Total</b>	<b>28</b>	<b>14</b>	<b>100</b>	<b>300</b>	<b>400</b>
<b>Overall Total</b>				<b>120</b>	<b>91</b>	<b>690</b>	<b>1710</b>	<b>2400</b>

## I YEAR I SEMESTER BIOPOLYMERS

Paper	: Core I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 21P1BC01	External	: 75

### SUBJECT DESCRIPTION:

Biopolymers deal with the brief information on the structure, functions and behavioral properties of biomolecules.

### OBJECTIVES:

The main objective of the course is to study about carbohydrates, proteins, lipids, and nucleic acids and their structure and properties in advanced level.

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Familiarize about the definition, occurrence, and types of various biomolecules	K2
CO2	Recall and understand the classification, chemistry and functions of macro and micro nutrients.	K2
CO3	Imbibe and interpret the chemical reactions of monosaccharides, amino acids and structural organization of various biomolecules.	K3
CO4	Evolve the physiological functions and significance of macro and micro nutrients.	K4
CO5	Correlate the need of macro and micronutrients with the metabolic and physiological functions of the human body.	K4

### Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

### CONTENT:

**Unit I – (15 Hrs.): Carbohydrates:** Introduction, Classification, and Properties of carbohydrates, Bacterial cell wall Polysaccharides, Amino sugars and Deoxy sugars, Glycosaminoglycans-Structure and biological role of Hyaluronic acid, Chondroitin sulphate and Heparin, Sialic acid - Structure and Significance, Biological importance of Proteoglycans and Glycoproteins.

**Unit II – (15 Hrs.): Proteins and Amino Acids:** Classification, Structure, Function, Properties of Amino acids and Proteins, Amino acid sequencing, biological importance of selenocysteine and desmosine, Ramachandran plot, Structure and Function of Hb, myoglobin, Actin, Myosin, Keratin,

Collagen and Elastin, Transport of amino acid in to mitochondria. DNA binding proteins - helix-turn-helix, zinc-finger motif, leucine zipper – direct interactions, Techniques for characterizing nucleic acid- protein complex- gel retardation assay. Disease related to protein folding – Alzheimer’s and mad cow disease, Protein denaturation.

**Unit III – (15 Hrs.): Lipids:** Classification, Structure, Properties and Functions of lipids, Transport and hydrolysis of triglycerol, Plant and animal sterols, Fatty acids - Types and significance, Structure and functions of cholesterol, Lipid peroxidation and antioxidants, Lipoproteins - Classification, composition and functions

**Unit IV – (15 Hrs.): Nucleic Acids:** Structure and properties of nitrogenous bases and nucleotides, Cot value and Cot curve, Chemical synthesis of DNA, Major classes of RNA-Structure and biological functions of mRNA, rRNA, tRNA, snRNA, hnRNA, DNA histone proteins, chromatin, non-histone proteins, Methylated bases of DNA and DNA super coiling, Properties of DNA- buoyant density, viscosity, denaturation and renaturation.

**Unit V – (15 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, functions and deficiency symptoms. Minerals: Requirements, macro and micro minerals (sources and functions).

#### TEXT BOOKS:

1. Deb, A.C (2004) **Fundamentals of Biochemistry**. 8<sup>th</sup> Edition, New Central Book Agency,
2. Jain, J.L & Jain, (2005) **Fundamentals of Biochemistry**. Sixth Edition, S.Chand & Company, New Delhi.
3. U.Sathayanarayana,(2009). **Biochemistry**. 5th Edition by Books and Allied (P) Ltd., India.

#### REFERENCE BOOKS

1. Murray, K.R. Granner, K.D.Mayes, P.A. and Rodwell W.V. (2016). **Harper’s Biochemistry**. 31<sup>st</sup> Edition, Prentice Hall International Inc., New Jersey.
2. Nelson, D.L. and Cox, M.M (2017). **Lehninger Principles of Biochemistry**. 8<sup>th</sup> Edition, W.H.Freeman and Company, New York.
3. Bery J.M., Tymoezko J.L. and Stryer L. (2008) **Biochemistry**, 5<sup>th</sup> Edition, W.H. Freeman and Company, New York.

#### WEB OF RESOURCES

1. <http://ull.chemistry.uakron.edu/genobc/>.
2. <http://www.biology.arizona.edu/biochemistry/biochemistry.html>.
3. <https://www.sciencedirect.com/topics/neuroscience/dna-binding-protein>
4. <https://biologydictionary.net/nucleic-acid/>
5. <https://www.helpguide.org/harvard/vitamins-and-minerals.htm>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER I  
CELLULAR BIOCHEMISTRY**

Paper	: Core II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 21P1BC02	External	: 75

**SUBJECT DESCRIPTION:**

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

**OBJECTIVES:**

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

**OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Discuss the structure, differentiation of eukaryotes and prokaryotes and also cell cycle, check point interpretation, differentiation between mitosis and meiosis	K2
CO2	Illustrate the cell organelles structure and functions such as nucleus, chloroplast, mitochondria, endoplasmic reticulum, ribosome and lysosome etc.	K3
CO3	Apply the knowledge cell signaling of oncology markers such as P <sup>53</sup> , Bcl2, Bax, AFP and IL-1 e and their clinical interpretation	K4
CO4	Describes the critical based knowledge of membrane architecture and their types of models, and membrane transporters- like ion channels, symporters, and antiporters etc.	K5
CO5	Evaluate and hypothesis of extra cellular matrix, gap junction and cell to cell communication and also signal transtrduction pathways such as G protein-coupled receptor and TrkA receptor etc.,.	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

**CONTENT:**

**Unit I – (15 Hrs.): Cellular Organelles:** Definition, Structure and functions of cells-prokaryotes and eukaryotes, Morphology and function of Cytoplasm, endoplasmic reticulum, ribosomes, golgi apparatus, lysosomes, mitochondria, nucleus, chromosomes, chromosome organization, centrioles, chloroplasts, peroxisomes and glyoxysomes; Intracellular compartments and protein sorting, Intracellular vesicular traffic, Autocrine, Paracrine and endocrine.

**Unit II – (15 Hrs.): Cell cycle :** Cell division - mitosis and meiosis, cell cycle - phases of cell cycle, and regulation of cell growth and cell cycle,. Cytoskeleton - Structure and composition of cytoskeleton, Actin filament, intermediate filament and microtubule, Self assembly and dynamic structure of cytoskeletal filaments, regulation of cytoskeletal filaments, Molecular motor, Cytoskeleton and cell behaviour, molecular motors, micro tubular associated proteins - role in intracellular motility

**Unit III – (15 Hrs.):Cellular Interaction and signaling :** Cell-Cell interaction - Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins, Cell-Cell adhesion - Specialised junctions, Desmosomes, Gap junctions, Adhesion molecules – Cadherins, Connexins.Cell-Cell signaling – Types, Cell Signaling molecules and their receptors, functions of cell surface receptors, pathways, intra and extracellular signal transduction and second messengers (G – protein coupled receptors, receptor tyrosine kinases), cAMP, cGMP

**Unit IV – (15 Hrs.):**

**Programmed Cell Death and cancer signaling :** cell growth and apoptosis, Apoptosis – PI3K-Akt, NF-KB, Ras-Erk IGF-1 and NOTch signaling Pathways, regulators, effectors in apoptosis, oncology: oncogenes, causes, malignant non-malignant tumor, Properties of tumor cells, Tumor suppressor genes, human chorionic gonadotropin, cancer antigen 125, carcinoembryonic antigen (CEA), prostate-specific antigen, alpha-fetoprotein cancer markers. Carcinogenic effect of chemicals and radiation. Methods of studying the cell surface, re-constititional studies; fluorescence assisted methods e.g. flow cytometry

**Unit V – (15 Hrs.): Membrane Architecture and Functions:** Membrane bilayer - Models, Membrane lipids - fluidity, Asymmetry phase transition, Liposomes Membrane proteins - Types, Orientation, Bacteriorhodopsin, Porins-aquaporin, RBC ghosts, solubilisation of proteins, lipid anchored proteins carbohydrates and cell surface carbohydrates – Lectins, Membrane transport - ion channels, symporters and antiporters, Transport of water, glucose and amino acids.

**TEXT BOOKS:**

1. Rastogi,S.C. (2003), 2<sup>nd</sup> Edition, **Cell and Molecular Biology**. New Age International Publishers,New York.
2. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. (2000) **Molecular Cell Biology**, New York: W. H. Freeman
3. Gerald Karp, (2008).**Cell and Molecular Biology**. 5<sup>th</sup>Edition, John Wiley and Sons New Jersey.
- 4.Ajay Paul, (2009).**Text Book of Cell and Molecular Biology**. 2<sup>th</sup> Edition, Books and Allied (P) Ltd, Kolkata.
- 5.VK Agarwal and PS Varma , (2000). Cell Biology and Molecular Biology, Chand & Company, New Delhi.

**REFERENCE BOOKS**

- 1.Lodish, H. Baltimore, and *et al.*, (2008).**Molecular Cell Biology**. 6<sup>th</sup> Edition. W.H.Freeman and Co, NY.
2. Garrette, Grisham (1994) **Principles of Biochemistry**, Saunders College Publishing Co. USA.
- 3.Geoffrey, M. Cooper, Robert E. Hausman, **The Cell:A Molecular Approach**.4<sup>th</sup> Edition,Asm Press,USA.
4. **Bruce Albert et al.**, *Molecular biology of the cell*, Garland publications, New York & London, 3<sup>rd</sup> edition, 1994.
5. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin C. Raff, Keith Roberts, Peter Walter (2007), **Molecular Biology of the Cell**, Garland Science, Taylor & Francis Group.

**WEB SOURCES:**

1. <https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookCELL2.html>
2. <https://www.physics.uoguelph.ca/~dutcher/download/.../1.pdf>
3. <https://www.khanacademy.org/.../cells/cell-cell-interactions/.../cell-cell-interactions-ho...>
4. [https://en.wikipedia.org/wiki/Programmed\\_cell\\_death](https://en.wikipedia.org/wiki/Programmed_cell_death)
5. <https://www.cellsignal.com/contents/science/key-signaling-networks-in-cancer/cancer-research>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER I**  
**ENZYMOLGY AND ENZYME TECHNOLOGY**

Paper	: Core III	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 21P1BC03	External	: 75

**SUBJECT DESCRIPTION:**

Enzymology and Enzyme Technology deal with the knowledge on enzymes, classification structure kinetics and applications.

**OBJECTIVES**

The Students should update their knowledge about the enzyme and its role in all stages of metabolism and biochemical reaction. This course will describe a clear idea about an isolation of enzyme, characteristic properties, production on bench scale to pilot scale and their application in bio-industries.

**COURSE OUTCOMES**

Course No	Course Outcome	Knowledge Level
CO1	Know about the key structural and energetic factors which increase enzyme stability	K2
CO2	Understand about the role of enzyme as a catalyst in biological process	K2
CO3	Interpret the optimum pH, Temperature , Concentration of enzyme for certain enzyme catalysed reaction	K3
CO4	Learn about the logistic and sensible entrapment technique to improve the state of enzyme immobilization	K3
CO5	Familiarize about the application of enzyme technology in industrial sector	K4

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low



**CONTENT:**

**Unit I – (15 Hrs.): Enzymology:** Introduction, Nomenclature and classification of enzymes by IUB system, enzyme characteristics, monomeric, oligomeric and multienzyme complex. Active site, models of enzyme action – lock and key and Koshland induced fit model. Investigations of active site structure. Isoenzymes, abzymes and ribozymes. Multienzyme systems. Enzyme units and enzyme turnover.

**Unit II – (15 Hrs.): Enzyme Kinetics:** MM Kinetics, LB plot, Eadie - Hofstee plot and Hanes-woolf plot. Factors affecting enzyme activity (pH, temperature, substrate and enzyme concentration and activators) - Bisubstrate reactions - Enzyme inhibition- Reversible and irreversible. Feedback inhibition -Allosteric inhibition and regulation, concerted and sequential models for allosteric enzymes, positive and negative co-operativity with special reference to aspartate transcarbamoylase.

**Unit III – (15 Hrs.): Enzyme Catalysis & Coenzymes:** Acid-base catalysis, covalent catalysis and metal ion catalysis. Mechanisms of action of lysozyme, chymotrypsin, ribonuclease and carboxypeptidase. Metal activated enzymes and metalloenzymes. Coenzymes – TPP, PLP, FMN, FAD, NAD, NADP, CoA, Biotin and tetrahydrofolate.

**Unit IV – (15 Hrs.): Enzyme Technology:** Definition, types of immobilization – adsorption, covalent binding, entrapment, liposomes, cross linking and microencapsulation. Effect of immobilization on enzyme activity and application of immobilized enzyme. Biosensors- calorimetric biosensors, potentiometric biosensors, Amperometric biosensors, optical biosensors, Piezo-electric biosensors and thermometric biosensor. Enzyme engineering – Artificial enzymes and antioxidant enzymes.

**Unit V – (15 Hrs.): Enzyme Purification and Applications:** Objectives and strategies of enzyme purification – source – methods of homogenization and separation based on size, polarity and binding sites – purification (Adenylate kinase from pig muscle). Enzymes as analytical agent, therapeutic agents and diagnostic reagents, Enzymes in industry like textile & leather industries and food industries. Medical application of enzymes

**TEXT BOOKS****TEXT BOOKS**

1. Cornish-Bowden A. (2012) Fundamentals of Enzyme Kinetics, Wiley-VCH GmbH, Germany.
2. Price n.C. and Steven, V. (2002) Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins, 3<sup>rd</sup> Edition, Oxford University Press.
3. Khan, M Y nad khan, F (2015) Principles of Enzyme Technology, PHI learning

**REFERENCE BOOKS**

1. Buchholz, K., Kasche, V. and Bornscheur, L.T. (2012) Bioatalyst and Enzyme Technology, Wiley-VCH VerlagGmnH, Gerany.
2. Paler, T. (1995) Understanding of Enzymes, 4<sup>th</sup> Edition, prentice Hall.
3. Nelson, D.L. and Cox, M.M (2013). Lehninger Principles of Biochemistry. 7<sup>th</sup> Ed. W.H. Freema and Company, New York.
4. Voet, D and Voet, G, Fundamentals of Biochemistry, John Wiley and Sons, New York.

**WEB SOURCES**

[www.ebi.ac.uk/enzymeportal](http://www.ebi.ac.uk/enzymeportal)

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

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

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

<https://www.khanacademy.org/...enzymes/enzyme.../basics-of-enzyme-kinetics-graphs>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER I**  
**ANALYTICAL BIOCHEMISTRY**

Paper : Core IV  
Hours/Week : 4  
Credit : 4  
Paper Code : 21P1BCE01

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

**SUBJECT DESCRIPTION:**

Analytical Biochemistry deal with the principles, instrumentation, working and application of the instruments commonly used in the laboratories.

**OBJECTIVES:**

To make the students learn about buffers, centrifugation techniques, chromatography, electrophoresis and spectroscopy studies.

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
CO1	Obtain knowledge about pH, buffers , difference between invivo and invitro studies and types of centrifugation techniques	K2
CO2	Apply the knowledge about the separation and analysis of macromolecules and their fragments, based on their size and charge.	K3
CO3	Implement chromatography techniques for the separation of the individual compound from the mixture of compound.	K3
CO4	Explore the various spectroscopic techniques for studying the structures of atoms and molecules	K4
CO5	Appraise the attributes of naturally decaying atoms and their multiple applications across many aspects of modern day life	K5

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit I – (15 Hrs.): pH, Buffers and centrifugation:** Definition and determination of pH, Henderson-Hasselbalch equation, Measurement of pH, pH electrode, Biological buffers, types of buffer system, In vivo and in vitro studies, organ and tissue slice techniques, tissue homogenization, Methods of cell disruption. Basic principles of sedimentation, types of centrifuges and rotors, Preparative ultracentrifugation, differential centrifugation, density-gradient and analytical ultracentrifugation and its applications in determination of molecular weight.

**Unit II – (15 hrs) Electrophoresis and blotting techniques :** Electrophoresis techniques – Principle, technique and applications of paper, Native PAGE gels, SDS-PAGE, Isoelectric focusing, Pulse field electrophoresis, Capillary electrophoresis, Immunoelectrophoresis. Separation of cell organelles 2D gel electrophoresis. Hybridization probes - Southern, western and Northern blotting techniques.

**Unit III – (15 Hrs.): Chromatography:** Definitions, General principles, Instrumentation and application of Chromatography – Paper, Column, Thin layer chromatography, Ion- Exchange, Molecular sieve (gel filtration), Affinity, High-performance liquid chromatography (HPLC), Gas-liquid chromatography (GLC), FPLC, HPTLC, FTIR.

**Unit IV – (15 Hrs.): Spectroscopic Technique:** Basic principles, wave number, wave laws of absorption, absorption spectrum, instrumentation and applications of UV, visible and IR spectrophotometers, Electron spin resonance, Nuclear Magnetic Resonance, Mass Spectrometry, Molecular analysis using light scattering and Atomic absorption spectroscopy, Flame Photometry – principle, instrumentation and applications, Electron microscope – principle, instrumentation and application of SEM and TEM. Colorimetry, fluorimetry.

**Unit V – (15 Hrs.): Radioisotopes and Microscopy:** X-ray diffraction - Principle, theory of operation and application, Circular dichroism (CD) – principles, theory of operation and applications, Radioisotopic techniques- Principle and applications of GM Counter, Liquid and Solid Scintillation Counter and autoradiography, applications of radioactive isotopes in biological research, radiation hazards. Microscopy: basic principles, light, brightfield, phasecontrast, fluorescent, electron microscopy-TEM, SEM, preparation of specimen, microtomy fixation and staining, flow cytometry and FACS.

**TEXT BOOKS**

1. Wilson. K and Walker. J. (2010), Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, New York, USA.
2. Upadhyay, A., Upadhyay, K., and Nath, N., (2014), Biophysical chemistry – principle & techniques, Himalaya publishing House, Mumbai.
3. Gurdeep, R. Chatwal and Aanand. S.K. (2009). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.

**REFERENCE BOOKS**

1. Foster, L.E. (2007), Nanotechnology Science, Innovation and opportunity (First edition), Pearson Education, Inc, New York.
2. Pattabhi, V and Gautham, (2015), Biophysics, Narosa Publishing House PVT Ltd, New Delhi.
3. Rathi, R. (2007), Core Concept of Nanotechnology with application spectrum (First Edition), SBS Publishers and Distribution Pvt Ltd, New Delhi.
4. Sharma. P.K. (2008), Origin and Development of Nanotechnology (first edition), Vista

International publishing House Mumbai, New Delhi.

5. Wilson, K and Goulding, KH (1987). A Biologist Guide to Principles and Tecchniques of Practrical Biochemistry, 3rd edition, Edward Arnold Publishers. Londen, UK.

**WEB OF RESOURCE:**

1. [www.centrifugebybeckman.com](http://www.centrifugebybeckman.com)

2. [www.axis-shield-density-gradient-media.com/training-1new](http://www.axis-shield-density-gradient-media.com/training-1new).

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

4. [www.austincc.edu/.../](http://www.austincc.edu/.../)

5. <https://www.dnalc.org/resources/animations/gelectrophoresis.html>

**PEDOGOGY: CHALK and Talk , PPT**

## PLANT BIOCHEMISTRY AND PLANT BIOTECHNOLOGY

Paper	: Elective – II	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 21P1BCE02	External	: 75

### SUBJECT DESCRIPTION:

Plant biochemistry and Plant biotechnology deal with the plant and animal tissue culture methods, and mechanism of gene transfer, Methods of selection, Production of novel proteins and their applications.

