

# 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 2019-2020  
ONWARDS UNDER AUTONOMOUS CBCS AND OBE  
PATTERN

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

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## COLLEGE VISION 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

#### IV. 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.

#### V. DURATION OF THE COURSE

- The course duration shall be two years consisting of 4 semesters. Each academic year shall be divided into 2 semesters. The first academic year shall comprise the first and second semesters, and the second academic year the third and fourth semesters respectively. The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University. Each subject will have six hours of lecture per week apart from practical training at the end of each semester.

#### VI. ASSESSMENT

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

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

### A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

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

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

Activity	Marks (25)	Activity	Marks (40)
Attendance	5	Attendance	5
CA Test I	2.5	CA Test I/Review	5
CA Test II	2.5	CA Test II/Review II	5
Model	10	Model/Model Presentation	10
Assignment	5	Observation note and result in lab	15
	<b>25</b>		<b>40</b>

#### Distribution of attendance mark

S. No.	Percentage	Marks	
		Theory	Practical
1	76-80	1	2
2	81-85	2	4
3	86-90	3	6
4	91-95	4	8
5	96-100	5	10

### A. EXTERNAL ASSESSMENT (EA)

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

The pattern of assessment is as follows:

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

Section	Activity	Marks (75)	Activity	Marks (60)
A	Five marks (5) (Either or)	25	Record work	5
B	Ten marks (10) (Either or)	50	Viva Voce	5
			Spotter	20
			Experiment I	15
			Experiment II	15
	<b>Total</b>	<b>75</b>	<b>Total</b>	<b>60</b>

## VII. PASSING MINIMUM

### INTERNAL

There is no passing minimum for CIA

**EXTERNAL**

In the University Examinations, the passing minimum shall be 50 % out of 75 Marks (38 Marks).

**VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES**

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

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

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

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

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

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

**XI. COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2018-19 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018-19 and thereafter.

**XII. TRANSITORY PROVISIONS.**

Candidates who have undergone the PG Course of study before 2018-19 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 April/May 2020-2021. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years. (3+2)

**XII. COURSE PATTERN**  
**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN**  
**(AUTONOMOUS)**  
**SYLLABUS FRAME WORK**

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
<b>YEAR I</b>													
<b>Semester I</b>							<b>Semester II</b>						
Core Paper I	5	4	3	25	75	100	Core Paper V	5	4	3	25	75	100
Core Paper II	5	4	3	25	75	100	Core Paper VI	5	4	3	25	75	100
Core Paper III	5	4	3	25	75	100	Core Paper VII	5	4	3	25	75	100
Core Paper IV	5	4	3	25	75	100	Elective I	5	3	3	25	75	100
Practical – I	5	4	6	40	60	100	Practical-III	5	4	6	40	60	100
Practical – II	5	4	6	40	60	100	Practical – IV	5	4	6	40	60	100
<b>Total</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>Total</b>	<b>30</b>	<b>23</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>
<b>I YEAR TOTAL</b>								<b>60</b>	<b>47</b>	<b>48</b>	<b>360</b>	<b>840</b>	<b>1200</b>
<b>YEAR II</b>													
<b>Semester III</b>							<b>Semester IV</b>						
Core Paper VIII	5	4	3	25	75	100	Core Paper XI	5	5	3	25	75	100
Core Paper IX	5	4	3	25	75	100	Core Paper XII	5	4	3	25	75	100
EDC	5	4	3	25	75	100	Core Paper XIII	5	4	3	25	75	100
Core Paper X	4	4	3	25	75	100	Project Work	15	4	6	40	60	100
Practical – V	5	4	6	40	60	100							
Practical – VI	4	3	6	40	60	100							
Internship Training Programme		2		40	60	100							
Human Rights	2	2	3	25	75	100							
<b>Total</b>	<b>30</b>	<b>27</b>	<b>27</b>	<b>245</b>	<b>555</b>	<b>800</b>	<b>Total</b>	<b>30</b>	<b>17</b>	<b>15</b>	<b>115</b>	<b>285</b>	<b>400</b>
<b>II YEAR TOTAL</b>								<b>60</b>	<b>44</b>	<b>42</b>	<b>360</b>	<b>840</b>	<b>1200</b>
<b>TOTAL CREDIT FOR THE COURSE</b>								<b>120</b>	<b>91</b>	<b>90</b>	<b>720</b>	<b>1680</b>	<b>2400</b>