Course No	Course Outcome	Knowledge Level
CO1	To obtain the knowledge of the state the importance of photosynthesis, factors affecting photosynthesis, the photosynthetic pigment, and describe the biochemistry of photosynthesis.	K1 & K2
CO2	To make the students understand the components of culture media and various tissue culture techniques. Learnt about the technique of genetic	K1 & K2
CO3	Define respiration and itemize detailed processes of cell respiration and gaseous exchange in flowering plants;	K1, K2 & k3
CO4	Clear about the list and describe the features of phloem translocation	K3 & K4
CO5	To obtain the knowledge about plant and animal tissue culture methods, mechanism of gene transfer Methods of selection, Production of novel proteins and their applications.	K3 & K4

### Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

### CONTENT:

**Unit I – (15 Hrs.): Photosynthesis:** Photosynthetic apparatus, organisation of thylakoid, role of chlorophylls, carotenoids and other photosynthetic pigments, light absorption and energy conservation, Light – properties of both particle and wave, light absorption by pigment molecules, Photosystems I and II, Electron transport pathways in chloroplast membranes, ATP synthesis in chloroplasts, cyclic and noncyclic photophosphorylation

**Unit II – (15 Hrs.): Carbon Reactions & Transpiration:** C3, C4 and CAM plants - Calvin

cycle; Hatch-Slack pathway, Photorespiration in plants, biochemical basis of PR pathway – C2 cycle, Pathways of glucose oxidation in plants, starch biosynthesis and degradation, metabolic transport between organelles, Overview of lipid and protein metabolism in plants, Transpiration-Types, theories of transpiration, mechanism and factors affecting transpiration.

**Unit III – (15 Hrs.): Nitrogen Fixation:** Symbiotic and non-symbiotic - Symbiotic nitrogen fixation in legumes by Rhizobia, biochemistry and molecular biology of nitrogen fixation, enzymology of nitrogen fixation, regulation of *nif* and *nod* genes of nitrogen fixation, Interaction between nitrate assimilation and carbon metabolism, Sulphur chemistry and functions, reductive sulfate assimilation pathway, Synthesis and functions of glutathione and its derivatives, Interrelationship between photosynthesis and nitrogen metabolism.

**Unit IV – (15 Hrs.): Structure of Plant Genes:** Structure, transport, distribution, mechanism of action and physiological effects of Auxin, gibberellins, cytokinins, abscisic acid, ethylene, Phytochrome, Biological clock, Fruit ripening, senescence

**Unit V – (15 Hrs.): Plant Cell Culture:** Tissue culture media – composition and preparation, Micropropagation, somoclonal variation, Callus, Protoplast culture - isolation and purification of protoplasts, Protoplast fusion, genetic modification of protoplasts, Anther, pollen and ovary culture for production of haploid plants and homozygous lines, Uses of haploids in plant breeding. Secondary metabolites

#### TEXT BOOKS

1. Heldt, H.W. (2005), **Plant Biochemistry**. 3<sup>rd</sup> Edition, Elsevier Academic Press Publication, USA.
2. Lea, P.J. and Leegood, R.C. (1999). **Plant Biochemistry and Molecular Biology**. 2<sup>nd</sup> Edition, Wiley and Sons, New York.
3. Harborne, J.B. (1989). **Methods in Plant Biochemistry in Plant Phenolics**. Academic Press, London, UK.
4. Goodwin Ane Mercer, (2003). **Introduction to Plant Biochemistry**. 2<sup>nd</sup> Edition, CBS Publishers, New Delhi.

#### REFERENCE BOOKS

1. Hans, Walter-Heldt, (1997). **Plant Biochemistry and Molecular Biology**. 3<sup>rd</sup> Edition Academic Press, California.
2. Narayanaswamy, S. (1999). **Plant Cell and Tissue Culture**. 2<sup>nd</sup> Edition, Tata McGraw Hill Publishing Company Ltd, New York.

#### WEB REFERENCES:

1. [www.biology4kids.com/files/plants\\_photosynthesis.html](http://www.biology4kids.com/files/plants_photosynthesis.html)
2. [www.slideshare.net/BiologyIB/photosynthesis-powerpoint-3983595](http://www.slideshare.net/BiologyIB/photosynthesis-powerpoint-3983595)
3. [http://www.slideshare.net/shivam\\_hayabusa/production-of-secondary-metabolites](http://www.slideshare.net/shivam_hayabusa/production-of-secondary-metabolites)
4. [www.slideshare.net/JonathanOLeary/photosynthesis-power-point](http://www.slideshare.net/JonathanOLeary/photosynthesis-power-point)
5. <https://en.wikipedia.org/wiki/Photophosphorylation>

**PEDOGOGY: CHALK and Talk , PPT**

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

Paper	: Core Biochemistry Practical I	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: <b>21P1BCP01</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Learn and understand the concepts of separation of amini acids and carbohydrates	K1 & K2
<b>CO2</b>	Demonstrate the level of glucose, Ascorbic acid, Lecithine	K1 & K2
<b>CO3</b>	Learn the isolation of compounds like starch, Glycogen etc	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 and estimation of Starch from Potato.
2. Isolation and estimation of DNA from liver
3. Estimation of RNA
4. Separation of Amino acids, Sugars by Paper Chromatography (Ascending, Descending and Circular).
5. Estimation of Calcium from milk by titrimetry.
6. Isolation of Lecithin from milk
7. Isolation of plasmid DNA
8. Isolation of Genomic DNA
9. Restriction digestion of DNA
10. Preparation of competent cell and Transformation



**REFERENCE BOOKS:**

1. Harold Varley, (1980). **Practical Clinical Biochemistry, Volume I and II**. 5<sup>th</sup> Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
3. Sadasivam S and Manickam P. (2005) **Biochemical Methods**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

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

Paper	: Core Biochemistry Practical II	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: <b>21P2BCP02</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Learn and understand the concepts of buffer, separation techniques of biomolecules.	K1 & K2
<b>CO2</b>	Demonstrate marker enzyme by kit method	K1 & K2
<b>CO3</b>	Optimize the enzyme activity in terms of pH, substrate, temperature, and enzyme concentration.	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

**Enzyme Studies:**

I. Sub cellular fractionation of organelles from liver cells and identification of beta glucuronidase

II. Kinetic studies of

Effect of pH, Temperature and Substrate concentration-MM Plot, V max )

1. Peroxidase
2. Amylase
3. Urease
4. Alanine Phosphatase
5. Acid Phosphatase (Effect of pH and Temp)
6. Catalase

III. Immobilised Enzyme Reactions

1. Immobilisation of peroxidase/Acid phosphatase by matrix entrapment, ionic and cross linking

IV. Separation of Isoenzymes

Seperation of LDH by SDS-PAGE

**REFERENCE BOOKS:**

1. Harold Varley, (1980). **Practical Clinical Biochemistry, Volume I and II.** 5<sup>th</sup> Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). **Laboratory Mannual in Biochemistry.** 2<sup>nd</sup> Edition .New Age International (P) Limited. New Delhi
3. Sadasivam S and Manickam P. (2005) **Biochemical Methods.** 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc., BIOCHEMISTRY  
YEAR I – SEMESTER I (2021-22)  
Core Practical - I**

Paper : Core Practical – I  
Examination : External  
Time : Six Hours  
Paper Code : 21P1BCP01 Maximum Marks : 60

**(Answer all the questions)**

1. a) Estimate the amount of glycogen present in the given unknown sample. (25 Marks)  
(Or)  
b) Estimate the amount of Sodium and Potassium by Flame photometry
  
2. a) Estimate the amount of Ascorbic acid from fruits (25 Marks)  
(Or)  
b) Separate the given mixture of amino acids by Paper Chromatography.

RECORD : 10

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc., BIOCHEMISTRY  
YEAR I – SEMESTER I (2021-22)  
Core Practical - II**

Paper : Core Practical – II  
Examination : External  
Time : Six Hours  
Paper Code : **21P1BCP02** Maximum Marks : 60

**(Answer all the questions)**

1. a) Determine the Effect of Temperature on the activity of Peroxidase (25 Marks)  
(Or)  
b) Determine the Effect of pH on the activity of Alanine phosphatase
  
2. a) Perform Immobilisation of peroxidase by matrix entrapment methods (25 Marks)  
(Or)  
b) Determine the Effect of Substrate concentration on the activity of Alkaline phosphatase

RECORD : 10

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

**PART – A (20X 1=20 marks)**

**Multiple Choice Question From each unit 4 Questions**

**PART – B (5 X 5 = 25 marks)**  
**Answer All Questions**

One Question from each unit with internal choice

**PART-C (3x10=30 marks)**

**Answer any three Questions**

One question from each unit

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)**

**MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER I (2021-22)  
CELLULAR BIOCHEMISTRY**

Paper	: Core Paper II		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: 21P1BC02	Maximum Marks :75	: 75

**Section A (Answer all the questions) (20x1=20)**

1	What are the chromosomes in eukaryotes cell	CO1	K1
	A Single chromosome		
	B Multiple chromosomes		
	C No chromosomes		
	D Double chromosome		
2	Which of the following transports only one kind of substrate?	CO4	K3
	A Uniport carriers		
	B Symport carriers		
	C Antiport carriers		
	D Membrane proteins		
3	Which one is the longest phase of cell cycle?	CO2	K3
	A Prophase		
	B Telophase		
	C G1-phase		
	D G2-phase		
4	Which of the following is energy independent?		
	A Active transport		
	B Primary active transport		
	C Secondary active transport		
	D Passive transport		
5	Which network of microtubules and microfilaments is classified as	CO2	K1
	A Endoplasmic skeleton		
	B Vertebral skeleton		
	C Active skeleton		
	D Cytoskeleton		
6	Which of the following is a microtubule organizing center?	CO3	K1
	A Centrosome		
	B Kinetochore		
	C G2 phase		
	D Centrioles		
7	Which of the following is not true for chromatin?	CO1	K3
	A Organized structure of DNA and protein		
	B These are highly condensed DNA		
	C It is found in the nucleus		
	D It contains a single dsDNA		
8	Which of these are not from plastid family?	CO3	K3
	A Chloroplast		
	B Tonoplast		
	C Chromoplast		
	D Leucoplast		
9	What is Protein kinase A	CO2	K2
	A Completely inhibited by cyclic AMP		
	B Allosterically activated by cyclic AMP		
	C Affected by cyclic AMP only under unusual circumstances		
	D Activated by covalent binding of cyclic AMP		
10	What are the enzyme activated by cyclic AMP	CO1	K2
	A Protein kinase B		
	B Protein kinase A		

	C	Protein kinase C	D	G protein receptor kinase		
11	What is Ras protein				CO3	K2
	A	G-protein switch	B	Small monomeric GTPase switch protein		
	C	Serine-threonine kinase	D	Tyrosine kinase		
12	Which is adhesion' molecules				CO5	K2
	A	The cadherin superfamily	B	Selectins		
	C	Integrin	D	All of above		
13	Which is cancer caused due to				CO1	K4
	A	Controlled mitosis	B	Uncontrolled mitosis		
	C	Controlled meiosis	D	Uncontrolled meiosis		
14	What are P <sup>53</sup> activated by				CO4	K4
	A	Phosphorylation	B	Dephosphorylation		
	C	Methylation	D	Carboxylation		
15	Which are cause cancer				CO4	K4
	A	Mutagen	B	Carcinogen		
	C	Oncogene	D	None of above		
16	Which of the following statement is correct				CO3	K4
	A	The levels of p53 in normal cell is high	B	DNA damage is due to low level of p53		
	C	The level of p53 in normal cell is low	D	High level of p53 in normal cell prevent apoptosis		
17	Which out of the following is not a mediated transport?				CO3	K5
	A	Facilitated diffusion	B	Primary active transport		
	C	Secondary active transport	D	Simple diffusion		
18	Which of the following is a microtubule organizing center?				CO4	K5
	A	Centrosome	B	Kinetochores		
	C	G2 phase	D	Centrioles		
19	Who discovered cell in 1665?				CO5	K5
	A	Robert Hook	B	Robert Crook		
	C	David Thomson	D	Marie Francois		
20	Which of the following is not a G-protein coupled receptor?				CO4	K5
	A	Glycine receptor	B	Adrenergic receptor		
	C	Glutamate receptor	D	Muscarinic receptor		
<b>Section B</b>						
<b>Answer All questions (5 x 5 = 25 )</b>						
21	A	Differentiate between prokaryote and eukaryote cells			CO3	K6
<b>OR</b>						
	B	What is cell cycle? discuss about the regulation of cell growth			CO2	K6



22	A	What is power house? briefly note on structure of mitochondrial	CO4	K5
		<b>OR</b>		
	B	Short a note on the structure of cytoskeleton	CO4	K5
23	A	Brief a note on TrkA signaling pathway and their significance	CO2	K2
		<b>OR</b>		
	B	Write a note on proteoglycans and its functions	CO2	K2
24	A	What is carcinogen? discuss about the chemical carcinogen	CO5	K3
		<b>OR</b>		
	B	What is tumor suppressor gene? significance of P53 gene	CO5	K3
25	A	Give a detailed account on ion channels transports	CO1	K1
		<b>OR</b>		
	B	What are cell surface carbohydrates? it's function	CO1	K1
<b>Section C</b>				
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>				
26		Brief a detailed note on mitosis cell division and significance		
27		Give a detailed account on how a protein undergoes change in ER.	CO3	K4
28		Write a detailed note on collagens and significance	CO1	K3
29		What is tumor suppressor gene? Brief a detailed note on P <sup>53</sup>	CO4	K5
30		Write a detailed note on fluid mosaic model	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
<b>Total</b>	<b>0</b>	<b>14</b>	<b>7</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>35</b>

**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
<b>Total</b>	<b>0</b>	<b>48</b>	<b>24</b>	<b>48</b>	<b>0</b>	<b>0</b>	<b>120</b>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER I  
BIOPOLYMERS**

Paper	: Core Paper I		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: 21P1BC01	Maximum Marks	: 75

**Section A (Answer all the questions) (20x1=20)**

1	The general formula of Carbohydrates is	CO1	K1
	A C <sub>n</sub> H <sub>2n</sub> O <sub>n</sub>	B C <sub>2n</sub> H <sub>2O</sub> <sub>n</sub>	
	C C <sub>n</sub> H <sub>2O</sub> <sub>2n</sub>	D C <sub>n</sub> H <sub>2n</sub> O <sub>2n</sub>	
2	The Keto sugar is	CO1	K1
	A Glycerose	B Ribulose	
	C Fructose	D Dihydroxyacetone	
3	Polysaccharides are	CO1	K1
	A Polymers	B Acids	
	C Proteins	D Oils	
4	The most important epimer of glucose is	CO1	K1
	A Galactose	B Fructose	
	C Arabinose	D Xylose	
5	A heteropolysaccharide among the following is	CO2	K2
	A Inulin	B Cellulose	
	C Heparin	D Dextrin	
6	An example of a saturated fatty acid is	CO2	K2
	A Palmitic acid	B Oleic acid	
	C Linoleic acid	D Erucic acid	
7	Molecular formula of cholesterol is	CO2	K2
	A C <sub>27</sub> H <sub>45</sub> OH	B C <sub>29</sub> H <sub>47</sub> OH	
	C C <sub>29</sub> H <sub>47</sub> OH	D C <sub>23</sub> H <sub>41</sub> OH	
8	Sphingomyelins	CO2	K2
	A Phospholipids	B Nitrolipids	
	C Alcohols	D None of these	
9	The end products of saponification	CO3	K3
	A glycerol	B acid	
	C soap	D Both (A) and (C)	
10	All proteins contain the	CO3	K3
	A Same 20 amino acids	B Different amino acids	

11	Sulphur containing amino acid is		CO3	K3
	A	Methionine	B	Leucine
	C	Valine	D	Asparagine
12	An essential amino acid in man is		CO3	K3
	A	Aspartate	B	Tyrosine
	C	Methionine	D	Serine
13	Which of the following is a dipeptide?		CO4	K4
	A	Anserine	B	Glutathionen
	C	Glucagon	D	$\beta$ -Lipoprotein
14	Vitamins are		CO4	K4
	A	Accessory food factors	B	Generally synthesized in the body
	C	Produced in endocrine glands	D	Proteins in nature
15	One manifestation of vitamin A deficiency is		CO4	K4
	A	Painful joints	B	Night blindness
	C	Loss of hair	D	Thickening of long bones
16	Vitamin K is found in		CO4	K4
	A	Green leafy plants	B	Meat
	C	Fish	D	Milk
17	In human body highest concentration of ascorbic acid is found in		CO5	K4
	A	Liver	B	Adrenal cortex
	C	Adrenal medulla	D	Spleen
18	A nucleoside consists of		CO5	K4
	A	Nitrogenous base	B	Purine or pyrimidine base + sugar
	C	Purine or pyrimidine base + phosphorous	D	Purine + pyrimidine base + sugar + phosphorous
19	RNA does not contain		CO5	K4
	A	Uracil	B	Adenine
	C	Thymine	D	Ribose
20	The major catabolic product of pyrimidines in human is		CO5	K4
	A	Alanine	B	Urea
	C	Uric acid	D	Guanine
<b>Section B</b>				
<b>Answer All questions (5 x 5 = 25)</b>				
21	A	Discuss about the Polysaccharides?	CO1	K1
<b>OR</b>				
	B	What are Proteoglycans? Explain	CO1	K1

22	A	Classify the Protein with examples	CO2	K2
		<b>OR</b>		
	B	Explain about the Ramachandran Plot?	CO2	K2
23	A	What are sterols? Explain about plant sterols	CO3	K3
		<b>OR</b>		
	B	Classify the Lipoproteins and explain its composition	CO3	K3
24	A	Write the structures of nucleotides	CO4	K4
		<b>OR</b>		
	B	Describe the DNA histone proteins?	CO4	K4
25	A	Explain about nucleic acid binding proteins?	CO5	K4
		<b>OR</b>		
	B	Write the biological properties of vitamins	CO5	K4
<b>Section C</b>				
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>				
26		Discuss briefly about bacterial cell wall polysaccharides?	CO1	K1
27		Explain about amino acid sequencing	CO2	K2
28		Explain the transport and hydrolysis of triglycerol ?	CO3	K3
29		Discuss the structure of nitrogenous bases?	CO4	K3
30		Explain the structure, requirement, deficiency and anti oxidant properties of water soluble vitamins?	CO5	K4

**TYPES OF SPECIFICATION (Question wise-no of questions)**

<b>Outcome / Unit</b>	<b>K1 (Remembering)</b>	<b>K2 (Understanding)</b>	<b>K3 (Applying)</b>	<b>K4 (Analyzing)</b>	<b>K5 (Evaluating)</b>	<b>K6 (Creating)</b>	<b>Total</b>
<b>I</b>	7	0	0	0	0	0	07
<b>II</b>	0	7	0	0	0	0	07
<b>III</b>	0	0	7	0	0	0	07
<b>IV</b>	0	0	1	6	0	0	07
<b>V</b>	0	0	0	7	0	0	07
<b>Total</b>	7	7	8	13	0	0	35

**TYPES OF SPECIFICATION (Marks wise-Total marks)**

<b>Outcome / Unit</b>	<b>K1 (Remembering)</b>	<b>K2 (Understanding)</b>	<b>K3 (Applying)</b>	<b>K4 (Analyzing)</b>	<b>K5 (Evaluating)</b>	<b>K6 (Creating)</b>	<b>Total</b>
<b>I</b>	24	0	0	0	0	0	24
<b>II</b>	0	24	0	0	0	0	24
<b>III</b>	0	0	24	0	0	0	24
<b>IV</b>	0	0	10	14	0	0	24
<b>V</b>	0	0	0	24	0	0	24
<b>Total</b>	24	24	34	38	0	0	120

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER I (2021-2022)  
ENZYMOLGY AND ENZYME TECHNOLOGY**

Paper	: Core Paper III	Section – A (20X1)	: 20
Examination	: External	Section – B (5X5)	: 25
Time	: Three Hours	Section – C (3X10)	: 30
Paper Code	: 21P1BC03	Maximum Marks	: 75
<b>Section A (Answer all the questions)</b>		<b>(20x1=20)</b>	

1	Noble prize for discovering enzyme was given to	CO1	K2
	A Fischer	B Altmann	
	C Fleming	D Buchner	
2	Esterases belongs to	CO1	K2
	A oxidoreductases	B carboxylases	
	C hydrolases	D transferases	
3	Ribozyme is	CO1	K2
	A RNA without sugar	B RNA without phosphate	
	C RNA have enzyme activity	D RNA with extra phosphate group	
4	Amount of enzyme transforming 1 $\mu$ mole of substrate per minute at 25 <sup>0</sup> C under optimal conditions of measurement is called	CO1	K2
	A Specific activity	B IU	
	C Catalytic center activity	D Enzyme purity	
5	An enzyme acts by	CO2	K2
	A Reducing activation energy	B Increasing activation energy	
	C Increasing reaction time	D Decreasing reaction time	
6	At temperature below the freezing point, an enzyme is	CO2	K2
	A Slightly activated	B killed	
	C inactivated	D unaffected	
7	When the action of the enzyme is inhibited in the presence of a substance which closely resembles the substrate molecule, then the inhibition is known as	CO2	K2
	A Feedback inhibition	B Non-competitive inhibition	
	C Allosteric inhibition	D Competitive inhibition	
8	Upon binding the substrate at one site, other sites on an enzyme become more reactive. This is called	CO2	K2
	A Allosteric inhibition	B Specificity	
	C Co-operativity	D Activation	
9	Activation or inactivation of certain he regulatory enzymes is accomplished by covalent modification of the amino acid	CO3	K3
	A tyrosine	B Phenyl alanine	
	C lysine	D Serine	
10	An enzyme which brings about lysis of bacterial cell wall is	CO3	K3
	A amylase	B lysozyme	
	C trypsin	D lipase	

11	The following are examples of nucleophile except		CO3	K3
	A	carbanion	B	Hydroxide ion
	C	imidazole	D	proton
12	Which of the following is not a component of coenzyme A		CO3	K3
	A	Adenylic acid	B	Pantothenic acid
	C	cystamine	D	Acetic acid
13	_____ is the enclosing of a droplet of solution of enzyme in a semipermeable membrane capsule by immobilization method		CO4	K3
	A	Entrapment	B	Encapsulation
	C	Cross-linking	D	Adsorption
14	The advantages of immobilized enzymes includes all except one. Identify it.		CO4	K3
	A	Saving in capital cost	B	More stability
	C	Minimum reaction time	D	Not reusable
15	During the functioning of biosensor, which of the following sequences of event occurs?		CO4	K3
	A	Enzyme reaction → detector → transducer	B	Enzyme reaction → transducer → detector
	C	Enzyme reaction → pressure guage → time	D	Enzyme reaction → vibrator → mechanical signal
16	The productivity of an enzyme when immobilized is		CO4	K3
	A	increased	B	decreased
	C	moderate	D	No change
17	The widely used enzyme in detergent making is		CO5	K4
	A	protease	B	Protease and amylase
	C	lipase	D	RNase
18	Invertase is widely used in		CO5	K4
	A	Detergent making	B	Confectionaries production
	C	Leather industry	D	Slatter house
19	Alkaline protease is used in		CO5	K4
	A	Leather industry	B	Food industry
	C	Detergent making	D	Dairy industry
20	The enzyme used to dissolve blood clot in coronary artery is		CO5	K4
	A	thrombokinase	B	renin
	C	streptokinase	D	tyrosinase
<b>Section B</b>				
<b>Answer All questions (5 x 5 = 25 )</b>				
21	A	Define active site and write about the properties of active site	CO1	K2
		OR		
	B	What are isoenzymes ? what are the properties of the same?	CO1	K2
22	A	Write a note on allosteric enzyme inhibition and its regulation.	CO2	K2
		OR		
	B	What are the factors affecting enzyme activity?	CO2	K2
23	A	Write a short note on acid base catalysis	CO3	K3



		OR		
	B	What are the coenzymic activity of tetrahydrofolate?	CO3	K3
24	A	What are the application of enzyme immobilization?	CO4	K3
		OR		
	B	Write in detail about the calorimetric biosensor and its application.	CO4	K3
25	A	Explain about the methods of homogenization.	CO5	K4
		OR		
	B	Discuss on enzyme application in diagnosis and textile industry.	CO5	K4
		<b>Section C</b> <b>Answer ANY THREE Questions (3 x 10 = 30)</b>		
26		Write in detail about nomenclature and classification of enzymes	CO1	K2
27		Write a detailed note on enzyme inhibition.	CO2	K2
28		What is the mechanism of action of lysozyme?	CO3	K3
29		Write a note on immunosensor.	CO4	K3
30		How enzymes are purified? Describe any one method.	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	7	0	0	0	7
V	0	0	0	7	0	0	7
<b>Total</b>	0	14	14	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	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	24	0	0	0	24
V	0	0	0	24	0	0	24
<b>Total</b>	0	48	48	24	0	0	120

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**(AUTONOMOUS)**  
**MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY**  
**YEAR I – SEMESTER I (2021-2022)**  
**ANALYTICAL BIOCHEMISTRY**

Paper : ELECTIVE I  
 Examination : External  
 Time : Three Hours  
 Paper Code : 21P1BCE01

Section – A (25X1) : 25  
 Section – B (5X5) : 25  
 Maximum Marks : 75

**Section A****Answer all Questions**

1	The blood pH maintains a		CO1	K2
	A	20:1 ratio $\text{HCO}_3^- : \text{H}_2\text{CO}_3$	B	20:1 ratio $\text{H}_2\text{CO}_3 : \text{HCO}_3^-$
	C	10:1 ratio $\text{HCO}_3^- : \text{H}_2\text{CO}_3$	D	10:1 ratio $\text{H}_2\text{CO}_3 : \text{HCO}_3^-$
2	The technique of performing a given procedure in a controlled environment, outside of a living organism		CO1	K2
	A	Invitro	B	Invivo
	C	Silico studies	D	Endocytosis
3	Reducing agent used for mammalian tissue homogenization is		CO1	K2
	A	Kcl	B	Sucrose
	C	Dithiothreitol d) NaOH	D	NaOH
4	In which method titanium carbide beads are used to rupture the cell wall		CO1	K2
	A	Bead mill disruption	B	Detergent solubilization
	C	Osmotic shock	D	High pressure Homogenizer
5	In paper chromatography, locating agent of amino acid is		CO2	K3
	A	Diazo reagent	B	Ninhydrin
	C	Ethidium bromide	D	Bromophenol Blue
6	Which of the following centrifugation is used to separate certain organelles from whole cell?		CO2	K3
	A	Rate-zonal centrifugation	B	Normal centrifugation
	C	Differential centrifugation	D	Isopycnic centrifugation
7	In the following electrophoresis, the separation of protein based upon isoelectric point is		CO2	K3
	A	Pulse field	B	Submarine
	C	Isoelectric focusing	D	Capillary
8	Pulse field gel electrophoresis was developed by _____		CO2	K3
	A	Collins and John	B	Kary Mullis
	C	Patrick O' Farrell	D	Schwartz and Cantor
9	In which of the following separation method where proteins are separated on the basis of their net charge		CO3	K3
	A	Affinity	B	adsorption
	C	Gel filtration	D	Ion Exchange

10	Retardation factor is the ratio of		CO3	K3
	A	Distance moved by substance from base line to distance moved by the solvent from base Line	B	Distance moved by solvent from base line to distance moved by the substance from base line
	C	Distance moved by substance from top line to distance moved by the solvent from top line	D	Distance moved by solvent from top line to distance moved by the substance from top line
11	The thin layer chromatography plate is made up of		CO3	K3
	A	Glass	B	wood
	C	Fiber	D	Metal
12	Which would be best to separate a protein that binds strongly to its substrate?		CO3	K3
	A	Gel filtration	B	Affinity chromatography
	C	Cation exchange	D	Anion exchange
13	In infrared spectroscopy which frequency range is known as the fingerprint region?		CO4	K4
	A	400 - 1400cm <sup>-1</sup>	B	1400 - 900cm <sup>-1</sup>
	C	900 - 600cm <sup>-1</sup>	D	600 - 250cm <sup>-1</sup>
14	Mass spectrometer use to determine isotopes in solid state is		CO4	K4
	A	Bohr's	B	Aston's
	C	dempester's	D	Alison's
15	Beer's Law states that		CO4	K4
	A	absorbance is proportional to both the path length and concentration of the absorbing species	B	absorbance is proportional to the log of the concentration of the absorbing species
	C	absorbance is equal to P <sub>0</sub> / P	D	none of the above
16	Where do we obtain the magnified image of the specimen in SEM?		CO4	K4
	A	Cathode ray tube	B	phosphorescent screen
	C	anode	D	scanning generator
17	X-ray diffractometers are not used to identify the physical properties of which of the following?		CO5	K5
	A	Metals	B	Liquids
	C	Polymeric materials	D	solids
18	When nuclear radiations pass through, gas ionization is produced.' This is the principle of which of the following detectors?		CO5	K5
	A	Proportional counter	B	Flow counter
	C	Geiger Muller counter	D	Scintillation counter

19	Liquid Scintillators are used for which of the following materials?		CO5	K5
	A	Low energy beta materials	B	High energy beta materials
	C	Low energy gamma materials	D	High energy gamma materials
20	Radioisotopes are commonly used in		CO5	K5
	A	Pharmacological studies	B	Molecular biology techniques
	C	Ecological studies	D	All the above
<b>Section B</b>				
<b>Answer All questions (5 x 5 = 25 )</b>				
21	A	Write a short note on biological buffers	CO1	K2
<b>OR</b>				
	B	Explicate organ and tissue slice techniques	CO1	K2
22	A	Write a short note density gradient centrifugation	CO2	K3
<b>OR</b>				
	B	Explicate capillary electrophoresis	CO2	K3
23	A	Describe molecular sieve chromatography	CO3	K3
<b>OR</b>				
	B	Explain affinity chromatography	CO3	K3
24	A	Explicate scanning electron microscope	CO4	K4
<b>OR</b>				
	B	Describe the instrumentation of NMR spectroscopy	CO4	K4
25	A	Write a short note on autoradiography and its applications	CO5	K5
<b>OR</b>				
	B	Explicate the working principle of solid scintillation counter	CO5	K5
<b>Section C</b>				
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>				
26		Write a brief note on invivo and invitro techniques	CO1	K2
27		Describe the principle, instrumentation and applications of SDS-PAGE electrophoresis	CO2	K3
28		Discuss the principle, instrumentation and applications of Gas-liquid chromatography	CO3	K3
29		Describe the principle, instrumentation and applications of Flame photometer	CO4	K4
30		Write a brief note on principle, theory of operation and applications of X-ray diffraction	CO5	K5

**TYPES OF SPECIFICATION (Question wise-no of questions)**

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

**TYPES OF SPECIFICATION (Marks wise-Total marks)**

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

**YEAR I – SEMESTER II**  
**INTERMEDIARY METABOLISM AND REGULATION**

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 6	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: <b>21P2BC04</b>	External	: 75

**SUBJECT DESCRIPTION:**

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

**OBJECTIVE:**

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

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Explore knowledge on biological oxidation, redox potential, ETC and mitochondrial shuttle mechanism.	K1 & K2
CO2	Demonstrate the important carbohydrate metabolic pathways and understand alternate pathways for glucose oxidation, anaerobic	K1 & K2
CO3	Highlight about types of fatty acid oxidation, biosynthesis of TGs, Phospholipids and prostaglandins and various regulatory mechanism involved. Understand the concepts of metabolism of	K1, K2 & K3
CO4	Describe the types and significance of anabolic and catabolic reactions of amino acids, interrelationship between carbohydrate, lipid & protein metabolism and understand the specialized products from amino acids.	K3 & K4
CO5	Demonstrate the fate of nucleic acids and porphyrins in the biological system.	K3 & K4

**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 – (15 Hrs.): Bioenergetics and Biological Oxidation:** Introduction, Free energy, laws of thermodynamics, Enzymes involved in redox reactions, Electron transport chain - organization and role in electron capture, Mechanism of Electron transport chain and oxidative phosphorylation, Chemiosmotic theory, Inhibitors of respiratory chain and oxidative phosphorylation, Uncouplers and Ionophores, Regulation of oxidative Phosphorylation, Mitochondrial transport systems - ATP/ADP exchange, malate / glycerophosphate shuttle.

**Unit II – (15 Hrs.): Carbohydrate Metabolism:** An overview of carbohydrate metabolism - glycolysis and gluconeogenesis, energetic - Regulation of glycolysis and gluconeogenesis, Metabolism of glycogen and its regulation, HMP shunt, TCA cycle steps and its regulation, glyoxalate pathway, Cori cycle, Anaplerotic reactions, Metabolism of fructose, galactose and mannose, Lactose and glycoprotein synthesis.

**Unit III – (15 Hrs.): Lipid Metabolism:** An overview of fatty acid metabolism - fatty acid synthesis and Regulation control of cetyl CoA carboxylase, Oxidation of saturated and unsaturated fatty acids, Oxidation of fatty acids with even and odd numbered carbon atoms, Alpha, beta and omega oxidation, biosynthesis and regulation of triacylglycerols, cholesterol, phosphatidyl choline, sphingomyelin, Biosynthesis and regulation of prostaglandins, Eicosanoids, thromboxanes and leucotriens, Ketogenesis and its control.

**Unit IV – (15 Hrs.): Amino acid Metabolism:** An overview of gamma glutamyl cycle, An overview- Methionine methyl donor (SMP pathway), Urea cycle and its regulation, Degradation of amino acids- transamination, decarboxylation, oxidative and non-oxidative deamination, Catabolism of amino acids- carbon skeleton of amino acids to amphibolic intermediates, Inter relationship between carbohydrates, proteins and fat metabolism, Conversion of amino acids to specialized products: Serotonin, GABA, dopamine, epinephrine, nor-epinephrine, melanin, creatinine and creatine.

**Unit V – (15 Hrs.): Porphyrin Metabolism:** Regulation, biosynthesis and degradation of Hb, chlorophyll and cytochrome, Nucleic acid metabolism - Biosynthesis and degradation of purine and pyrimidines (De novo and Salvage pathway), Regulation of Pyrimidine biosynthesis - aspartate carbomoyl transferase, Biosynthesis and degradation of porphyrin, formation, transport and excretion of bile pigment.

**TEXT BOOKS**

1. Nelson, David, L. and Cox, (2008). **Lehninger principles of Biochemistry**. 5<sup>th</sup> Edition, W.H. Freeman and Co., New York.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). **Fundamentals of Biochemistry**, 3<sup>rd</sup> Edition. John Wiley & Sons, New Jersey.
3. Lubert Stryer, (1995). **Biochemistry**. 4<sup>th</sup> Edition .WH freeman and co, Sanfrancisco.
4. Thomas, M. Devlin, (1997). **Text book of Biochemistry**. 4<sup>th</sup> Edition A John Wiley, Inc Publication, New York.

**REFERENCE BOOKS**

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

**WEB SOURCES**

- [www.britannica.com/science/glyoxylate-cycle](http://www.britannica.com/science/glyoxylate-cycle)  
<https://www.uic.edu/classes/phar/.../transaminationofaminoacid.htm>  
[www.slideshare.net/YESANNA/transamination-deamination](http://www.slideshare.net/YESANNA/transamination-deamination)



## MOLECULAR BIOLOGY

Paper : Core V  
 Hours/Week : 5  
 Credit : 5  
 Paper Code : 21P2BC05

Total Hours : 75  
 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	Illustrate the molecular mechanism of DNA replication in prokaryotes and eukaryotes and DNA repair mechanisms	K2
CO2	Explain the stages of transcription and post transcriptional processing	K3
CO3	Analyze the decoding process of mRNA for protein designing principle	K4
CO4	Formulate the protein targeting, transport, translocation and regulation of gene expression	K6
CO5	Categorize the different types of DNA recombination and mutation	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

### CONTENT:

**Unit I – (15 Hrs.): DNA Replication and DNA damage & repair mechanisms:** Types of replication, evidence for semi conservative replication, Meselson and Stahl experiment, replications in circular chromosomes - Cairns model, rolling circle model, Enzymology of Replication, Replication in prokaryotes and eukaryotes- inhibitors of replication. DNA damage - different types, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, recombination error and SOS repair.



**Unit II – (15 Hrs.): Transcription:** Prokaryotic RNA polymerase, Initiation of transcription, chain elongation, chain termination, Eukaryotic RNA polymerases, Conserved sequences of eukaryotic promoters, Transcriptional factors and basal eukaryotic transcription complex, Enhancers, Transcriptional termination in eukaryotes, Post transcriptional processing of Pre-mRNA – addition of Cap to the 5' end, Polyadenylation of the 3' end, RNA splicing and processing of Pre-mRNA, Inhibitors of transcription, Reverse transcription.

**Unit III – (15 Hrs.): Translation:** Genetic code - salient features of genetic code, structure of tRNA, activation of enzymes, binding of amino acids to tRNA, wobble mechanism and its significance, composition of prokaryotic and eukaryotic ribosomes, prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, translocation and termination, Inhibitors of protein synthesis, Post translational modification of proteins.

**Unit IV – (15 Hrs.): Protein Transport and Regulation of Gene Expression:** Protein targeting, translocation, heat shock proteins, glycosylation, SNAPs and SNAREs, bacterial signal sequences, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction, gene expression and regulations, molecular mechanism of regulation, prokaryotes - operon model, lac, trp, arabinose operons, repression and attenuation, eukaryotes - C value paradox, repetitive DNA, gene dosage and gene amplifications.

**Unit V – (15 Hrs.): DNA Recombination and Mutation:** Homologous recombination, Site specific recombination and DNA transposition. Types of mutation- Base substitution, insertion, deletion, inversion, duplication, translocation, mutagens.

### TEXT BOOKS

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

### REFERENCE BOOKS

1. David L. Nelson and Michael Cox, Lehninger Principles of Biochemistry, WH Freeman Publisher, 7th ed., 2017
2. Freifelder. D., Essentials of Molecular Biology, Jones and Bartlett Publications Inc., London 3rd Edition, 1998.
3. De Robertis E.D.P and E.M.F. De Robertis, Cell And Molecular Biology, Walters Kluwer Publisher, 8th ed., 2010.
4. Gerald Karp, Janet Iwasa and Wallace Marshall, Karp's Cell and Molecular Biology, Wiley Publisher, 9th ed., 2019.
5. Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick, Lewin's GENES XII, Jones and

Bartlett Publishers, 12th Revised edition, 2017.

### **WEB SOURCES**

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.nature.com/articles/nrm2008>

**PEDOGOGY: CHALK and Talk , PPT**

**ENDOCRINOLOGY**

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>21P2BCE04</b>	External	: 75

**SUBJECT DESCRIPTION:**

Endocrinology deal with the endocrine system of human body, mechanism of action on endocrine system and hormonal actions

**OBJECTIVE:**

To make the students understand clearly on various alimentary parts of human body. Learnt more the endocrinal activities, learn about the mechanisms and actions of vital organs.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Explain the hormones, neuroendocrine, hormone secretion, mechanism of hormone action I and II and also communication between the chemical messenger and endocrine system	K2
CO2	Illustrate the pituitary gland, hormones, pathology and their feedback mechanism	K3
CO3	Apply the knowledge of hormonal disease like thyroids hormones and their medication	K4
CO4	Describes the critical knowledge of synthesis, chemistry and action of	K5
CO5	Evaluate the male and female reproductive system, synthesis of hormones, pathology and also treated with infertility	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	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit I – (15 Hrs.): Hormones**-Introduction, hormones and homeostasis, neuroendocrine integration in homeostasis, Classes of chemical messengers, hormone secretion, transport and clearance, Feed back control of secretion, Mechanism of hormone action-Type I and II, Second messengers -postoglandine, Cytosolic hormone receptors, Eicosonoids and hormone action.