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

Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam Hours	Internal	External	Total Marks
<b>YEAR I</b>													
<b>Semester I</b>							<b>Semester II</b>						
Paper I - Biopolymers	5	4	3	25	75	100	Paper V – Intermediary Metabolism and Regulation	5	4	3	25	75	100
Paper II – Cellular Biochemistry	5	4	3	25	75	100	Paper VI – Molecular Biology	5	4	3	25	75	100
Paper III –Enzymology and Enzyme technology	5	4	3	25	75	100	Paper VII – Immunology and Immunotechnology	5	4	3	25	75	100
Paper IV – Analytical Biochemistry	5	4	3	25	75	100	Elective II – Plant Biochemistry and Plant Biotechnology Endocrinology	5	3	3	25	75	100
Practical I	5	4	6	40	60	100	Practical III	5	4	6	40	60	100
Practical – II	5	4	6	40	60	100	Practical – IV	5	4	6	40	60	100
<b>Total</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>Total</b>	<b>30</b>	<b>23</b>	<b>24</b>	<b>180</b>	<b>420</b>	<b>600</b>
<b>I YEAR TOTAL</b>								<b>60</b>	<b>47</b>	<b>42</b>	<b>330</b>	<b>870</b>	<b>1200</b>
<b>YEAR II</b>													
<b>Semester III</b>							<b>Semester IV</b>						
Paper VIII –Advanced Clinical Biochemistry	5	4	3	25	75	100	Paper XI – Neuroscience	5	5	3	25	75	100
Paper IX – Research Methodology	5	4	3	25	75	100	Paper XII – Bioinformatics and Nanotechnology	5	4	3	25	75	100
Paper X –Genetic Engineering and Fermentation Technology	5	4	3	25	75	100	Paper XIII – Human Physiology	5	4	3	25	75	100
EDC -	4	4	3	25	75	100	Project Work	15	4	6	40	60	100
Practical - V	5	4	6	40	60	100							
Practical – VI	5	4	6	40	60	100							
Internship Training Programme		2		40	60	100							
Human Rights	1	1	3	25	75	100							
<b>Total</b>	<b>30</b>	<b>27</b>	<b>27</b>	<b>245</b>	<b>555</b>	<b>800</b>	<b>Total</b>	<b>30</b>	<b>17</b>	<b>15</b>	<b>115</b>	<b>285</b>	<b>400</b>
<b>II YEAR TOTAL</b>								<b>60</b>	<b>44</b>	<b>45</b>	<b>345</b>	<b>855</b>	<b>1200</b>

## I YEAR I SEMESTER BIOPOLYMERS

Paper : Core I  
Hours/Week : 5  
Credit : 4  
Paper Code : **18P1BC01**

Total Hours : 75  
Exam Hours : 03  
Internal : 25  
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	K1
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.	K1,K2 & K3
CO4	Evolve the physiological functions and significance of macro and micro nutrients.	K3 & K4
CO5	Correlate the need of macro and micro nutrients with the metabolic and physiological functions of the human body.	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	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, Actin, Myosin, Keratin, Collagen and Elastin, Transport of amino acid in to mitochondria.

**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 and composition.

**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.): Molecular Aspects of Proteins:** 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.

**TEXT BOOKS:**

1. Bery J.M., Tymoezko J.L. and Stryer L. (2008) **Biochemistry**, 5<sup>th</sup> Edition, W.H. Freeman and Company, New York.
2. Deb, A.C (2004). **Fundamentals of Biochemistry**. 8<sup>th</sup> Edition, New Central Book Agency,
3. Jain, J.L & Jain, (2005) **Fundamentals of Biochemistry**. Sixth Edition, S.Chand & Company, New Delhi.
4. U.Sathayanarayana,(2006). **Biochemistry**. 3<sup>rd</sup> Edition by Books and Allied (P) Ltd., India.