**Unit II – (15 Hrs.): Pituitary Hormones**-Anatomy of pituitary gland, hormones of the pituitary, pathophysiology, Endocrine hypothalamus- structure, hypophysiotropic hormones, control of hypothalamic hormone secretion, feedback mechanisms, mechanism of action, Neurohypophysis - Synthesis, chemistry and control of neurohypophyseal hormone secretion, mechanism of action

and pathophysiology of oxytocin, vasopressin, Somatotropins and somatomedins, Growth factors- neurotropic growth factors, hematopoietic growth factors.

**Unit III – (15 Hrs.): Thyroid and Parathyroid Gland-** Synthesis and chemistry of hormones, control of thyroid hormone secretion, circulation and metabolism, physiological function, mechanism of action, Physiological function of vitamin D, Pathophysiology, Mechanism of action of calcium homeostasis and pathophysiology. Melanotropic hormones- chemistry, functions of MSH, mechanism of action and pathophysiology, Pineal gland - melatonin, melatonin secretion and circulation, functions of pineal gland and mechanism of action.

**Unit IV – (15 Hrs.): Pancreas-** Endocrine pancreas, insulin, glucagons and somatostatin, Pancreatic peptide – chemistry, physiological function and mechanism of action, Pathophysiology, Catecholamines - synthesis, chemistry and metabolism, Neurohormones- endorphins-source, chemistry, control of secretion, physiological function, mechanism of action and pathophysiology.

**Unit V – (15 Hrs.): Reproductive Endocrinology-** Male and female reproductive system- source, chemistry, synthesis, metabolism of hormones, physiological function, mechanism of action and pathophysiology. Sex differentiation and development, endocrinology of pregnancy, parturition and lactation, puberty and hormone control, human infertility-reasons, therapy and treatment.

#### TEXT BOOKS

1. Murray, K.R., Granner, K.D., Mayes, P.A. and Rodwell, W.V. (2009) **Harper's Biochemistry**, 28<sup>th</sup> Ed, Appleton & Lange Stamford, Connecticut.
2. Guyton, A.C. and Hall, J.E (2006), **Textbook of Medical Physiology**, 11<sup>th</sup> Edition, Saunders Co. Pennsylvania.

#### REFERENCE BOOKS

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

#### WEB OF RESOURCE:

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

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER II**  
**IMMUNOLOGY AND IMMUNOTECHNOLOGY**

Paper : Core VI  
Hours/Week : 5  
Credit : 4  
Paper Code : 21P2BC06

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

**SUBJECT DESCRIPTION:**

Immunology and Immunotechnology deal with the immunity, cells and organs of immune system, mechanism of how immune cells act, to understand infectious diseases and interaction with the host's immune system.

**OBJECTIVE:**

To understand about immunity and its types, cells and organs, MHC and its significances and disorders and techniques in immune biology.

Course No	Course Outcome	Knowledge Level
CO1	To obtain the knowledge of the immune system is a host defense system comprising many biological structures and processes within an organism that protects against disease.	K1 & K2
CO2	To concentrate on the antigen and antibody reactions and immunological techniques.	K1 & K2
CO3	Understanding about the two branches of immune system such as humoral immunity and cellular immunity, cytokines and complement system.	K1, K2 & K3
CO4	Clear about the hypersensitivity reaction or intolerance with undesirable reactions produced by the normal immune system, including allergies and	K3 & K4
CO5	To obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (also called monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates an immune response.	K3 & K4

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit I – (15 Hrs.): Overview of Immunology and Cells and Organs of Immune system:** Historical perspective, Basic concepts of immunology-types of immunity-Innate and Adaptive Immunity, components of immune system, Cells of the Immune System, Hematopoiesis, Organs of Immune system –Primary and Secondary lymphoid organs. Phagocytosis

**Unit II – (15 Hrs.): Antigen and Antibodies:** Antigens, Haptens, Epitopes Cross-Reactivity, Properties of the immunogen, Adjuvants, Antibodies- Structure, theories of antibody formation, side chain and clonal selection theory, Antibody classification and Biological activities, MHC Antigen processing and presentation, Monoclonal Antibodies- Production and Application, cytokines, complement system

**Unit III – (15 Hrs.): Antigen –Antibody interactions:** Principles and Applications - Strength of Antigen-Antibody interactions, Cross-Reactivity, Precipitation reactions, Agglutination reactions, Radiimmunoassay, ELISA, Western Blotting, Immunofluorescence, Humoral immune response- B Cell maturation, activation, differentiation and proliferation, Cell mediated immune response - T-cell maturation, activation and differentiation, Hypersensitivity Types and clinical manifestations, Immunotolerance, autoimmune disorders - type I DM.

**Unit IV – (15 Hrs.): Pathophysiology of Immune System:** Immunology disorders- B cell deficiencies, T cell deficiencies, secondary immunodeficiency diseases – AIDS, HIV lifecycle, pathogenesis, immunological abnormalities, diagnosis and treatment, Transplantation immunology- allograft, typing – HLA typing and GVH reaction, organ transplantation and immune suppressive therapy

**Unit V – (15 Hrs.): Immune System in Disease:** Vaccines, Quantification of Antibody and Tumor Immunology, Isolation and characterization of immune cells, Macrophage culture and assay of macrophage activation, Tumor immunology - immune surveillance, tumor antigens, immune response to tumors, immunotherapy of tumors. Sars, mars, covid Benefits and adverse effects of vaccination, Recombinant Vaccines

**TEXT BOOKS**

1. Tizard (1984). **An Introduction Immunology:** Tizard K, Saunders college Publishing
2. Immunology Roitt. Brostoff and David (1998). **Immunology**, 4<sup>th</sup> Edition, Mosby Times Mirror Int Pub Ltd.
3. Kuby Richard, (2000). **Immunology**, 4<sup>th</sup> Edition, W.H. Freeman and Company, New York.
4. Janeway Jr. Paul., (2001). **The Immune System in Health and Disease.** Travels and Co.,

**REFERENCE BOOKS**

1. Kuby Richard, (2000). **Immunology**, 4<sup>th</sup> Edition, W.H. Freeman and Company, New York.
2. Stites D.P. Stobo, J.D. Fundanberg. H.A and Wells. J.V. (1990) **Basic and Clinical Immunology**. 6<sup>th</sup> Edition Los Atlas Lange.

**WEB OF REFERENCE:**

- [www.microbiologybook.org/mayer/ab-ag-rx.htm](http://www.microbiologybook.org/mayer/ab-ag-rx.htm)  
[www.ebi.ac.uk/interpro/potm/2005\\_2/Page1.htm](http://www.ebi.ac.uk/interpro/potm/2005_2/Page1.htm)  
[www.quickhack.net/](http://www.quickhack.net/)  
<https://www.sciencebasedmedicine.org/>

**PEDOGOGY: CHALK and Talk , PPT**

**PHARMACETICAL BIOCHEMISTRY AND TOXICOLOGY**

Paper	: Elective II	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 21P2BCE03	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:**

This course deals with the study of fundamental concepts of pharmacology about the physicochemical properties of the drug, their origin, classification and nomenclature of drugs, how do they act etc., It also enables the students to gain the complete knowledge about drug designing and also know about the principles of toxicology.

**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-1 - (15 Hrs ) General Pharmacology** Introduction to pharmacology, Sources of drugs, Classification and Nomenclature of drugs, Dosage forms, Routes of Drug administration, Factors

influencing dosage and drug action, Absorption of drugs and factors affecting absorption, Distribution of drugs, Factors affecting distribution, Bioavailability, Dose response relationship, ED50 and LD50. Combined effect of drugs.

**UNIT-II: - (15 Hrs ) Pharmacodynamics:** Mechanism of drug action: Theories of Receptors. Types of Receptors: Enzyme linked receptors, G-Protein coupled receptors, Ion-channel receptors, Nuclear receptors. Drug metabolism: pathway of drug metabolism, phase I and phase II reactions, Adverse drug reactions, Drug Interactions. Cytochrome P450 cycle, non- microsomal reactions of drug metabolism, drug metabolizing enzymes. Elimination of Drugs. Role of isomerism in drugs and its clinical significance.

**UNIT-III - (15 Hrs ) Drug design and Discovery:** Physicochemical factors in relation to biological activity of drugs: Hydrogen bonding, Ferguson principle, Ionisation and pKa value, steric features of drug, bioisosterism, Lipinski's rule of five, Concepts of drug designing and marketing, Molecular modeling, QSAR-Quantitative structure Activity Relationship, Drug targets.

**UNIT-IV - (15 Hrs ) Systemic Pharmacology:** Anticholinergic drugs, Diuretics and anti diuretics, Antiarrhythmic drugs, Anti hypertensive drugs, Antibacterial agents, Antiviral agents, anticancer agents, Antiulcer agents, Anaesthetics-General and Local, Tranquillizers, Anti histamines, Non steroidal Anti inflammatory drugs-NSAIDS, Sedatives ,Analgesics, Anti tussives.

**UNIT-V - (15 Hrs ) Toxicology:** Basic Principles of Toxicology: Toxicants and its types, Classification of Poisons, Sources of Poisoning, Factors affecting toxicity, Chemical food poisoning, Toxic effects of metals (Arsenic Lead, Mercury, Copper, Iron) and nonmetals (Phosphorus, Chlorine, Bromine, Iodine, Formaldehyde) Toxic effects of Poisonous plants (Abrus precatorius, Ricinus communis, Calotropis) Toxic effects of Cardiac poison (Oleanders, Nicotine, Aconite) Toxic Effects Caustics, Treatment and management of poisoning, Antidotes.

### TEXT BOOKS

1. Willam.O.Foye, (1995) **Principles of Medicinal Chemistry** 4<sup>th</sup>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** 5<sup>TH</sup> 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** 2<sup>nd</sup> Edition ak, Panima Publishers,



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

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

#### **WEB REFERENCES**

- 1.<https://www.msmanuals.com/professional/clinical-pharmacology/adverse-drug-reactions/adverse-drug-reactions>
2. <https://en.wikipedia.org/wiki/Pharmacodynamics>
3. <https://www.healthline.com/health/chemotherapy>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3560124/>

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

Paper	: Core Practical III	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: <b>21P3BCP03</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
CO1	Get an insight into estimation of chlorophyll, alkaloid, flavonoid from leaves results interpretation	K1 & K2
CO2	Get an insight into isolation of solanine, caffeine and its results identification	K1 & K2
CO3	Get an insight into plant tissue culture and its methods, Get an insight into extraction of pectin from orange peel and its results identifications	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

**I. PHYTOCHEMICAL ANALYSIS**

1. Qualitative analysis of secondary phytochemicals in medicinal plants
2. Estimation of chlorophyll in leaves
3. Extraction and confirmation
  - a. Pectin from orange peel
  - b. Caffeine from tea
  - c. Solanine from potato

**II. PLANT TISSUE CULTURE**

1. Sterilization and media preparation
2. Callus Induction and micro propagation
3. Isolation of protoplasts
4. Protoplast Culture
5. Anther culture

**III QUANTITATIVE ANALYSIS**

1. Estimation of total alkaloids
2. Estimation of total flavonoids

**REFERENCES**

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

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

Paper	: Core Practical IV	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 3	Internal	: 40
Paper Code	: <b>21P3BCP04</b>	External	: 60

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Learn and understand the methods of bleeding-Tail vein puncture, Intravenous, Retro orbital, cardiac vein puncture	K1 & K2
<b>CO2</b>	Demonstrate Rh typing and Identification of blood group	K1 & K2
<b>CO3</b>	Learn the Immunodiffusion –Single radial and double diffusion and Immuno electrophoresis – Counter Current immunoelectrophoresis	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. Preparation of serum and plasma from Blood
2. Identification of blood cells
3. Isolation of blood mononuclear cells.
4. Identification of blood group & Rh typing
5. Preparation of Blood antigens
6. Testing: Widal slide test and Pregnancy Test (Slide Test)
7. Immunodiffusion –Single radial and double diffusion
8. Immuno electrophoresis – Counter Current immunoelectrophoresis
9. C reactive protein

**REFERENCES**

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

International (P) Limited. New Delhi

4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2<sup>nd</sup> Edition. New Age

International (P) Limited. New Delhi.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER II (2021-22)  
Intermediary Metabolism And Regulation**

Paper	: Core Paper IV		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P2BC04</b>	Maximum Marks:	: 75

**Section A (Answer all the questions)**

1	<b>Study of relationship of energy and transformation of energy in living organisms is known as</b>	CO1	K2
	A Catabolic energetic	B Anabolic energetic	
	C Broken energetic	D Bioenergetics	
2	<b>Which out of the following has the highest redox potential?</b>	CO1	K2
	A NAD	B FMN	
	C FAD	D O <sub>2</sub>	
3	<b>Loss of hydrogen atoms from a molecule results in</b>	CO1	K2
	A Loss of electron	B Gain of electrons	
	C Gain of protons	D Gain of neutrons	
4	<b>Which one out of the following is not a NAD<sup>+</sup> requiring enzyme?</b>	CO1	K2
	A Lactate dehydrogenase	B Pyruvate dehydrogenase complex	
	C Maltate dehydrogenase	D Acyl co-A dehydrogenase	
5	<b>Which type of metabolic fuel is utilised for generating glucose under conditions of severe starvation?</b>	CO2	K3
	A Glycogen	B Fat	
	C Starch	D Amino acid	
6	<b>Simplest carbohydrate is ....</b>	CO2	K3
	A Dihydroxy acetone	B Glycerldehyde	
	C Glucose	D Gulose	
7	<b>The under mentioned compound is an acid mucopolysaccharide....</b>	CO2	K3
	A Dicumarol	B EDTA	
	C Hyaluronic acid	D Glycogen	
8	<b>The carrier of citric acid cycle is -----</b>	CO2	K3
	A Succinate	B Fumarate	
	C Malate	D Oxaloacetate	
9	<b>The key regulatory enzyme of cholesterol synthesis is -----</b>	CO3	K3
	A HMG Co A synthase	B HMG Co A lyase	

	C	HMG Co A reductase	D	Mevolanate kinase		
10	<b>The dietary fat are transported as -----</b>				CO3	K3
	A	Micelles	B	Chylomicrons		
	C	Fatty acid albumin complex	D	Liposomes		
11	<b>Which of the following is not used for fatty acid synthesis?</b>				CO3	K3
	A	Cobalamine	B	NADPH		
	C	Biotin	D	Bicarbonate		
12	<b>The key enzyme for the utilization of ketone bodies is -----</b>				CO3	K3
	A	Thiolase	B	Thiophorase		
	C	Thiokinase	D	Thioesterase		
13	<b>3-phosphoglycerate is not the metabolic precursor for</b>				CO4	K4
	A	Serine	B	Glycine		
	C	Cysteine	D	Arginine		
14	<b>The cyclized derivative of glutamate is</b>				CO4	K4
	A	Proline	B	Arginine		
	C	Glutamine	D	Serine		
15	<b>pyrophosphate is a precursor of tryptophan an</b>				CO4	K4
	A	Tyrosine	B	Histidine		
	C	Phenylalanine	D	Isoleucine		
16	<b>Which of the following is not an aromatic amino acid?</b>				CO4	K4
	A	Phenylalanine	B	Tyrosine		
	C	Tryptophan	D	Leucine		
17	<b>Acquired porphyria is due to -----</b>				CO5	K3
	A	Hg	B	Pb		
	C	Cu	D	Sn		
18	<b>Heme synthesis happens in -----condition and is expressed as</b>				CO5	K4
	A	Cytoplasm	B	Mitochondria		
	C	Both	D	None		
19	<b>Which is not a hemoprotein?</b>				CO5	K4
	A	Catalase	B	Tryptophan pyrrolase		
	C	Neuroglobin	D	Adenylate kinase		
20	<b>Single letter code of pyrrolysine is -----</b>				CO5	K4
	A	B	B	J		
	C	O	D	U		
<b>PART B</b>						
<b>Answer ALL Questions(5 X 5 = 25 Marks)</b>						
21	A	Write a short notes on high energy phosphate			CO1	K2

		<b>OR</b>		
	B	Describe malate-Asparatate shuttle system.	CO1	K2
22	A	Explain the energetic of Glycolysis	CO2	K3
		<b>OR</b>		
	B	Give a note on Glyoxalate pathway	CO2	K3
23	A	Explain alpha oxidation of Fattyacid	CO3	K3
		<b>OR</b>		
	B	Write the synthesis of TAG and phosphatidyl choline	CO3	K3
24	A	Explain transamination and decarboxylation	CO4	K4
		<b>OR</b>		
	B	Describe the synthesis of epinephrine and nor epinephrine	CO4	K4
25	A	Write a notes on biosynthesis of Hb	CO5	K4
		<b>OR</b>		
	B	Write about the regulation of pyrimidine biosynthesis	CO5	K4
		<b>Section C</b>		
		<b>Answer ANY THREE Questions (3 x 10 = 30)</b>		
26		Write a short notes on oxidative phosphorylation	CO1	K2
27		TCA cycle and its regulation	CO2	K3
28		Write about beta oxidation of palmitic acid and calculate the energetics	CO3	K3
29		Describe Urea cycle and its regulation	CO4	K4
30		Describe about denovo synthesis of purines	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	5	0	0	0	0	05
II	0	0	7	0	0	0	07
III	0	0	7	0	0	0	07
IV	0	0	01	6	0	0	07
V	0	0	0	0	7	0	07
<b>Total</b>	0	5	15	6	7	0	33

#### 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	0	24	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



<b>Total</b>	0	24	48	48	0	0	120
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**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**(AUTONOMOUS)**  
**MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY**  
**YEAR I – SEMESTER II (2021-22)**  
**Molecular Biology**

Paper	: Core Paper V		
Examination	: External	Section – A (25X5)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P2BC05</b>	Maximum Marks:	: 75

**Section A (Answer all the questions)      20\*1=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 lagging strand synthesis of DNA replication, the synthesized DNA fragments are known as	CO1	K2
	A Okazaki fragments	B Complementary DNA	
	C Primer	D Primed-DNA Template	
3	Name the protein, which is used for termination of replication?	CO1	K2
	A DnaC	B SSB	
	C Tus protein	D DNA polymerase	
4	The DNA polymerase involved in base excision repair is	CO1	K2
	A DNA polymerase $\alpha$	B DNA polymerase $\beta$	
	C DNA polymerase $\sigma$	D DNA polymerase $\gamma$	
5	In prokaryotes, transcription is	CO2	K3
	A terminated by the stop codon	B terminated by a protein called rho	
	C terminated by a poly A sequence	D terminated by a start codon	
6	In eukaryotes, there are three different RNA polymerases. The RNA polymerase responsible for transcription of mRNA is	CO2	K3
	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	K3