**REFERENCE BOOKS**

1. Murray, K.R. Granner, K.D.Mayes, P.A. and Rodwell W.V. (2009). **Harper's Biochemistry**. 23<sup>rd</sup> Edition, Prentice Hall International Inc., New Jersey.
2. Nelson, D.L. and Cox, M.M (2008). **Lehninger Principles of Biochemistry**. 5<sup>th</sup> Edition, W.H.Freeman and Company, New York.

**WEB OF RESOURCES**

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

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

<https://www.sciencedirect.com/topics/neuroscience/dna-binding-protein>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER I**  
**CELLULAR BIOCHEMISTRY**

Paper	: Core II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P1BC02</b>	External	: 75

**SUBJECT DESCRIPTION:**

Cellular Biochemistry deal with the brief information on the different tissue types, cellular organelles and its biochemistry.

**OBJECTIVES:**

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

**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 transduction 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 Organization:** Structure and functions of cells - prokaryotes and eukaryotes, Cell division - mitosis and meiosis, cell cycle - phases of cell cycle, and regulation of cell growth and cell cycle, molecular motors, micro tubular associated proteins - role in intracellular motility.

**Unit II – (15 Hrs.): Cellular Organelles:** Structure and composition of cytoskeleton, Actin filament, intermediate filament and microtubule, Nucleus - internal organization, traffic between the nucleus the nucleolus, and Cytoplasm- endoplasmic reticulum, golgi apparatus and lysosomes, protein sorting and transport, Morphology and function of mitochondria, chloroplasts, peroxisomes and glyoxysomes.

**Unit III – (15 Hrs.): Cellular Interaction:** 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, intracellular signal transduction and second messengers (G –protein coupled receptors, receptor tyrosine kinases)

**Unit IV – (15 Hrs.): Programmed Cell Death:** Apoptosis - Pathways, regulators & effectors in apoptosis, Cancer - Properties of tumor cells, Tumor suppressor genes-p53, Bcl2 and Bax. Cancer markers- AFP, IL-1, BRCA1 and BRCA2. Carcinogenic effect of chemicals and radiation.

**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. Geoffrey, M. Cooper and Robert E. Hausman, **The Cell: A Molecular Approach**. 4<sup>th</sup> Edition, Asm Press, USA.
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.

**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.

**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)

**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	: 4	Internal	: 25
Paper Code	: <b>18P1BC03</b>	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	K1 & K2
CO2	Understand about the role of enzyme as a catalyst in biological process	K1 & K2
CO3	Interpret the optimum pH, Temperature , Concentration of enzyme for certain enzyme catalysed reaction	K1,K2 & K3
CO4	Learn about the logistic and sensible entrapment technique to improve the state of enzyme immobilization	K3 & K4
CO5	Familiarize about the application of enzyme technology in industrial sector	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.): 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. 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 and application of immobilized enzyme. Biosensors- calorimetric biosensors, potentiometric biosensors, Amperometric biosensors, optical biosensors, Piezo-electric biosensors and immunosensors.

**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.

#### TEXT BOOKS

1. Nicholas, C. Price, (1998). **Fundamentals of Enzymology**. 2<sup>nd</sup> Edition, Oxford University Press. UK
2. Trevor Palmer and Philip.L.Bonner (2008). **Enzymes**. 5<sup>th</sup> Edition, Affiliated East –West press (P)Ltd. New Delhi.
3. Gary Walsh, Denis and Headon, (2002). **Protein Biochemistry and Biotechnology**. John Wiley and sons Ltd. USA.
4. Ashok Pandey, Colin Webb, Carlos Ricardo Soccol, Christian, (2005). **Enzyme Technology**. Asiatech Publishers, Inc., New Delhi.