	A	Splicing	B	capping		
	C	polyadenylation	D	replication		
8	The largest class of introns which are found in nuclear mRNA primary transcript is				CO2	K3
	A	Spliceosomal introns	B	Group I introns		
	C	Group II introns	D	Group IV introns		
9	During translation, the role of enzyme peptidyl transferase is				CO3	K4
	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	K4
	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	K4
	A	RF3	B	RF2		
	C	RF1	D	eRF		
12	Which of the following is not a type of post translational modification?				CO3	K4
	A	Proteolysis	B	Protein folding		
	C	Glycosylation	D	Lipid addition		
13	Which of the following acts as the inducer of lac operon is?				CO4	K6
	A	Glucose	B	lactose		
	C	galactose	D	Allolactose		
14	The gene product of lacA gene in lac operon is				CO4	K6
	A	$\beta$ -galactoside permease	B	$\beta$ -galactoside isomerase		
	C	$\beta$ -galactosidase	D	$\beta$ -galactoside		
15	How many amino acid residues are there in ubiquitin?				CO4	K6
	A	72	B	73		
	C	75	D	76		
16	Secretory proteins are synthesized by				CO4	K6
	A	Ribosomes on the nuclear membrane	B	Ribosomes on endoplasmic reticulum		

	C	Free ribosomes	D	None of the mentioned		
17	Recombinational repair is often due to				CO5	K5
	A	Incorporation of many incorrect nucleotides by DNA pol	B	Many cystidine dimer and associated large gaps in a strand		
	C	Many thymidine dimer formation and associated large gaps in a strand	D	All of the above		
18	Why recombinational repair system is called double strand break repair?				CO5	K5
	A	Both strands are broken	B	One strand is broken		
	C	No strand is broken	D	Both strand act ss template		
19	Addition or deletion of bases causes which kind of mutation?				CO5	K5
	A	Transversion	B	Frameshift mutation		
	C	Transition	D	Transcription		
20	Name the type of mutation in which the cause of mutation is not known?				CO5	K5
	A	Spontaneous mutation	B	Suppressor mutation		
	C	Nonsense mutation	D	Mis-sense mutation		
<b>Section B</b>						
<b>Answer All questions (5 x 5 = 25 )</b>						
21	A	Illustrate semi conservative replication and experimental proof			CO1	K2
		<b>OR</b>				
	B	Explicate SOS repair			CO1	K2
22	A	Write a note on inhibitors of transcription			CO2	K3
		<b>OR</b>				
	B	Explicate splicing mechanism of group I introns			CO2	K3
23	A	Describe genetic code and its features			CO3	K4
		<b>OR</b>				
	B	What is wobble hypothesis? How is it used in genetic code?			CO3	K4
24	A	Illustrate arabinose operon			CO4	K6
		<b>OR</b>				

	B	Narrate protein targeting and translocation	CO4	K6
25	A	Describe site specific recombination	CO5	K5
<b>OR</b>				
	B	Describe the holiday model of recombination	CO5	K5
<b>Section C</b> <b>Answer ANY THREE Questions (3 x 10 = 30)</b>				
26		Describe briefly about mechanism of prokaryotic replication	CO1	K2
27		Describe the mechanism of initiation, elongation and termination of transcription in Prokaryotes	CO2	K3
28		Describe briefly about the mechanism of translation in prokaryotes	CO3	K4
29		Explicate positive and negative regulation mechanism of Trp operon	CO4	K6
30		Write a brief note on types of mutation	CO5	K5

**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	0	7	0	0	0	07
III	0	0	0	7	0	0	07
IV	0	0	0	7	0	7	07
V	0	0	0	0	7	0	07
<b>Total</b>	0	7	7	7	7	7	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	0	24	0	0	0	24
III	0	0	0	24	0	0	24
IV	0	0	0	0	0	24	24
V	0	0	0	0	24	0	24
<b>Total</b>	0	24	24	24	24	24	120

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER II (2021-22)  
Endocrinology**

Paper : ELECTIVE IV  
Examination : External  
Time : Three Hours  
Paper Code : 21P2BCE04

Section – A (25X1) : 25  
Section – B (5X5) : 25  
Maximum Marks : 75 : 75

**Answer All Questions****20X1= 20**

1	Which cells produce insulin?		Unit – IV	K1	CO-1
	A	Alpha cells	B	Beta cells	
	C	Delta cells	D	F cells	
2	Where is Pancreas located?		Unit – IV	K2	CO-1
	A	Below stomach	B	In-between stomach and liver	
	C	Behind the stomach	D	Above the stomach	
3	What does pancreas make?		Unit – IV	K2	CO-1
	A	Enzymes	B	Carbohydrates	
	C	Fats	D	Muscles	
4	Which among the following is structural and functional unit of a kidney?		Unit – IV	K1	CO-1
	A	Nephron	B	Neuron	
	C	Urethra	D	Henle's loop	
5	DNA and histones are collectively called as ?		Unit – I	K2	CO-3
	A	Chromosomes	B	Chromatin	
	C	Centromere	D	Loci	
6	Which type of epithelium is found in thyroid follicles?		Unit – III	K1	CO-2
	A	Squamous	B	Cuboidal	
	C	Transitional	D	Columnar	
7	What hormone does the parathyroid produce?		Unit – III	K2	CO-3
	A	Calcitonin	B	PTH	
	C	PFH	D	Insulin	
8	How many parathyroid glands are present?		Unit – III	K1	CO-1
	A	4	B	3	
	C	2	D	1	
9	Which cells produce calcitonin?		Unit – III	K2	CO-2
	A	C cells	B	B cells	
	C	A cells	D	T cells	
10	Where are parathyroid glands present?		Unit – I	K2	CO-3

	A	Posterior surface of lateral lobes of thyroid	B	Posterior to stomach			
	C	On top of kidneys	D	Upper chest under breastbone			
11	Which of the following is an energy source for the sperm?				Unit – II	K2	CO-3
	A	Somatostatin	B	Prostaglandin			
	C	Proteins	D	Fructose			
12	Which of the following produces the male sex hormone?				Unit – V	K2	CO-3
	A	Rete testis	B	Seminiferous tubule			
	C	Leydig cell	D	Scrotum			
13	Which hormone possesses anti-insulin effect?				Unit – V	K2	CO-3
	A	Cortisol	B	Calcitonin			
	C	Oxytocin	D	Aldosterone			
14	Which hormone stimulates the secretion of milk from female?				Unit – II	K2	CO-3
	A	Oxytocin	B	Progesterone			
	C	LH	D	Prolactin			
15	Which gland secretes odorous secretion in mammals?				Unit – I	K3	CO-2
	A	a) bartholins	B	Prostate			
	C	Anal gland	D	Liver.			
16	Which of the following is the common passage for bile and pancreatic juice?				Unit – II	K3	CO-2
	A	Duct of oddi	B	Ampulla			
	C	Stomach	D	Duct of Wirsung			
17	Which of these is not an endocrine property?				Unit – V	K3	CO-2
	A	Hormones reach targets through the blood	B	Effects are slow and cyclic			
	C	Rapid acting effects	D	Effects caused by chemicals			
18	Which of these is not an endocrine gland?				Unit – V	K3	CO-2
	A	Pancreas	B	Testes			
	C	Salivary gland	D	Parathyroid			
19	Which of the following is Growth hormone inhibiting hormone?				Unit – II	K3	CO-2
	A	FSH	B	TRH			
	C	GHRH	D	Somatostatin			
20	What do delta cells secrete?				Unit – I	K3	CO-2
	A	Cortisol	B	Glucose			
	C	Pancreatic enzyme	D	Somatostatin			

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



21	A	Discuss the thyroid hormone and their pathology	Unit – III	K6	CO-5
		<b>OR</b>			
	B	Evaluate the pancreas hormone and their pathology	Unit – IV	K6	CO-4
22	A	Discuss the interrelationship between insulin and glucagons?	Unit – IV	K6	CO-4
		<b>OR</b>			
	B	Evaluate the Pineal gland and their pathology	Unit – III	K5	CO-2
23	A	Explain the Cytosolic hormone receptors	Unit – I		
		<b>OR</b>			
	B	Elaborate the Classes of chemical messengers	Unit – I	K6	CO-4
24	A	Draw the structure of pituitary gland and its function	Unit – II	K6	CO-4
		<b>OR</b>			
	B	Discusses the mechanism of growth factors	Unit – II	K5	CO-2
25	A	Brief notes on human infertility	Unit – V	K5	CO-2
		<b>OR</b>			
	B	Draw the structure of male reproductive system and its function	Unit – V	K6	CO-4

**Section C**  
**Answer ALL Questions (3x 10 = 30)**

26		Explain the interrelationship between calcium, vitamin D and K and physiology functions	Unit – III	K5	CO-4
27		Elaborate the catecholamines neurotransmitters and their functions	Unit – IV	K4	CO-6
28		Brief notes on Mechanism of hormone action-Type I and II	Unit – I	K5	CO-6
29		Explain the Endocrine hypothalamus	Unit – II	K4	CO-4
30		Discusses the menstruation cycle	Unit – V	K5	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
<b>Total</b>	<b>0</b>	<b>14</b>	<b>7</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>35</b>

**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
<b>Total</b>	<b>0</b>	<b>48</b>	<b>24</b>	<b>48</b>	<b>0</b>	<b>0</b>	<b>120</b>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)**

**MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY**

**YEAR I – SEMESTER II (2021-22)**

**Immunology and Immunotechnology**

Paper	: Core Paper VI		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P2BC06</b>	Maximum Marks : 75	: 75

**Section A**

**Answer all questions (10 x 1 = 10)**

1	What Immunity acquired after an infection is		K1	CO-1
	A	Active immunity	B	Passive immunity
	C	Innate immunity	D	Both B and C
2	Which one engulfs foreign materials		K1	CO-1
	A	Macrophages	B	Plasma cells
	C	Mast cells	D	Lymphocytes
3	Which one helps in differentiation of cells of immune system		K1	CO-1
	A	Cortisol	B	Thymosin
	C	Steroid	D	Thyroxine.
4	Which of the following does <b>not</b> protect body surfaces:		K1	CO-1
	A	Skin.	B	Mucus.
	C	Salivary amylase	D	Gastric acid.
5	Which of the following statements about monoclonal antibody production is true?		K2	CO-2
	A	B cell+hybridoma -> myeloma	B	B cell + myeloma -> hybridoma
	C	B cell + spleen cell -> hybridoma	D	T cell + hybridoma -> myeloma
6	Which of the following interleukin activates eosinophil that consists of FcR for IgE?		K2	CO-2
	A	IL-1	B	IL-2
	C	IL-4	D	IL-5
7	Which of the following is a hapten		K2	CO-2
	A	cyanide	B	penicillin
	C	paracetamol	D	None of the above
8	Which of the following is NOT true regarding effective immunogens?		K2	CO-2
	A	Foreign to the host	B	Fairly large (molecular weight > 6000)
	C	Chemically complex	D	Requires a carrier-conjugate to cause the generation of antibodies

9	Which of the following statement is true regarding Fc region		K2	CO-3
	A	Fragment crystallisation and is the constant region	B	Fragment constant and is the variable region
	C	Fragment crystallisation and is the variable region	D	Fragment crystallisation and has both variable and constant region
10	Which of these autoimmune diseases can be cured?		K3	CO-3
	A	Lupus	B	Multiple sclerosis
	C	Scleroderma	D	None of the above
11.	Which of the following molecule can be detected by ELISA?		K4	CO-3
	A	proteins	B	hormones
	C	antibodies	D	all of the above
12.	What kind of microscope slide should be used in preparation for immunofluorescence staining?		K4	CO-3
	A	Plain glass slide	B	Monospot slide
	C	Any kind of slide	D	Glass slide frosted on both sides
13.	Which of the following immune cells/molecules are most effective at destroying intracellular pathogens?		K4	CO-4
	A	T helper cells	B	B cells
	C	Antibodies	D	T cytolytic cells
14.	What is the name of MHC in humans?		K4	CO-4
	A	HLA	B	H2
	C	Adjuvants	D	Haplotype
15.	Which MHC molecule recognizes CD8 TC cells?		K5	CO-4
	A	MHC I	B	MHC II
	C	MHC III	D	HLA-C
16.	Which hypersensitivity reactions are T cell mediated?		K5	CO-4
	A	Type I	B	Type II
	C	Type III	D	Type IV
17.	Which of the following animal was the material isolated which was used for the vaccination for the first time?		K3	CO-5
	A	cat	B	goat
	C	cow	D	pig
18.	Which viral disease, vaccine has been recently developed through the use of tissue culture?		K3	CO-5
	A	Measles	B	Mumps
	C	Rabies	D	Small pox

19.	An example of a known oncogenic virus is		K2	CO-5
	A	Herpes zoster.	B	HIV-2
	C	Epstein-Barr virus.	D	Vesicular stomatitis virus.
20.	Which of the following is a non-organ-specific autoimmune disease:		K3	CO-5
	A	Myasthenia gravis.	B	Systemic lupus erythematosus
	C	Hashimoto's thyroiditis.	D	Pernicious anemia.
11	A	Outline of the innate immunity?	K2	CO-1
	<b>OR</b>			
	B	Summarize the haematopoiesis.?	K2	CO-1
12.	A.	Explain about structure and properties of antibody?	K2	CO2
	OR			
	B.	Explain about properties of immunogen?	K2	CO2
13.	A.	Distinuguish the T –cell maturation and B-cellmaturation?	K4	CO3
	OR			
	B.	Discuss about Immunofluorescence?	K4	Co3
14.	A.	Discuss about allograft?	K4	CO4
	OR			
	B.	Explain about HLA-Typing	K2	Co4
15.	A	Outline of the Tumor antigen?	K2	CO5
	OR			
	B.	Discuss about Vaccines?	K4	Co5
<b><u>Section C</u></b>				
<b><u>Answer ANY THREE Questions (3 x 10 = 30)</u></b>				
16.	A.	Explain about classification of types of immunity?	K3	CO-4
	OR			
	B.	Explain about classification of immune response?	K3	CO-3
17.	A.	Explain about production and application of monoclonal antibodies?	K3	CO4
	OR			
	B.	Explain about Structure and theories of antibody formation?	K3	CO4

18	A.	Detailed account on Principles and application of Antigen & Antibody interaction?	K2	CO3
	B.	Explain about differentiation and proliferation and activation of B cell maturation?	K3	CO3
<b>OR</b>				
19.	A.	Explain about Secondary immune deficiency diseases?	K3	CO4
<b>OR</b>				
	B.	Illustrate the organ transplantation of immune suppressive therapy?	K4	CO4
20.	A.	Evaluate the isolation and characterization of immune cells?	K5	CO5
	B.	Explain about immune surveillance and tumor antigens.?	K3	CO5

**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	04	04	02	0	0	0	10
II	0	06	02	0	0	0	08
III	0	02	02	4	0	0	08
IV	0	01	01	0	0	0	02
V	0	02	04	01	01	0	08
<b>TOTAL</b>	04	15	11	05	01	0	36

**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	04	10	20	0	0	0	34
II	00	14	20	0	0	0	34
III	00	06	11	12	0	0	29
IV	00	05	10	0	0	0	15
V	00	06	13	05	10	0	34
<b>TOTAL</b>	04	41	74	17	10	0	166

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR I – SEMESTER II (2021-22)  
Plant Biochemistry and Plant Biotechnology**

Paper	: Elective – II		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: 21P1BCE02	Maximum Marks : 75	: 75

**Section A (Answer all the questions)**

- 1. Which one of the following is a product of both cyclic and non cyclic photophosphorylation?**  
a) NADPH b) O<sub>2</sub> c) ATP d) Carbohydrate
- 2. Which of the following is the reduced form of a temporary electron carrier molecule?**  
a) FADH<sub>2</sub> b) ATP c) NADP<sup>+</sup> d) CO<sub>2</sub>
- 3. NADP<sup>+</sup> is reduced to NADPH during**  
a) Light dependent reactions b) photorespiration c) calvin cycle d) none of these
- 4. Autophosphorylation is done on**  
a) His residues b) Ser/ Thr residues c) Lys residues d) Thr residues
- 5. Transcription factor in plants is**  
a) Serine b) Therein c) WRKY/22/29 D) Leucine
- 6. A factor involved in regulating the fate of stem cells in plant development**  
a) Adrenaline b) Epinephrine c) Thyroid stimulating hormone d) CLVI
- 7. Transpiration can be influenced by interfering with**  
a) Guard cell b) Epidermis c) Osmotic pressure d) Atmospheric temperature
- 8. Which of the following statements is not true for stomatal apparatus**  
a) Guard Cells invariably posses chloroplast and mitochondria b) Inner wall of guard cell are thick c) Stomata are involved in gaseous exchange d) Guard cells are always surrounded by subsidiary cells
- 9. Plants absorbs N<sub>2</sub> in the form of**  
a) Nitrites (NO<sub>2</sub><sup>-</sup>) b) nitrates (NO<sub>3</sub><sup>-</sup>) c) ammonium (NH<sub>4</sub><sup>+</sup>) d) all of the above
- 10. The conversion of nitrogen to ammonia nitrogenous compounds is called as**  
a) Nitrogen assimilation b) Nitrogen fixation c) Denitrification d) Nitrification
- 11. Symbiotic N<sub>2</sub> Fixing Cyanobacteria are present in all except**  
a) Anthoceros b) Azolla c) Cycas d) Gnetum
- 12. Conversion of NO<sub>2</sub> to NO<sub>3</sub> is carried out by**  
a) Nitrosomonas b) Nitrosococcus c) Nitrobacteria d) Clostridium
- 13. Genes of chromosome consists of**  
a) Genesis b) dominant genesis c) DNA d) alleles
- 14. Chromosomes are made up of special material of protein called**  
a) Cytosine b) thymine c) chromatin d) adenine
- 15. If BP is a gene pair of individual then alleles for this gene pair are**  
a) A & B b) a & b c) a & A d) b & B
- 16. Two chromosomes in pair are classified as**  
a) Heterologous chromosomes b) homologous chromosomes c) homozygous chromosomes d) heterozygous
- 17. Cellular totipotency is the property of**  
a) Plants b) animals c) bacteria d) all of these

**18. Subculturing is similar to propagation by cutting because**

- a) It separates multiple microshoots and places them in a medium
- b) It uses scions to produce new microshoots
- c) They both use in vitro growing conditions
- d) All of the above

**19. What are the benefit(s) of micro propagation or clonal propagation**

- a) Rapid multiplication of superior clones
- b) Multiplication of disease free plants
- c) Multiplication of sexually derived sterile hybrids
- d) All of the above

**20. Protoplasts can be produced from suspension culture, callus tissues or intact tissues by enzymatic treatment with**

- a) Cellulolytic enzymes
- b) Pectolytic enzymes
- c) Both cellulolytic & pectolytic enzymes
- d) Pectolytic enzymes

**Section B (Answer all the questions)**

21. a) Photosynthetic apparatus (Or)

b) Write a note on photosystem

22. a) Hatch-Slack pathway (Or)

b) Write a note on starch biosynthesis

23. a) Describe the biochemistry of nitrogen fixation (Or)

b) Explain the interaction between nitrate assimilation and carbon metabolism

24. a) Write about organization of plant chromatin (Or)

b) List out the advantages and uses of transgenic plants

25. a) Write a short note on media preparation (Or)

b) Write the uses of haploids in plant breeding

**Section-C (Answer any 3 Questions)**

26. Write in detail about photosynthetic pigment

27. Write a short note on photorespiration

28. Explain the mechanism of symbiotic nitrogen fixation in legumes

29. Write in detail about development of chloroplast

30. Write a short note on somoclonal variation

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc., BIOCHEMISTRY  
YEAR I – SEMESTER II (2021-22)  
Core Practical - III**

Paper : Core Practical – III  
Examination : External  
Time : Six Hours  
Paper Code : **21P2BCP03** Maximum Marks : 60

**(Answer all the questions)**

1. a) Estimate the amount of chlorophyll from plant leave extracts. (25 Marks)  
(Or)

b) Estimate the amount of total alkaloids

2. a) Estimate the amount of Coffeine from Tea (25 Marks)

(Or)

b) Determine the amount of alkaloids from lemon oil.

RECORD : 05

VIVA : 05



**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc., BIOCHEMISTRY  
YEAR I – SEMESTER II (2018-19)  
Core Practical - IV**

Paper : Core Practical – IV  
Examination : External  
Time : Six Hours  
Paper Code : **21P2BCP04** Maximum Marks : 60

**(Answer all the questions)**

1. a) Estimate the amount of DNA from Diphenylamine method (25 Marks)  
(Or)  
b) Estimate the amount of RNA by orcinol method
2. a) Determine Restriction digestion of DNA (25 Marks)  
(Or)  
b) Isolate the genomic DNA from give unknown sample

RECORD : 10

**YEAR II – SEMESTER III**  
**ADVANCED CLINICAL BIOCHEMISTRY**

Paper : Core VII  
Hours/Week : 5  
Credit : 4  
Paper Code : 21P3BC07

Total Hours : 75  
Exam Hours : 03  
Internal : 25  
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 basic principles and practices of clinical laboratory-Automation, Laboratory safety	K1 & K2
CO2	Execute disorders of carbohydrate metabolism and lipid metabolism	K3
CO3	Distinguish about disorders of aminoacids and nucleic acid metabolism	K4
CO4	Interpret the Renal function test, Liver function test, Gastric function test, Cerebrospinal fluid	K3 & K4
CO5	Categorize Porphyria, porphyrinuria and Disorders of erythrocyte metabolism	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

**CONTENT:**

**Unit I – (15 Hrs.): Basic principles and practices of clinical laboratory:** Collection of specimens – Blood, Urine, CSF, Amniotic fluids. Laboratory safety –first aid in laboratory accident, Toxic chemicals and biohazards, Automation in clinical laboratory – Precision, Quality assurance, clinical validation. Automation and computerization water and electrolytes homeostatis.

**Unit II – (15 Hrs.): Disorders of carbohydrate and lipid metabolism** (Hyperglycemia and Hypoglycemia): Diabetes Mellitus, Diabetes incipitus, Renal Threshold Value, Insulin receptors Glycogen storage disease, Mucopolysaccharidosis, Lipids and lipoprotein abnormalities - Lipidosis, hypercholesterolemia, Plasma lipoproteins – albuminuria Taysach’s and Niemann picks diseases, Atherosclerosis.

**Unit III – (15 Hrs.): Disorders of aminoacids metabolism:** Inborn errors of Branched chain amino acids- Maple Syrup Disease, Aromatic amino acids-Alkaptunuria, Tyrosinaemia, Aliphatic amino acids, Disorders of

Purine and Pyrimidine metabolism-Gout, Lesch Nyhan syndrome.

**Unit IV – (15 Hrs.): Clinical Tests:** Renal function test - Osmolarity and free water clearance, acute and chronic renal failure, nephritic syndrome, dialysis, Liver function test - Clinical significance of AST, ALT, ALP and Gamma glutamyl transpeptidase, Jaundice, Pancreatic function test, Gastric function test- Peptic Ulcer, Cerebrospinal fluid – Blood-brain barrier, composition of CSF and chemical changes in CSF.

**Unit V – (15 Hrs.): Haematological Tests:** Disorders of mineral metabolism- phosphorus, Potassium, Iron, Copper, Calcium, Sodium - Porphyria, porphyrinuria. Disorders of erythrocyte metabolism- hemoglobinopathies, thalassemia and anemia, Classification of anemia.

### TEXT BOOKS

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

### REFERENCE BOOKS

- 1.Philip. D. Mayne (1994). *Clinical Biochemistry in Diagnosis and Treatment* 6<sup>th</sup> Edition ELBS Publication
2. A.C. Guyton & J.E.Hall, (2006). *Text Book of Medical Physiology* 11<sup>th</sup> Edition Harcourt Asia.
3. Medical laboratory technology by Kanai L mukherjee and Swarajit gosh. 2<sup>ND</sup> EDITION 2014 PUBLISHED BY mc.Graw hill education(India) Pvt ltd, Newdelhi.

### WEB REFERENCE

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

### PEDOGOGY: CHALK and Talk , PPT

**YEAR II – SEMESTER III**  
**GENETIC ENGINEERING AND FERMENTATION TECHNOLOGY**

Paper	: Core IX	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: 21P3BC09	External	: 75

**SUBJECT DESCRIPTION:**

Genetic Engineering and Fermentation technology deal with the basis of gene cloning, vectors, genetic engineering techniques and large scale production of biochemical by fermentation technology.

**OBJECTIVE:**

The objective of the course is to learn about the basics of genetic engineering, vectors, methods of gene cloning. Techniques and application of gene technology, Fermentation technology and its application in fermented food preparation.

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
CO1	Define the basics of gene cloning, enzymes involved in genetic engineering techniques and genomic DNA libraries.	K2
CO2	Outline the techniques involved in sequencing, molecular markers and gene transfer techniques	K2
CO3	Applications of genetic engineering and genome editing techniques	K3
CO4	Perceive fermentation screening, media preparation and knowledge about fermentors	K4
CO5	Production of products like antibiotics, enzymes and fermented foods	K4

**Mapping with Programme Outcomes**

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

**CONTENT:****Unit I****15 Hours**

**Introduction to Genetic Engineering:** Molecular tools of GE – Restriction endonucleases its types, and

applications, DNA ligases, Alkaline phosphatase, reverse transcriptase and Topoisomerase. Vectors – plasmids, bacteriophage lambda, M13, cosmids, phagemids, bacterial and yeast artificial chromosome, plant viral vector – CaMV, animal viral vector – retroviral vector, shuttle vector, expression vector, Strategies and steps involved in Gene Cloning, cDNA and Genomic DNA library.

**Unit II****15 Hours**

**Techniques in Genetic engineering:** DNA sequencing – DNA/RNA labelling, Maxam and Gilbert method, Dideoxynucleotide method, next generation sequencing, Chromosome walking, Automated DNA sequencing, DNA fingerprinting, Molecular markers - RFLP, RAPD, AFLP, STR and SNP. *In-situ* hybridization, Site-directed mutagenesis, PCR. Methods of gene transfer – transformation, conjugation, electroporation, liposome-mediated gene transfer, transduction, direct transfer of DNA.

**Unit III****15 Hours**

**Applications of Genetic engineering:** Production of recombinant therapeutic proteins – recombinant insulin, growth hormone, interferons, vaccine – hepatitis B surface antigen, GE of *B.thuringiensis* toxin genes and GE for improved biocontrol agent - baculovirus. Concept of gene therapy – types, applications – gene therapy for SCID, ADA, CF, Anti-sense therapy, Genome editing- CRISPR-Cas, gene targeting.

**Unit IV****15 Hours**

**Zymology:** Pasteur and fermentation, Strain - screening, development, preservation, storage. Inoculum preparation, production medium, sterilization -equipment, media and air. Fermentor - factors, configuration – batch, semi continuous, continuous stirred – tank, tubular, fluidised bed, computer application in fermentation technology. Downstream processing – stages.

**Unit V****15 Hours**

**Application of fermentation technology:** Production of antibiotics - penicillin, streptomycin, tetracyclin, organic acids – citric acid, lactic acid and vinegar, enzymes - extracellular amylase, proteases, pectinase, solvents – ethanol, glycerol, aminoacids - glutamic acid and lysine, vitamins - vitamin B12 and vitamin C, SCP, fermented food - Sauerkraut, yoghurt.

**TEXT BOOKS**

1. Brown T.A., (2012), Gene cloning and DNA Analysis: An Introduction, 7<sup>th</sup> edition, Wiley-Blackwell.
2. Watson, W.H.Freeman(1992).**Recombianant DNA** 2<sup>nd</sup> Edition.Freeman and Co., NY
3. A.H.Patel (2008). Industrial Microbiology 11<sup>th</sup> Edition. Macmillan India Ltd, New Delhi

**REFERENCE BOOKS**

1. Peter J.Russell., (2013) Genetics, 5<sup>th</sup> Edition, person Benjamin Cummings, New york
2. S.B. primrose and R.m.Twyman (2006) **Principles of Gene Manipulation and Genomics (2006)** 7<sup>th</sup> Edition. Blackwell pub., NY.
3. SmitaRastogi and neelamPathak (2014) Genetic Engineering 6<sup>th</sup> Edition Oxford University Press, New Delhi.

**WEB REFERENCES**

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2. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/chromosome-walking>
3. <https://www.yourgenome.org/facts/what-is-crispr-cas9>
4. <https://www.biologydiscussion.com/industrial-microbiology-2/fermentor-bioreactor-history-design-and-its-construction/55756>

5. <https://www.sciencedirect.com/topics/food-science/sauerkraut>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR II – SEMESTER III  
RESEARCH METHODOLOGY**

Paper : Core VIII  
Hours/Week : 5  
Credit : 5  
Paper Code : 21P3BC08

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

**SUBJECT DESCRIPTION:**

Research Methodology deal with the knowledge on the basic concepts of research and its methodologies and identify appropriate research topics.

**OBJECTIVE:**

To understand basic concepts of research and its methodologies and identify appropriate research topics. Select and define appropriate research problem and parameters and prepare a project proposals.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Understood about basic concepts of research and its methodologies and identify appropriate research topics	K2
CO2	Provide the importance and need for research.	K2
CO3	Understood about basic concepts of research designs, ethics in scientific research.	K3
CO4	Understood about basic concepts of data collection and analysis of scientific data using software along with ethical issues in human gene therapy and human cloning.	K4
CO5	Select and define appropriate research problem and parameters	K5

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit I – (15 Hrs.): Scientific Research and Writing:** Importance and need for research, Ethics and scientific research, Plagiarism- Types of Plagiarism, Types and characteristic designing a research work, Formulation of hypothesis, Scientific writing – Characteristics, Logical format for writing thesis and papers, Essential features of abstract, introduction, review of literature, materials and methods, and discussion, Effective illustration - tables and figures, Reference styles - Harvard and Vancouver systems, citations and h-index

**Unit II – (15 Hrs.): Measures of central tendency:** Arithmetic mean, median, mode, quartiles, deciles and percentiles, Measures of variation - range, quartile and Quartile deviation, mean deviation, standard deviation, Correlation analysis - Scatter diagram, Karl Peason's coefficient of correlation and Spearman's rank method, Regression analysis- Regression line, Regression equation.

**Unit III – (15 Hrs.): Probability-** Definition, concepts, Addition and Multiplication theorems (proof of the theorems not necessary) and calculations of probability, Theoretical, distributions, Binomial, Poisson, Fit a Poisson distribution, Normal distribution - importance, properties, conditions and constants of the distribution (proof not necessary), Simple problems.

**Unit IV – (15 Hrs.): Sampling distribution and test of significance:** Testing of hypothesis, errors in hypothesis testing, standard error and sampling distribution, sampling of variables (large samples and small samples ), Student's 't' distribution and its applications, Chi - square test & goodness of fit.

**Unit V – (15 Hrs.): Bioethics and Patenting:** The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines - Animal care and technical personnel environment-Animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia, Institutional Ethical Committee (IEC) - General ethical issues of human- Drugs, herbal remedies , Food and drug safety and human genetic research- Gnen Therapy and Cloning. Definition- Patent, Intellectual Property, Intellectual Property rights - Patents, Copy rights, Design, Trademark and Trade secrets, Geographical indication (GI), criteria for patentability, Declaration of Bologna.

**TEXT BOOKS**

1. R.A. Day, **How to Write a Scientific Paper**. Cambridge University Press.
2. Alley, Michael (1987). **The Craft of Scientific Writing**. Englewood Cliffs. N.N. Prentice
3. M.C. Sharma (1997). Desk Top Publishing on PC, BPB Publications,

**REFERENCE BOOKS**

1. Contemporary issues in Bioethics, Beauchamp & Leroy, 1999. Wardsworth Pub. Co. Belmont, California.
2. Ethical Guidelines for Biomedical Research on Human Subjects (2000). ICMR, New Delhi.
3. Biostatistics – A foundation for analysis in health Science Danien.



## WEB RESOURCES

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2. [www.wipo.int/wipo\\_magazine/en/2006/04/article\\_0003.html](http://www.wipo.int/wipo_magazine/en/2006/04/article_0003.html)
3. [www.ijme.in/182ar82.html](http://www.ijme.in/182ar82.html)
4. <https://en.wikipedia.org/wiki/Database>
5. [www.tutorialspoint.com/database\\_tutorials.htm](http://www.tutorialspoint.com/database_tutorials.htm)

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR II – SEMESTER III  
CORE PRACTICAL V**

Paper : Core Practical - V  
Hours/Week : 5  
Credit : 3  
Paper Code : 21P3BCP05

Total Hours : 45  
Exam Hours : 06  
Internal : 40  
External : 60

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the collection and storage of blood	K1 & K2
CO2	Estimate the amount of Glucose, Serum protein, urea, uric acid, Creatinine, Bilirubin	K1 & K2
CO3	Learn the qualitative analysis of normal and pathological constituents in urine.	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

**Analysis of Blood and Urine samples**

1. Estimation of glucose by O-Toluidine Method.
2. Estimation of proteins by Lowry and Biuret Method.
3. Estimation of A/Gratio in serum.
4. Estimation of urea by DAM method.
5. Estimation of uric acid by Phosphotungstate Method.
6. Estimation of creatinine by Alkaline Picrate Method.
7. Estimation of cholesterol by Zlatkis, Zak and Boyle method.
8. Estimation of bilirubin by Evelyn Malloy method.
9. Qualitative analysis of normal and pathological constituents in urine.
10. Estimation of Calcium in urine by Clark Method
11. Estimation of Chloride in urine by Schales & Schales Method

**REFERENCES**

1. David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.

3. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
4. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

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

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

Paper : Core Practical - VI  
Hours/Week : 5  
Credit : 3  
Paper Code : 21P3BCP06

Total Hours : 45  
Exam Hours : 06  
Internal : 40  
External : 60

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the genetic material	K1 & K2
CO2	Isolation and Estimation of DNA, RNA	K1 & K2
CO3	Learn the restriction digestion, PCR techniques	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. Estimation of DNA a) Diphenylamine method b) UV method
2. Estimation of RNA a) Orcinol method b) UV method
3. Comet Assay
4. Agarose Gel Electrophoresis
5. Isolation of plasmid DNA
6. Isolation of Genomic DNA
7. Isolation of RNA
8. Restriction digestion of DNA
9. Preparation of competent cell and Transformation
10. PCR – Demonstration
11. Southern Blotting – Demonstration

**REFERENCES**

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

## NEUROSCIENCE

Paper	: Elective	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	:21P3BCE05	External	: 75

### SUBJECT DESCRIPTION:

Neuroscience deal with the understanding of the functions of various sensory organs in human system, biochemical aspects behind diseases associated with the nervous system and effect of drug therapy.

### OBJECTIVE:

To enable the students to gain knowledge about the structure and functions of the nervous system and have basic understanding of the nervous system and effect of drug therapy

### COURSE OUTCOME:

Course No	Course Outcome	Knowledge Level
CO1	Discuss the structure of nervous system, neurons and neurotransmitters receptors like cholinergic, exhibitory and inhibitory nerve impulse	K2
CO2	Understand a broad fundamentals neurohormones, neurotransmitters and neuronal behavior such as cognitive, movement and sleeping	K3
CO3	Analyses critical knowledge skills by a analyzing and evaluation of neuronal sensory and visual sensation	K4
CO4	Explain the knowledge of treated drugs action for neurological disease	K5
CO5	Hypothesis and evaluate the neurological diseases such as Dementia, Schizophrenia, Parkinson disease and Alzheimer's disease etc. and their clinical interpretation	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	M	L	M	S	S	S	L	M	M	M	S	L	M	S	M
CO3	L	M	L	M	L	L	S	L	S	S	M	M	L	L	L
CO4	S	L	M	S	S	L	L	S	L	L	S	L	M	S	S
CO5	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L

S- Strong; M-Medium; L-Low

### CONTENT:

**Unit I – (15 Hrs.): Introduction Nervous system-** Classification, General functions of autonomic and somatic nervous system, Neuron – Structure and function, types of neurons, excitation and action potential, Neuroglia - structure and fuctions, olfactory signal transduction, Synapse- structure and functions.

**Unit II – (15 Hrs.): Brain and Spinal cord-**Structure and functions, Brain metabolism and metabolic adaptation, Neurohormones and neuromodulators, Neurotransmitters-structure and types, Receptors for

neurotransmitters - cholinergic, adrenergic, nicotinic and muscarinic, excitatory and inhibitory transmission, conduction of nerve impulse, acetylcholine mechanism.

**Unit III – (15 Hrs.): Sensory systems and behavior** -Somatic sensation -Perception of pain, Analgesia system in the brain and spinal cord, Special senses- Vision, photoreceptors, Visual cycle - Rod cell adaptation, Color vision - role of cone cell, Color blindness, Mechanism of hearing, Biochemical aspects of taste and olfactory, Neuronal behavior -sleep, learning and memory

**Unit IV – (15 Hrs.): Neurodegenerative Diseases and action of Drugs** -Dementia, Schizophrenia, Huntington's disease, amyotrophic lateral sclerosis, Parkinsonism disease and Alzheimer's disease, Neuromuscular diseases - Muscular dystrophy, tetanus and botulism. Magnetic resonance imaging, electroencephalogram, Positron emission tomography, CNS depressants (sedative, hypnotics), CNS stimulants, analgesics, antipsychotics and mood stabilizing drugs, Drug therapeutic actions of Huntington's disease, Parkinsonism and Alzheimer's disease.

**Unit V- (15 Hrs.): Pharmaceutical Biochemistry-** Introduction to Pharmacology, Sources of drugs, Dosage forms and routes of administration, mechanism of action, Combined effect of drugs, Factors modifying drug action, tolerance and dependence, Pharmacogenetics. Absorption, Distribution, Metabolism and Excretion of drugs, Principles of Basic and Clinical pharmacokinetics, Adverse Drug Reactions and treatment of poisoning, Bioassay of Drugs and Biological Standardization, Discovery and development of new drugs.

#### TEXT BOOKS:

- 1.Arthur C.Guyton and John E. Hall. 2007. **Text Book of Medical Physiology**. [Eleventh Edition]. Elsevier Publications, New Delhi. .
2. Gerald. J. Tortora and Sandra Reynolds. 2003. **Principles of Anatomy and Physiology**. [Tenth Edition]. John Wiley and Sons. Inc. Pub. New York..
3. Tripathi, K. D. 1999. **Essentials of Medical Pharmacology**. [Fourth Edition]. Jaypee Brothers Medical Publishers. New Delhi
- 4.Gerard J Tortora and Bryan derrickson **Principles of anatomy and physiology**, 14 th Edition.

#### REFERENCE BOOKS:

- 1.George I. Siegel, 2000. **Basic Neurochemistry**. [Seventh Edition]. Academic Press, New Delhi.
2. Kathleen J. W. Wilson and Anne Waugh. 1998. **Anatomy and Physiology in Health and Illness**. [Eighth Edition]. Churchill Livingstone, New York.

#### WEB SOURCES

<https://www.myvmc.com/anatomy/blood-function-and-composition/>  
<https://en.wikipedia.org/wiki/Blood>  
<https://www.pjms.com.pk/issues/aprjun107/article/article4.html>  
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**PEDOGOGY: CHALK and Talk , PPT**

**YEAR II – SEMESTER IV**  
**BIOINFORMATICS & NANOTECHNOLOGY**

Paper	: Core XI	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	:21P4BC11	External	: 75

**SUBJECT DESCRIPTION:**

Bioinformatics and Nanotechnology deal with the understanding of Biological databases, Tools for database search, Protein structure analyses and prediction and drug design.