#### REFERENCES BOOKS

1. Chapline, M.F. Bucke, C. (1990). **Enzyme Technology**. 1<sup>st</sup> Edition, Cambridge University Press. New York.
2. Chapline, Bucke C, (1990). **Protein Biotechnology**. 1<sup>st</sup> Edition, Cambridge University Press, 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>

#### PEDAGOGY: CHALK and Talk , PPT



**YEAR I – SEMESTER I  
ANALYTICAL BIOCHEMISTRY**

Paper	: Core IV	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P1BC04</b>	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	Distinguish invivo and invitro techniques and buffers in biological systems	K2
CO2	Explain the distinct modes of centrifugation and electrophoresis techniques and their applications	K3
CO3	Classify the various chromatography techniques for the separation of a mixture	K4
CO4	Choose spectroscopic techniques used as a tool for studying the structures of atoms and molecules	K6
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	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.): pH and Buffers:** 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.

**Unit II – (15 Hrs.): Centrifugation:** Basic principles of sedimentation, types of centrifuges and rotors, Preparative ultracentrifugation, differential centrifugation, density-gradient and analytical ultracentrifugation and applications in determination of molecular weight, Electrophoresis techniques – Principle, technique and applications of paper, Native PAGE gels, SDS-PAGE, Isoelectric focusing, Pulse field electrophoresis, Capillary electrophoresis, Immunoelectrophoresis.

**Unit III – (15 Hrs.): Chromatography:** General principles and definitions, Types, Principle, 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.

**Unit IV – (15 Hrs.): Spectroscopic Technique:** Basic principles, 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.

**Unit V – (15 Hrs.): Radioisotopes:** . 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.

**TEXT BOOKS**

1. Veerakumari, L (2006). **Bioinstrumentation**, MJP Publishers, Chennai.
2. B.K. Sharma (2019). **Instrumental methods of chemical analysis**, Goel Publishing House, Meerut, 27<sup>th</sup> edition,
2. Avinash Upadhyay, Kakoli Upadhyay, and Nirmalendu Nath, (2009). **Biophysical Chemistry: Principles and Techniques**. 2009 Rev.edition, Himalaya publishing House, Mumbai.
4. Keith Wilson and John walker 2017, Principles and techniques of biochemistry and molecular biology, 7<sup>th</sup> edition published by Cambridge university press.

**REFERENCE BOOKS**

1. Keith Wilson, and John Walker, (2000). **Principles and Techniques of Practical Biochemistry**. 5th edition, Cambridge University Press. UK.
2. Wilson, K and Goulding, KH (1987). **A Biologist Guide to Principles and Techniques of Practical Biochemistry**, 3rd edition, Edward Arnold Publishers. London, 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**

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

Paper	: Core Biochemistry Practical I	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: <b>18P1BCP01</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Learn and understand the concepts of separation of aminiacids 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 glycogen from liver.
2. Isolation and estimation of Starch from Potato.
3. Isolation and estimation of DNA from liver
4. Estimation of RNA
5. Isolation of lecithin from egg yolk.
6. Estimation of ascorbic acid from fruit
7. Estimation of lactose from milk
8. Separation of Amino acids, Sugars by Paper Chromatography (Ascending, Descending and Circular).
9. Estimation of Calcium from milk by titrimetry.

**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	: 4	Internal	: 40
Paper Code	: <b>18P2BCP02</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. Kinetic (Effect of pH, Temperature and Substrate concentration-MM Plot, V max) studies of

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

II. Immobilised Enzyme Reactions

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

III. Separation of Isoenzymes

7. Separation 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 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 II**  
**INTERMEDIARY METABOLISM AND REGULATION**

Paper	: Core V	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P2BC05</b>	External	: 75

**SUBJECT DESCRIPTION:**

Intermediary metabolism and regulation deal with the synthesis of biomolecules its regulation and catabolism of biopolymers and its regulation in healthy condition.

**OBJECTIVE:**

The objective of the paper is to make the students to study about bioenergetics and metabolism of that takes place in our body. Interrelationship between carbohydrate, fat and protein metabolism.

Role of purine and pyrimidines in nucleic acid metabolism.

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Understand how the glycolytic pathway is used to convert glucose to pyruvate and understand conservation of chemical potential energy in the form of ATP and NADH.	K1 & K2
<b>CO2</b>	understand the fate of pyruvate under aerobic and anaerobic conditions and the amphibolic nature of TCA cycle	K1 & K2
<b>CO3</b>	Understand the concepts of metabolism of carbohydrates.	K1,K2 & k3
<b>CO4</b>	Understand the concepts of metabolism of lipids.	K3 & K4
<b>CO5</b>	Understand the concepts of metabolism of protein, amino acid and nucleic acid.	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, 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 leucotrienes, 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 carbonyltransferase, 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 VI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P2BC06</b>	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
<b>CO1</b>	Illustrate the molecular mechanism of DNA replication in prokaryotes and eukaryotes	K2
<b>CO2</b>	Explain the stages of transcription and post transcriptional processing	K3
<b>CO3</b>	Analyze the decoding process of mRNA for protein designing principle	K4
<b>CO4</b>	Formulate the protein targeting, transport, translocation and regulation of gene expression	K6
<b>CO5</b>	Categorize the different types of DNA damage and repair mechanism	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:** 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.

**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, mechanism of intron removal and exon splicing, 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.

**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 Repair & Recombination:** DNA damage - different types, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, recombination error, SOS response and mutagenic repair, DNA Recombination - Homologous genetic recombination, Site specific recombination and DNA transposition.

#### TEXT BOOKS

1. D.L. Nelson and M. M. Cox (2008).Lehninger's **Principles of Biochemistry** 5<sup>th</sup> Edition. Freeman Publishers. New York.
2. Donald Voet, Judith, G. Voet and Charlotte W Pratt, (2008) **Fundamentals of Biochemistry.** 3<sup>rd</sup> Edition. John Wiley & sons Inc. New York
3. Gerald Karp (2008) **Cell and Molecular Biology.** 5<sup>th</sup> Edition, John Wiley and Sons Inc.
4. Ajay Paul, (2009).**Text book of Cell and Molecular Biology.** 2<sup>nd</sup> Edition, Books and Allied (P) Ltd, Kolkata.

#### REFERENCE BOOKS

1. David Friefelder, (1987). **Molecular biology.** 2<sup>nd</sup> Edition, Narosa Publishing House, New Delhi.
2. E D P de Robertis and E M F de Robertis, (2001).**Cell and Molecular Biology.** 8<sup>th</sup> Edition, Lippincott W&W.

#### WEB SOURCES

[https://en.wikipedia.org/wiki/Cellular\\_component](https://en.wikipedia.org/wiki/Cellular_component)

<https://www.thoughtco.com> > ... > Science > Biology > Genetics

<https://www.khanacademy.org/science/.../transcription.../overview-of-transcription>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR I – SEMESTER II  
ENDOCRINOLOGY**

Paper	: Elective I	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: <b>18P2BCE01</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. Endocrinology of pregnancy, parturition and lactation. Sex differentiation and development. 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.

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### PEDOGOGY: CHALK and Talk , PPT

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

Paper	: Core VII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P2BC07</b>	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.

**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, Immunotolerance, autoimmune disorders.

**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.

#### **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.** Garland Science, New York.

#### **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:**

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[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/)  
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#### **PEDOGOGY: CHALK and Talk , PPT**

**PLANT BIOCHEMISTRY AND PLANT BIOTECHNOLOGY**

Paper	: Elective – II	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 3	Internal	: 25
Paper Code	: 18P2BCE02	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:** C<sub>3</sub>, C<sub>4</sub> and CAM plants - Calvin cycle; Hatch-Slack pathway, Photorespiration in plants, biochemical basis of PR pathway – C<sub>2</sub>



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, Inter relationship 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, Gene transfer to plants - Agrobacterium mediated transformation, Ti plasmids, Ri plasmids, Direct DNA transfer to plants – protoplast transformation, Plant viruses as vectors – CaMV, Gemini viruses, RNA viruses (TMV, potato virus X) as vectors, Advantages and uses of transgenic plants.