**OBJECTIVE:**

Analysis of gene and protein sequences to reveal protein evolution and alternative splicing, the development of computational approaches to study and predict protein structure to further understanding of function, the analysis of mass spectrometry data to understand the connection between phosphorylation and cancer, the development of computational methods to utilize expression data to reverse engineer gene networks in order to more completely model cellular biology, and the study of population genetics and its connection to human disease.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Students learn about Biological databases	K1 & K2
CO2	Tools for database search system.	K1 & K2
CO3	Protein structure analyses and prediction and drug design and nanoparticles	K1, K2 & k3
CO4	An ability to design and conduct experiments, as well as to analyze and interpret data	K3 & K4
CO5	Characterization methods for nanomaterials, understanding and critiquing nanomaterial safety and handling methods required during characterization	K4 & K5

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low

**CONTENT:****Unit I – (15 Hrs.): Introduction of Bioinformatics Database searches**

Introduction of Bioinformatics –DNA sequences and their types (cDNA, ESTs, STS Sequence-Tagged Site (STS) and GSS Genome Survey Sequences) RNA sequencing method and their application. Protein sequencing of Sanger's method

**Unit II (15 Hrs.): Biological Sequence and Databases**



Sequence Databases : Nucleotide Sequence Databases –GenBank, EMBL,– Protein Sequence Databases – SWISS-PROT, UniProt PIR — Genome Databases – GOLD, TIGR - Structure databases – PDB, MMDB, – Protein Structure Visualization Tools: RasMol, Swiss PDB Viewer

### **UNIT III(15 Hours) :Modeling, Designing and Genome Analysis**

Homology modeling, three-dimensional structure prediction, energy based prediction of protein structures, modeling software (Modeller). Design of ligands, drug-receptor interactions, automated structure construction methods, AUTODOCK. Human genome analysis, Whole genome analysis – shotgun sequencing. Genome identification Feature based approach – ORF's; Primer Designing; Vector designing; APE

### **UNIT IV (15 Hours) : Nanotechnology**

Introduction of Nanotechnology, synthesis of nanoparticles- Top to bottom (Laser ablation and Ball milling method), Bottom to up (Sol-gel and Laser pyrolysis). Nanostructures (1 Dimension, 2 Dimension and 3 Dimension), Nanoscale Characterization- Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic force microscopy and X-Ray Diffraction delete

### **UNIT V (15 Hours):Applications of Nanotechnology**

Application in Medicine, Agriculture, Environment (air and water pollution), Nanodevice, Cosmetics, Bioengineering, Nanofabrics, Nanofuels, Nanocomputers

### **TEXT BOOKS**

1.Functional and computational Aspects **Genomic and proteomics** – sandarsunai

**Bioinformatics-concepts,Skill and Application**-S,C Rastogi ,Namitamendritta,Paragrastogi (2000).

2. **Protein Biochemistry and Proteomics**(2006).Hubert Rehn, Academic press

3. Harshawaedhan .P.Bal **Bioinformatics** Principles and Application

4. JanuszM.Bujnicki (2008) **Practical Bioinformatics** Springer Berlin.

### **REFERENCE BOOK**

1. Nanotechnology –**Fundamentals and Application** –MansiKarKare

2. Liebler,Humana(2002) **Introduction to proteomics**:Tools for new biologyLiebler,Humana W.CBS pub.,

### **WEB REFERENCE**

<https://en.wikipedia.org/wiki/Nanomaterials>

<https://gmwgroup.harvard.edu/pubs/pdf/936.pdf>

[www.crnano.org/whatis.html](http://www.crnano.org/whatis.html)

[www.metabolomicdiscoveries.com/](http://www.metabolomicdiscoveries.com/)

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

**YEAR II – SEMESTER IV**  
**HUMAN PHYSIOLOGY**

Paper : Core X  
Hours/Week : 5  
Credit : 5  
Paper Code :21P4BC10

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

**SUBJECT DESCRIPTION:**

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

**OBJECTIVE:**

The objective of the subject is to make the students learn about various parts of alimentary parts of human body. Learnt more specific on the nervous activities.

**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

**CONTENT:**

**Unit I – (15 Hrs.): Physiology of vision:** Structure of eye, image formation and defects of the eye, Receptor mechanism of the eye, photopigments, Visual cycle and colour adaptation Muscle; Types of muscle. Structure of skeletal muscle. proteins - myosin, actin, troponin, tropomyosin and other proteins. Action potential, Reflex action, Mechanism and regulation of contraction and relaxation of skeletal muscle

**Unit II – (15 Hrs.): Digestive and cardiovascular system:** Digestive secretions - composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestions and absorption of carbohydrates, lipids, proteins and nucleic acids. Circulatory system – structure and functions of heart, ECG, Cardiac Cycle

**Unit III – (15 Hrs.): Respiratory system:** Diffusion of gases in lungs, transport of oxygen from lungs to tissues through blood, factors influencing the transport of oxygen, Transport of CO<sub>2</sub> from tissues to lungs through blood, factors influencing the transport of CO<sub>2</sub>, Excretory System - Structure and functions of kidney, Nephron, Mechanism of urine formation, Renal Transplantation, Dialysis.

**UNIT IV-(15 Hrs.): Nervous system:** Structure of neuron, resting potential and action potential, Propagation of nerve – impulses, Structure of synapse, synaptic transmission (electrical and chemical theory), Structure of Neuro muscular junction and mechanism of neuro muscular transmission, neurotransmitters.

**Unit V – (15 Hrs.): Reproductive biology:** Structure of testis, Spermatogenesis, functions of testis, Female Reproductive system - Ovarian cycle, Structure and hormones of ovaries, menstrual cycle, menopause, pregnancy and lactation, Steroids as contraceptives.

### TEXTBOOKS

1. Textbook of Medical Physiology (2011) 10th ed., Guyton, A.C. and Hall, J.E., Reed Elsevier India Pvt. Ltd. (New Delhi). ISBN: 978-1-4160-4574-8.
2. Chatterjee A.C (2004) **Human Physiology**,. Volume I & II. 11<sup>th</sup> Edition Medical agency allied, Calcutta
3. Vander's Human Physiology (2008) 11th ed., Widmaier, E.P., Raff, H. and Strang, K.T., McGraw Hill International Publications (New York), ISBN: 978-0-07-128366-3.
4. M.M.Muthiah **Text book of biochemistry, Lecture notes on human physiology** Vol II 1991.

### REFERENCE

1. William. F. Ganong, (2003) **Review of Medical Physiology**, 14<sup>th</sup> Edition, A Lange Medical book.
2. Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W., (2012) **Harper's Biochemistry** 29th ed., Lange Medical Books/McGraw Hill. ISBN:978-0-07-176-576-3.4

### WEB SOURCES

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<https://en.wikipedia.org/wiki/Blood>  
<https://www.pjms.com.pk/issues/aprjun107/article/article4.html>  
[www.drive5.com/muscle/](http://www.drive5.com/muscle/)

**PEDOGOGY: CHALK and Talk , PPT**

**MICROBIAL BIOCHEMISTRY**

Paper	: Elective VI	Total Hours	: 75
Hours/Week	: 4	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	:21P3BCE06	External	: 75

**SUBJECT DESCRIPTION:**

Microbial Biochemistry deal with the basic principles of metabolic processes within the cell and how these processes can be harnessed for biotechnology.

**OBJECTIVES:**

Basic knowledge regarding the structure and properties of micro-organisms, including those of clinical, environmental and industrial importance. A variety of laboratory exercises where students can apply their theoretical knowledge to Practical situations and demonstrations, in the above areas.

**OUTCOME:**

Students will be able to demonstrate an understanding of the major mechanisms of metabolism, energy exchanges and homeostasis in cells. Recognize the linkage between the structures, chemical properties and chemical processes of certain molecules and macromolecules, and their roles in cells and biological processes, and in certain diseases.

**CONTENT:**

**Unit I – (15 Hrs.): Microbial world:** Cellular organization of bacteria with special reference to molecular organisation of cell wall, flagella and pili, Identification and classification of bacteria, Handling and sterility maintenance in microbiological work, Methods of isolation and pure culture techniques, culture media preparation, enrichment culture, Microbial nutrition, bacterial growth and its kinetics, Cyanobacteria, Archeabacteria, Viruses - Structure, classification.

**Unit II – (15 Hrs.): Microbial metabolism:** overview, Role of chlorophylls, carotenoids and phycobilins, Chemolithotrophy, methanogenesis and acetogenesis, fermentations - diversity, syntrophy - role of anoxic decomposition, Entner - Doudoroff pathway, stickland reaction, pectin and aldo-hexuronate pathway, hydrocarbon transformation, Anaphlerotic reactions, Autotrophic metabolism, Amino acid synthesis in microbes.

**Unit III – (15 Hrs.): Bioprocess Technology:** Fermentation technology - Primary and secondary metabolites, Continuous and batch type culture techniques, Types and design of fermentors, fermentation processes, brewing, manufacture of penicillin, production of other antibiotics and organic compounds, single cell proteins, Isolation and screening of industrially important microbes, Inoculum preparation - primary and secondary strain improvement, Detection of Downstream processing.

**Unit IV – (15 Hrs.): Industrial Production:** Microbes in mineral recovery and petroleum recovery, Bioleaching and Biosorption, Production of Biomass, Production of Single cell protein and Mushrooms, Organic acids - Acetic acid, lactic acid, citric acid and gluconic acid, Solvent production - Ethanol and

Butanol, Antibiotics - Penicillin and streptomycin, Vitamins - B12 and riboflavin, Amino acid – Glutamic acid, Threonine and Phenylalanine, Fermented foods- Yoghurt, cheese, Production of beer, wine and vinegar.

**Unit V – (15 Hrs.): Industrial Application:** Wastewater treatment - physical, chemical and biological treatment processes, Effluent treatment, Bioremediation, oil spill clean-up, Microbial mining, Bio fertilizers - bacteria and blue-green algae, Biopesticides in integrated pest management - *Bacillus* and *Pseudomonas* as biocontrol agents, Soil microbiota, Biogeochemical role of soil microorganisms, Microbial degradation of xenobiotics in the environment.

#### TEXT BOOKS:

1. Microbial biotechnology – Alexander *et al.*, -W.H. Freeman Publishers, 1995
2. Biology of microorganisms – Madigan *et al.*, - Printice Hall, 2002
3. Biochemistry of bacterial growth – Mandelstram, Blackwell Scientific Publishers
4. Principles of fermentation technology, 2nd edition – Stanbury *et al.*, Pergamon Publishers, 1995
5. Basic Biotechnology, 2nd edition – Ratledge, Kristiansen Cambridge University Press, 2001

#### REFERENCES BOOKS:

1. Elements of Biotechnology – Gupta, Rastogi Publication, 1998
2. Bioprocess Engineering – basic concepts 2nd editon – Schuler, Karg, Printice Hall, 2001
3. Concepts in Biotechnology – Balasubramanian *et al.*, Universities Press (India) Ltd., 2004
4. Animal Tissue Culture – Freshney, IRL press
5. Culture of animal cells: a manual of basic techniques, 4th edition – Freshney, Wiley Liss, 2000

#### WEB SOURCES:

<http://www.sigc.edu/department/microbiology/studymet/10markQuestionsonBioprocess.pdf>  
[https://en.wikipedia.org/wiki/Entner%E2%80%93Doudoroff\\_pathway](https://en.wikipedia.org/wiki/Entner%E2%80%93Doudoroff_pathway)

**DIAGNOSTIC BIOCHEMISTRY**

Paper	: EDC	Total Hours	: 75
Hours/Week	: 2	Exam Hours	: 03
Credit	: 1	Internal	: 25
Paper Code	:21P3BCED01	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****15 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****15 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****15 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****15 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****15 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.

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER III  
Advanced Clinical Biochemistry**

Paper	: Core Paper VII		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: 21P3BC07	Maximum Marks	: 75

**Section A**

**Answer all questions (20 x 1 = 20)**

1	Renal threshold for glucose is _____?	Unit I	K1	CO-1
	A 80 mg%                      B 100 mg%			
	C 180 mg/ dl                  D 200 mg%			
2	Untreated diabetes may result in all of the following except	Unit I	K1	CO-1
	A Blindness                      B Cardiovascular disease			
	C Kidney disease                D Tinnitus			
3	Hyperinsulinemia may be caused by all of the following except	Unit I	K2	CO-1
	A An insulinoma                B Nesidioblastosis			
	C Insulin resistance            D Type 1 diabetes			
4	Insulin deficiency is associated with	Unit I	K2	CO-1
	A Reduced lipolysis            B Increased ketogenesis			
	C Reduced gluconeogenesis    D Reduced proteolysis			
5	_____ is responsible for the yellow coloring in jaundice	Unit II	K1	CO-1
	A . Urobilinogen                B Carotene			
	C Bilirubin                        D AST			
6	Highest elevations with AST is seen in viral _____.	Unit II	K1	CO-1
	A Hepatitis                        B Meningitis			
	C Influenza                        D Pneumonia			
7	Urea production occurs almost exclusively in	Unit II	K1	CO-1
	A Kidneys                         B Liver			
	C Blood                             D Urine			



8	The carbon atom source while producing urea in the urea cycle is		Unit II	K1	CO-1
	A	CO <sub>2</sub>	B	Glucose	
	C	Aspartic acid	D	Arginine	
9	Which of the following lipid act as lungs surfactant?		Unit III	K2	CO-1
	A	Phosphatidylcholine	B	Phosphatidylethanolamine	
	C	Ceramide	D	Phosphatidylinositol	
10	Which of the following disorder is caused due to the high serum level of urate?		Unit III	K1	CO-1
	A	Gout	B	Galectosemia	
	C	Cystic fibrosis	D	Maple syrup urine disease	
11	Which of the following is not the precursor of a purine ring?		Unit III	K2	CO-1
	A	Glutamine	B	Lysine	
	C	Glycine	D	Aspartate	
12	Severe combined immunodeficiency disease is caused by the deficiency of the following enzymes?		Unit III	K2	CO-1
	A	AMP deaminase	B	Adenosine deaminase	
	C	PRPP synthetase	D	None of the above	
13	Function of stomach include all except		Unit IV	K1	CO-1
	A	Stomach	B	mix food with gastric secretion	
	C	empties content to the intestine	D	Swallowing	
14	Non-specific symptoms of chronic kidney disease include		Unit IV	K1	CO-1
	A	increased urination at night	B	loss of appetite	
	C	swallowing of hand and feet	D	all of the above	
15	which kidney disease known is to be inherited		Unit IV	K1	CO-1
	A	end stage renal disease	B	protein disease	
	C	autoimmune kidney disease	D	polycystic kidney disease	
16	Uric acid is usually eliminated from the body by the ay of		Unit IV	K1	CO-1
	A	Breathing	B	Urine	
	C	Metabolism in the liver	D	Sweat	
17	The myocardial infarction is also known as		Unit V	K1	CO-1
	A	Diabetes	B	heart attack	
	C	Cholesterol	D	hypertension	
18	The heart attack occurs when there is blood clotting in		Unit V	K1	CO-1
	A	renal arteries	B	mesenteric arteries	
	C	hepatic arteries	D	coronary arteries	
19	The best liver function tests		Unit V	K1	CO-1
	A	AST/ALT	B	alkaline phosphatase	

	C	Bilirubin	D	INR			
20		Acute pancreatitis is exclusively diagnosed by measuring serum levels of			Unit V	K1	CO-1
	A	Amylase	B	Lipase			
	C	Acid phosphatase	D	Alkaline phosphatase			
<b>Section B</b>							
<b>Answer All questions (5 x 5 = 25 )</b>							
21	A	Describe precision, Accuracy			Unit – I	K2	CO-2
		<b>OR</b>					
	B	Summarize Automation in clinical bochemistry			Unit – I	K2	CO-2
22	A	Write an short note on GTT			Unit – II	K2	CO-2
		<b>OR</b>					
	B	Explain about bilirubin metabolism			Unit – II	K2	CO-2
23	A	Write about atherosclerosis			Unit – III	K2	CO-2
		<b>OR</b>					
	B	Describe fatty Liver			Unit – III	K2	CO-2
24	A	Explain about tubeless gastric analysis.			Unit – IV	K2	CO-2
		<b>OR</b>					
	B	Give short note on Detoxification and excretory function.			Unit – IV	K2	CO-2
25	A	Write about Quality Control			Unit – V	K2	CO-2
		<b>OR</b>					
	B	Explain Clinical significance of haemoglobinopathies			Unit – V	K2	CO-2
<b>Section C</b>							
<b>Answer ALL Questions (1 x 10 = 10)</b>							
26	A	Explain about Diabetes mellitus-Types, Clinical features, metabolic effects, complications			Unit – I	K5	CO-2
27	A	Illustrate etiology and clinical features of phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia			Unit – II	K5	CO-2
28	A	Describe Disorders of nucleic acid metabolism: Gout, types,aetiology and clinical features.			Unit – III	K5	CO-2
29	A	Write short note on Renal function test			Unit – IV	K5	CO-2
30	A	Summarize enzyme level on the onset of myocardial infarction and hepatobiliary diseases			Unit – V	K5	CO-2

**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	2	4	0	0	1	0	<b>7</b>
II	4	2	0	0	1	0	<b>7</b>
III	1	5	0	0	1	0	<b>7</b>
IV	4	2	0	0	1	0	<b>7</b>
V	4	2	0	0	1	0	<b>7</b>
<b>Total</b>	<b>15</b>	<b>15</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>35</b>

**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	2	12	0	0	10	0	<b>24</b>
II	4	10	0	0	10	0	<b>24</b>
III	1	13	0	0	10	0	<b>24</b>
IV	4	10	0	0	10	0	<b>24</b>
V	4	10	0	0	10	0	<b>24</b>
<b>Total</b>	<b>15</b>	<b>55</b>	<b>0</b>	<b>0</b>	<b>50</b>	<b>0</b>	<b>120</b>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER III  
Genetic Engineering and Fermentation Technology**

Paper : Core Paper IX  
Examination : External Section – A (25X1) : 25  
Time : Three Hours Section – B (5X5) : 25  
Paper Code : **21P3BC09** Maximum Marks : 75

1	In which one of the following way type II restriction endonuclease enzyme cuts the sequences ?		CO1	K2
	A	Within the recognition sequence	B	At 100-1000 nucleotides away from the recognition sequence
	C	At 27-30 nucleotides away from the recognition sequence	D	It cuts randomly
2	Which endonuclease cleaves both single and double stranded DNA molecules, in a non-specific manner?		CO1	K2
	A	S1	B	Bal31
	C	DNase I	D	BamHI
3	Linkers are often used in cloning. Choose the incorrect statement for linkers.		CO1	K2
	A	These are short chemically synthesized molecules that contain a particular restriction enzyme site within the sequence	B	They are blunt ended molecules
	C	They are ligated to staggered ended insert molecules by T4 DNA ligase	D	After treatment with enzyme, both the ends of the linker are staggered
4	If linkers are combined with other features such as a selectable marker, it is called as		CO1	K2
	A	cassette	B	modified linker
	C	adaptors	D	induced linker
5	Which antibiotic resistance is present in pBR322?		CO2	K2
	A	Ampicillin	B	Kanamycin
	C	Lactase	D	Gentamycin