**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.

#### TEXT BOOKS

- 1.Heldt, HW. (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:

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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. <http://en.wikipedia.org/wiki/Photophosphorylation>

**PEDOGOGY: CHALK and Talk , PPT**

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

Paper	: Core Practical III	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: <b>18P3BCP03</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Get an insight into estimation of chlorophyll, alkaloid, flavonoid from leave its results interpretation	K1 & K2
<b>CO2</b>	Get an insight into isolation of solanine, caffeine and its results identification	K1 & K2
<b>CO3</b>	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. Determination of aldehydes in lemon oil
4. Extraction and confirmation
  - a. Pectin from orange peel
  - b. Caffeine from tea
  - c. Solanine from potato

**II. PLANT TISSUE CULTURE (DEMO)**

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

**III QUANTITATIVE ANALYSIS**

1. Estimation of total alkaloids
2. Estimation of total phenols
3. Estimation of total flavonoids
4. Estimation of Phytosterols

**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	: 4	Internal	: 40
Paper Code	: <b>18P3BCP04</b>	External	: 60

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
<b>CO1</b>	Learn and understand the concepts agarose gel electrophoresis	K1 & K2
<b>CO2</b>	Demonstrate the level of DNA, RNA by orcinol and Diphenylamine method	K1 & K2
<b>CO3</b>	Learn the isolation of genomic DNA, RNA	K1, K2 & K3

**Mapping with Programme Outcomes**

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

S- Strong; M-Medium; L-Low

**IMMUNOLOGY**

1. Estimation of DNA Diphenylamine method
2. Estimation of RNA Orcinol method
3. Agarose Gel Electrophoresis
4. Isolation of plasmid DNA
5. Isolation of Genomic DNA
6. Isolation of RNA
7. Restriction digestion of DNA
8. Preparation of competent cell and Transformation
9. PCR – Demonstration
10. 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.

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

Paper	: Core VIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P3BC08	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	Catagorize 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, Laboratory safety –first aid in laboratory accident, toxic chemicals and biohazards, Automation in clinical laboratory – Precision, Quality assurance, clinical validation and accreditation.

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

**Unit III – (15 Hrs.): Disorders of aminoacids metabolism:** Inborn errors of Branched chain amino acids, aromatic amino acids, aliphatic amino acids, Disorders of Nucleic acid metabolism - 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, 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.
4. 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.

### 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.

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2. [www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...](http://www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...)
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**PEDOGOGY: CHALK and Talk , PPT**

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

Paper	: Core X	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P3BC10</b>	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, vectors, methods of gene cloning. Techniques and application of gene technology.

**COURSE OUTCOMES:**

Course No	Course Outcome	Knowledge Level
CO1	The basis of gene cloning, vectors, genetic engineering techniques and large scale production of biochemical by fermentation technology.	K1 & K2
CO2	Methods to produce different genetically modified organisms	K1 & K2
CO3	Applications of genetic engineering in biotechnology	K1, K2 & L2
CO4	Become well in handling the molecular techniques like PCR, Western blotting etc.,	K3 & K4
CO5	Understanding of how in vitro manipulation can be used to create distinct cell lineages	K4 & 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.): Introduction to Gene Manipulation** – Basic techniques of Genetic Engineering - Restriction modification enzymes used in recombinant DNA technology, Agarose gel electrophoresis, Southern, Northern, Western Blotting, PCR and its types, RFLP, RAPD, Genetic transformation of prokaryotes - Transferring DNA into E.coli, Chemical induction and Electroporation, DNA delivery methods, Gene targeting and Gene tagging. Cloning vectors - Plasmid cloning vector PBR322, other plasmid vectors, Vectors for cloning large piece of DNA,



Bacteriophage vectors and other phagevectors, Cosmids, Phagemids, YAC and BAC vectors, Viral vectors - SV40, Reterovirus, Adenovirus, Vacciniavirus and Baculovirus as Vectors, Marker genes - Selectable markers and Screenable markers, non-antibiotic markers.

**Unit II – (15 Hrs.): Gene expression in prokaryotes** - Tissue specific promoter, wound inducible promoters, Strong and regulatable promoters, increasing protein production, Fusion proteins, Translation expression vectors, Mammalian cell expression vectors, Two-vector expression system, two-gene expression vector, Gene library- Construction cDNA library and genomic library, screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity.

**Unit III – (15 Hrs.): Gene Therapy** - Somatic cell Gene therapy, Germ cell gene therapy, Stem cell and its application in gene therapy, Gene therapy for inherited disease, cystic fibrosis, ADA, infectious disease, familial hypercholesterolemia, Antisense oligonucleotides, SiRNA, MicroRNA , Ribozymes , Artificially designed aptamers.

**Unit IV – (15 Hrs.): Fermentor/bioreactor** - types and design of fermentor, Inoculum preparation, cell growth, substrate utilization, product formation, Mode of fermentation- fed-batch, batch and continuous culture - process and its control, Downstream processing –Recovery and purification of products.

**Unit V – (15 Hrs.): Food fermentations-** Bread, Malt Beverages, Vinegar, Fermented Vegetables, Fermented Dairy products, Microorganisms as Food- Single cells protein, Fats from Microorganisms, Production of Amino acids, Production of Enzymes, Production of bioinsecticides and fungal polysaccharides, GM foods, Food security and General ethical concern-Foods produced using modern biotechnology, Impacts of GM foods on human health and environment.

### TEXT BOOKS

1. Glick, B.R. and Pasternak, (2010) .**Molecular Biotechnology** 4<sup>th</sup> Edition Pasternak, J.J. ASM Press,USA
- 2 Sambrook, J. Molecular cloning. (2001). **A Laboratory Manual** 3<sup>rd</sup> Edition , USA
- 3 Watson, W.H.Freeman(1992).**Recombianant DNA** 2<sup>nd</sup> Edition.Freeman and Co., NY
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1. Marx, J.L., (1989). **A Revolution in Biotechnology**, Cambridge Univ. press, UK
2. Smith, (1996). **Biotechnology** 3<sup>rd</sup> Edition. Smith, Cambridge Univ. press
3. Principles of **Gene Manipulation and Genomics** 7<sup>th</sup> Edition. Blackwell pub., NY.

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3. [www.cdc.gov/adenovirus/](http://www.cdc.gov/adenovirus/)
4. [www.thefreedictionary.com/fermentation](http://www.thefreedictionary.com/fermentation)
5. [www.atcc.org/Products/Cells\\_and\\_Microorganisms/Cell\\_Lines.aspx](http://www.atcc.org/Products/Cells_and_Microorganisms/Cell_Lines.aspx)
6. <https://www.thermofisher.com/so/en/home/.../gibco-cell.../cell-lines.html>

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR II – SEMESTER III  
RESEARCH METHODOLOGY**

Paper	: Core IX	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P3BC10</b>	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	K1 & K2
CO2	Provide the importance and need for research.	K1 & K2
CO3	Understood about basic concepts of research designs, ethics in scientific research.	K1, K2 & 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.	K3 & K4
CO5	Select and define appropriate research problem and parameters	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	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 & Writing:** Importance and need for research, Ethics and scientific research, Formulation of hypothesis, Types and characteristic designing a research work, 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.

**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:** Declaration of Bologna, Ethics in animal experimentation, CPCSEA guidelines - Animal care and technical personnel environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia, Composition of (Human) institutional Ethical Committee (IEC) - General ethical issues, Specific principles for chemical evaluation of drugs, herbal remedies and human genetic research, Ethics in food and drug safety, Environmental release of microorganisms and genetically engineered organisms, Ethical issues in human gene therapy and human cloning.

#### 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,
4. Biostatistics – A foundation for analysis in health Science Danien.