6	What is the copy number of the pUC8 plasmid vector?		CO2	K2
	A	5-10	B	50-100
	C	100-200	D	500-700
7	In genome southern blotting can be used to identify		CO2	K2
	A	Sequences	B	number of sequences
	C	DNA fragments	D	RNA sequence
8	Western blotting is the technique for the detection of		CO2	K2
	A	specific DNA in a sample	B	specific RNA in a sample
	C	specific protein in a sample	D	specific glycolipid in a sample
9	The ability of cells to take up DNA fragments from surrounding is called		CO3	K3
	A	transfection	B	transduction
	C	transformation	D	conjugation
10	Chemicals used for gene transfer methods include		CO3	K3
	A	poly ethylene glycol	B	CaCl <sub>2</sub>
	C	dextran	D	all of the above
11	Introduction of DNA into cells by exposing to high voltage electric pulse is		CO3	K3
	A	electrofusion	B	elctrofision
	C	electrolysis	D	electroporation
12	The injection of DNA into developing inflorescence using a hypodermic syringe is called		CO3	K3
	A	macroinjection	B	micromanipulator mediated DNA delivery
	C	microfection	D	microinjection
13	Polymerase used for PCR is extracted from		CO4	K4
	A	Escherichia coli	B	Homo sapiens
	C	Thermus aquaticus	D	Saccharomyces cerevisiae
14	At what temperature do denaturation of DNA double helix takes place?		CO4	K4
	A	60°	B	54°
	C	74°	D	94°
15	Luciferase genes are also used at times for detection. Choose the correct statement for them.		CO4	K4
	A	They are obtained from fire flies only	B	The detection requires provision of substrate which produces light
	C	Enzymes such as beta-galactosidase requires substrate X-gluc to produce light	D	Lucifearse genes are preferred over fluorescent proteins
16	A short peptide region fused to a protein of interest is known as		CO4	K4
	A	tag	B	oligonucleotide
	C	fragment	D	dimer
17	Start up expenses in a fermentation industry varies from		CO5	K4
	A	0-5% of the capital cost	B	10-15% of the capital cst

	C	5-10% of the capital cost	D	15-20% of the capital cost		
18	The high yielding strain for antibiotic production could be achieved by				CO5	K4
	A	Sequential genetic selection	B	Non sequential genetic selection		
	C	Without genetic selection	D	Non mutants		
19	Ammonium hydrogen phosphate is used for the production of				CO5	K4
	A	Lactic acid	B	Acetic acid		
	C	Itacoic acid	D	Pyruvic acid		
20	Sauerkraut is rich source of vitamin				CO5	K4
	A	A	B	C		
	C	D	D	K		
<b>Section B</b>						
<b>Answer All questions (5 x 5 = 25 )</b>						
21	A	Define and classifu resptriction endonucleases.			CO1	K2
	B	Describe about cosmids.			CO1	K2
22	A	Illustrate DNA sequencing by Maxam and Gilbert technique.			CO2	K2
	B	Summarise about RFLP.			CO2	K2
23	A	How will you produce recombinant insulin?			CO3	K3
	B	Explain about baculovirus and its biocontrol activity.			CO3	K3
24	A	Record about screening techniques in strain development.			CO4	K3
	B	Write a detailed note on downstream processing			CO4	K3
25	A	Illustrate on antibiotic production of penicillin.			CO5	K4
	B	How ethanol produced by fermentation technology?			CO5	K4
<b>Section C</b>						
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>						
26	Explain in detail about genomic DNA library.				CO1	K2
27	What are the gene transfer techniques available nad explain about direct gene transfer techniques.				CO2	K2
28	Predict the methodology of genome editing by crisper cas techniques.				CO3	K3
29	Demonstrate on fermentation and explain its design.				CO4	K3
30	Evaluate on Sauerkraut production.				CO5	K4

**TYPES OF SPECIFICATION (Question wise-no of questions)**

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

**TYPES OF SPECIFICATION (Marks wise-Total marks)**

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

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER III  
Research Methodology**

Paper	: Core VIII		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P3BC08</b>	Maximum Marks	: 75

1	A research is generally expected to		CO1	K1
	A	Study the existing literature in a field	B	Generate new principles and theories
	C	Synthesize the ideas given by others	D	Evaluate the findings of a study
2	The basic need of a research is		CO1	K1
	A	in preparation of a project	B	in guidance
	C	in economic planning	D	in sitting in library.
3	A research should be		CO1	K1
	A	objective	B	valid
	C	reliable	D	all the above
4	Hypothesis is		CO1	K1
	A	a thoughtful statement	B	) a forwarding statement
	C	a temporary solution	D	all the above
5	Variance of the population is denoted by		CO2	K2
	A	$\mu^2$	B	$\Sigma^2$
	C	$\beta^2$	D	$\sigma^2$
6	The standard deviation tends to increase with the increase in		CO2	K2
	A	regression	B	mean
	C	correlaiton	D	variability
7	When the correlation between two variables is estimated by taking into		CO2	K1



	account the effect of a third variable it is called			
	A	partial correlation	B	regression
	C	perfect relation	D	multiple correlation
8	Regression is of how many types?		CO2	K1
	A	2	B	4
	C	1	D	5
9	The probability of an event is		CO3	K2
	A	The average frequency of the event	B	frequency
	C	sum of the events	D	independent event
10	When a random experiment is performed repeatedly, each repetition is called a		CO3	K2
	A	trial	B	event
	C	success	D	repeats
11	A random variable X is said to follow a Poisson distribution if it assumes only		CO3	K3
	A	non-negative values	B	negative values
	C	positive values	D	Non positive values
12	Normal distribution was first discovered by		CO3	K1
	A	James Bernoulli	B	De-Moivre
	C	Morgan	D	Rutherford
13	What is the name of the statement making a prediction that an event will occur under stated.		CO4	K3
	A	null hypothesis	B	hypothesis
	C	significance	D	Probability
14	Systematic sampling is		CO4	K4
	A	acomprehensice methodof sample selection	B	a simple method of sampleselection
	C	am effective method of generalizaiton of data	D	all the above
15	The t-distribution is used when sample size is		CO4	K3
	A	30	B	50
	C	60	D	80
16	In order to test the “goodness of fit” of the observed results, it is necessary to find		CO4	K4
	A	The deviation between the observed an the expected results	B	the probability value correponding to the deviation

	C	both a and b	D	none of the above		
17		WIPO stands for			CO5	K5
	A	World Industries Property organization	B	world Intellectual Property Organizaiton		
	C	World Intellectual Protect Organisation	D	World Industries Protect Organizaiton		
18		The un ethical practive of monopolizing a biodiversity based traditional knowledge is called			CO5	K5
	A	stolen	B	biopiracy		
	C	unregister	D	loot.		
19		The term which describes the safe methods for managing infectious agents in the laboratory environment is			CO5	K5
	A	practice	B	containment		
	C	environment	D	safety		
20		Which committee should take note of developments at national and international levels in Biotechnology towards the currentness of the safety regulation for India on recombinant research use and applications?			CO5	K5
	A	Recombinant DNA Advisory Committee	B	Institutional Biosafety Committee		
	C	Review Committee on Genetic Manipulation	D	Genetic Engineering approvan Committee		
<b>Section B</b>						
<b>Answer All questions (5 x 5 = 25 )</b>						
21	A	Describe about Ethics and scientific research			CO1	K2
		OR				
	B	Explain about the review of literature			CO1	K1
22	A	Write about Student t test correlation			CO2	K1
		OR				
	B	Write about the standard deviation			CO2	K2
23	A	Write about the scope of bioinformatics			CO3	K3
		OR				
	B	Write short note on role of computers in biology			CO3	K3
24	A	Explain about database system			CO4	K4
		OR				
	B	Give an account on CLUSTAL			CO4	K4
25	A	Write about Ethics in food and drug safety			CO5	K5
		OR				

B	Write a short note on gene therapy.	CO5	K5
<b>Section C</b>			
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>			
26	Explain in detail about Formulation of hypothesis.	CO1	K2
27	Explain about the Chi square test for independence of attributes	CO2	K2
28	Write a short notes on PubMed.	CO3	K3
29	Write in detail about FASTA and BLAST	CO4	K4
30	Write an essay about Ethics in animal experimentation	CO5	K5

**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	2	0	0	0	0	07
II	3	4	0	0	0	0	07
III	1	2	4	0	0	0	07
IV	0	0	2	5	0	0	07
V	0	0	0	0	7	0	07
<b>Total</b>	9	8	6	5	7	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	9	15	0	0	0	0	24
II	7	17	0	0	0	0	24
III	1	2	21	0	0	0	24
IV	0	0	2	22	0	0	24
V	0	0	0	0	24	0	24
<b>Total</b>	0	0	0	0	0	0	120

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER III (2021-22)  
Core Practical - V**

Paper	Core Practical V		
Examination	: External		
Time	: Six Hours		
Paper Code	: 21P3BCP05	Maximum Marks	: 60

**Answer all the questions**

1 (a). Estimate the amount of glucose present in the given blood sample by Ortho Toluidine method.

20 Marks

(Or)

(b) Estimate the amount of Chloride in the given urine sample by Schales and Schales method.

2 (a). Estimate the amount of creatinine present in the given serum sample by alkaline picrate method.

20 Marks

(Or)

(b) Estimate the amount of urea present in the given urine sample by DAM method.

RECORD : 10

VIVA : 10

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YEAR II – SEMESTER III  
Core Practical - VI**

Paper	: Core Practical VI		
Examination	: External		
Time	: Six Hours		
Paper Code	: <b>21P3BCP06</b>	Maximum Marks	: 60

**Answer all the questions**

1.A) Immuno-electrophoresis – Rocket or Counter Current immuno-electrophoresis

20 Marks

(Or)

B) Isolation of peripheral blood mononuclear cells.

2 (a). Identification of blood group & Rh typing

20 Marks

(Or)

(b) Immunodiffusion –Single radial and double diffusion

VIVA: 10  
Record:10

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**(AUTONOMOUS)**  
**MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY**  
**YEAR II – SEMESTER IV (2018-19)**  
**Neuroscience**

Paper	: ELECTIVE V		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P3BCE05</b>	Maximum Marks	: 75

**Section A**

**Answer all questions (20 x 1 = 20)**

1	Which vitamin is important for vision?		K1	CO-1
	A	Vitamin A	B	Vitamin B
	C	Vitamin C	D	Vitamin D
2	Which of the following is incorrect?		K2	CO-1
	A	Retina is made up of rods and cones	B	Cones are lesser in number as compared to rods
	C	Rods are more sensitive than cones	D	Cones are responsible for vision in dim light
3	Which scientist first discovered that rod cells contain rhodospin?		K2	CO-2
	A	Franz Boll	B	Benjamin Franklin
	C	Robert Lewis	D	Andrew Boll
4	Which nerves are attached to the brain and emerge from the skull?		K1	CO-1
	A	Cranial Nerves	B	Thoracic Nerves
	C	Spinal Nerves	D	Sacral Nerves
5	What is the unit of Nervous system?		K3	CO-2
	A	Brain	B	Spinal Cord
	C	Neuron	D	Nerves
6	Spinal Cord originates from which part of the brain?		K1	CO-3
	A	Cerebellum	B	Medulla
	C	Pons	D	Cerebrum

7	Which of the following helps in maintaining the shape of the eye?		K2	CO-3
	A Neuroglia	B Aqueous humor		
	C Vitreous humor	D Perikaryon		
8	What is Sclera?		K1	CO-1
	A Cornea	B White part of the eye		
	C Red part of the eye	D Lens		
9	How many sense organs in human body are?		K1	CO-2
	A 2	B 5		
	C 4	D 7		
10	Which is the INCORRECT statement in lens?		K2	CO-2
	A Protein found in the lens are $\alpha$ , $\beta$ , and $\gamma$ crystalline	B Composed of water and proteins		
	C Mainly made up of water	D It has a blood supply		
11	Which of the following are the classic pathological of Alzheimer's disease?		K1	CO-2
	A Lewy bodies	B Hirano bodies		
	C Neurofibrillary tangles and senile plaques	D Neurofibrillary tangles		
12	Which neurotransmitter receptors are commonly lost in Alzheimer's disease?		K1	CO-2
	A Acetylcholine	B GABA		
	C Dopamine	D Serotonin		
13	Which of the following is not true of dementia of the Alzheimer's disease		K1	CO-2
	A There is a lack of recovery effort	B Previously learned information does not interface with new material		
	C Normal semantic memory	D All of the above		
14	Which of the following is found in dementia?		K1	CO-2
	A Impairment in short term and long term memory	B Abstract thinking Impairment		
	C Personality change	D All of the above		
15	Which of the following are not included in the DSM criteria for schizophrenia?		K1	CO-2
	A Disorganized speech	B Delusions		
	C Hallucinations	D Catastrophic thinking		
16	Which part of the limbic system is involved in an animal's feeling of hunger?		K1	CO-4
	A Thalamus	B Pons		
	C Hippocampus	D Hypothalamus		

17	Which lobe is primarily responsible for hearing and language?		K4	CO-2	
	A	Temporal	B	Parietal	
	C	Frontal	D	Occipital	
18	What part of a neuron is responsible for receiving information?		K1	CO-5	
	A	Axon	B	Terminal fibre	
	C	Dendrite	D	Myelin sheath	
19	The effect of neurotransmitters may be:		K1	CO-2	
	A	Chemical electrical	or	B	Excitatory or inhibitory
	C	Positive or negative	D	Active or passive	
20	Which of the following is NOT a lobe of the brain?		K1	CO-2	
	A	Frontal	B	Dorsal	
	C	Parietal	D	Temporal	
<b>Section B</b>					
<b><u>Answer All questions (5x 5 = 25 )</u></b>					
21	A	Elaborate the Dementia and their treatments?		K6	CO-4
		<b>OR</b>			
	B	Explain the Visual cycle and their mechanism of action		K5	CO-3
22	A	Explain the schizophrenia and their treatments?		K5	CO-2
		<b>OR</b>			
	B	Evaluate the color vision		K5	CO-3
23	A	Brief notes on structure and function of neurons		K4	CO-4
		<b>OR</b>			
	B	Short notes on receptors for neurotransmitters		K5	CO-3
24	A	Explain the Huntington's disease and their treatments?		K6	CO-3
		<b>OR</b>			
	B	Explain the Alzheimer's disease and their treatments		K4	CO-4
25	A	Elaborate the Neurohormones and neuromodulators		K5	CO-3
		<b>OR</b>			
	B	Brief notes on Neuronal behavior		K6	CO-3
<b>Section C</b>					
<b><u>Answer ALL Questions (3 x 10 = 30)</u></b>					



26	Explain the structure and function of brain	K5	CO-3
27	Discuss the neuromuscular diseases and their treatments?	K6	CO-3
28	Discuss the Parkinsonism disease and their treatments?	K5	CO-4
29	Brief account on Brain metabolism	K5	CO-2
30	Short notes on excitatory and inhibitory transmission	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
<b>Total</b>	<b>0</b>	<b>14</b>	<b>7</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>35</b>

**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
<b>Total</b>	<b>0</b>	<b>48</b>	<b>24</b>	<b>48</b>	<b>0</b>	<b>0</b>	<b>120</b>

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER IV (2021-22)  
Bioinformatics and Nanotechnology**

Paper	: Core Paper XI		
Examination	: External	Section – A (25X1)	: 25
Time	: Three Hours	Section – B (5X5)	: 25
Paper Code	: <b>21P4BC11</b>	Maximum Marks	: 75

**Section A (Answer all the questions)**

**1. Which of these is not a protein sequence database?**

- a) PIR b) Genbank c) PDB d) COGs

**2. Global alignment uses \_\_\_\_\_ algorithm**

- a) Smith-Waterman algorithm b) Needleman-Wunsch algorithm c) Dot Plots d) DALI

**3. FASTA program was first described by**

- a) Lipmann and Pearson b) Adachi and Hasegawa c) Fitch and Margoliash d) Kyte and Doolittle

**4. BAC stands for**

- a) Bacteria Artificial Chromosome b) Bacterial Artificial Chromatid c) Bacterial Artificial Chromatid d) Bacterial Artificial Chromosome

**5. TAP Tags are useful for**

- a) protein resolution b) genome sequencing c) peptide sequencing d) proteome exploration

**6. Bioinformatics can not analyse**

- a) Mathematical analysis b) Statistical analysis c) Biomedical analysis d) Chemical analysis

**7. URL for NCBI is**

- a) www.ncbi.nlm.nih.gov b) www.ncbi.gov c) www.ncbi.nih.nlm.gov d) www.ncbi.nlm.gov

**8. GCG is**

- a) Protein sequencing tool b) Compare two DNA or protein sequences c) Compare multiple DNA or protein sequences d) Nucleic acid sequencing tool

**9. Clustal W**

- a) multiple sequence alignment tool   b) Protein secondary structure predicting tool   c) Data retrieving tool  
d) Nucleic acid sequence analysis tool

**10. Which is data retrieving tool?**

- a)KEGG   b) EMBL   c)ENTREZ   d) PHD

**11. Motifs of protein sequences are**

- a) Secondary databases   b) Relational databases   c) Primary databases   d)Objecti oriented databases

**12. BLASTX program is used for**

- a)Translate DNA database   b) Translate input sequence   c)Translate both sequence   d)Translate protein sequence

**13. “There is a plenty of room at the bottom”. This was stated by**

- a)Issac Newton   b) Albert Einstein   c)Richard Feynman   d)Eric Drexler

**14. I nanometre = \_\_\_\_\_ cm**

- a) $10^{-9}$    b) $10^{-8}$ c) $10^{-7}$    d) $10^{-6}$

**15. The size of E.colibacteir a is \_\_\_\_\_ nm**

- a)75000   b) 2000   c) 200   d) 5

**16. The most important property of nanomaterials is**

- a) force   b) friction   c)pressure   d)temperature

**17. Which one of these statements is not true?**

- a) Gold at the nanoscale is red   b) copper at the nanoscale is transparent   c) Silicon at the nanoscale is an insulator   d) Aluminum at the nanoscale is highly combustible

**18. What is graphene?**

- a) A new material made from carbon nanotubes   b) a one-atom thick sheet of carbon   c) Thin film made from fullerenes   d)a software tool to measure and graphically represent nanoparticles.

**19. Which of the following is the application of nanotechnology to food science and technology?**

- a) Agriculture   b) Food safety and biosecurity   c) Product development   d)all the above

**20. The nanoparticles from iron and palladium are used to produce**

- a)magnets   b) magnetic lens   c)magneto meters   d)magnetic storage devices.

**Section B (Answer all the questions)**

21. a) Write about the Bioinformatics (Or)

b) Explain about FASTA format

22. a) Write about the Bioinformatics (Or)

b) Explain about FASTA format

23. a)How to search the sequences (Or)

b)How to do the substitute Matrix

24. a)Define Nanotechnology & Length scales (Or)

b) Write short on applications of Nanotechnology

25. a) Short note on fluorescence (Or)

b) Write about Carbon Nano tubes

**Section-C(Answer all the Questions)**

26. Explain the Multiple Sequence alignment

27. Briefly explain the Bioinformatics tool

28. Describe the drug discovery & development

29. Explain the history of Nanotechnology

30. Explain Gold Nanoparticles

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MODEL QUESTION PAPER M.Sc. BIOCHEMISTRY  
YEAR II – SEMESTER IV (2021-22)  
HUMAN PHYSIOLOGY**

Paper : Core Paper X  
Examination : External  
Time : Three Hours  
Paper Code : 21P4BC10

Section – A (25X1) : 25  
Section – B (5X5) : 25  
Maximum Marks : 75

**Answer all questions**

**PART A**

**(20X1=20)**

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 <sup>+</sup> 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	CO3	
	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		
<b>Section B</b>						
<b>Answer All questions (5 x 5 = 25 )</b>						
21	A	Write a detailed account on Gastrointestinal tract			CO2	K4
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
<b>Section C</b>						
<b>Answer ANY THREE Questions (3 x 10 = 30)</b>						

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
<b>Total</b>	<b>0</b>	<b>14</b>	<b>7</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>35</b>

**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
<b>Total</b>	<b>0</b>	<b>48</b>	<b>24</b>	<b>48</b>	<b>0</b>	<b>0</b>	<b>120</b>

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

**PART – A (20X 1=20 marks)**

Multiple Choice Questions

**PART – B (5 X 05 = 25 marks)**

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

**PART – C (3 X 10 = 30 marks)**

Answer any 3 Question