#### 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.

#### WEB RESOURCES

[www.newagepublishers.com/samplechapter/000896.pdf](http://www.newagepublishers.com/samplechapter/000896.pdf)  
[www.wipo.int/wipo\\_magazine/en/2006/04/article\\_0003.html](http://www.wipo.int/wipo_magazine/en/2006/04/article_0003.html)  
[www.ijme.in/182ar82.html](http://www.ijme.in/182ar82.html)

<https://en.wikipedia.org/wiki/Database>  
[www.tutorialspoint.com/database\\_tutorials.htm](http://www.tutorialspoint.com/database_tutorials.htm)  
[www.ipr-helpdesk.org/](http://www.ipr-helpdesk.org/) 4.  
[www.patentoffice.nic.in/ipr/patent/patents.htm](http://www.patentoffice.nic.in/ipr/patent/patents.htm)

**PEDOGOGY: CHALK and Talk , PPT**

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

Paper	:Core Practical - V	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: <b>18P3BCP05</b>	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

**A. COLLECTION AND ANALYSIS OF BLOOD**

1. Collection of venous blood
2. Estimation of blood glucose by O-Toluidine Method.
3. Estimation of serum proteins by Lowry and Biuret Method.
4. Estimation of A/G ratio in serum.
5. Estimation of blood urea by DAM method.
6. Estimation of serum uric acid by Phosphotungstate Method.
7. Estimation of serum creatinine by Alkaline Picrate Method.
8. Estimation of serum cholesterol by Zlatkis, Zak and Boyle method.
9. Estimation of serum bilirubin by Evelyn Malloy method.

**B. URINE ANALYSIS**

1. Qualitative analysis of normal and pathological constituents in urine.
2. Estimation of urea in urine by DAM method.
3. Estimation of creatinine in urine by Alkaline Picrate Method
4. Estimation uric acid in Urine by Phosphotungstate Method.
5. Estimation of Calcium in urine by Clark Method
6. Estimation of Chloride in urine by Schales &Schales Method

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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 - III	Total Hours	: 45
Hours/Week	: 5	Exam Hours	: 06
Credit	: 4	Internal	: 40
Paper Code	: <b>18P3BCP06</b>	External	: 60

**COURSE OUTCOME:**

Course No	Course Outcome	Knowledge Level
CO1	Learn and understand the methods of bleeding-Tail vein puncture, Intravenous, Retro orbital, cardiac vein puncture	K1 & K2
CO2	Demonstrate Rh typing and Identification of blood group	K1 & K2
CO3	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 antigen and Routes of immunization (Intra-peritoneal, Sub-cutaneous, Intra-muscular, Intra- nasal, Oral)
2. Methods of bleeding (Tail vein puncture, Intravenous, Retro orbital, cardiac vein puncture)
3. Preparation of serum and plasma from peripheral Blood
4. Identification of blood cells
5. Isolation of peripheral blood mononuclear cells.
6. Identification of blood group & Rh typing
7. Preparation of Blood antigens
8. Testing for typhoid antigens by Widal slide test
9. Pregnancy Test (Slide Test)
10. Immunodiffusion –Single radial and double diffusion
11. Immuno electrophoresis – Counter Current immunoelectrophoresis
12. Western blot analysis - Demo



**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 Mannual 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 IV**  
**IV SEMESTER M.Sc., BIOCHEMISTRY**  
**NEUROSCIENCE**

Paper	: Core XI	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 5	Internal	: 25
Paper Code	: <b>18P4BC11</b>	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 functions of various sensory organs in human system. To learn the biochemical aspects behind diseases associated with 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

cos	M	M	L	M	L	M	S	L	S	S	M	M	L	L	L
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S- Strong; M-Medium; L-Low

### CONTENT:

**Unit I – (15 Hrs.): Nervous system-** Classification, General functions of autonomic and somatic nervous system, Neuron - Structure, types of neurons, properties - excitation and action potential, Neuroglia - structure and properties, Receptors – sensory, Synapse-properties and functions, Neurotransmitters-structure and types, Receptors for neurotransmitters - cholinergic, adrenergic, nicotinic and muscarinic, excitatory and inhibitory transmission, conduction of nerve impulse.

**Unit II – (15 Hrs.): Brain and Spinal cord-** Structure and functions, Brain metabolism and metabolic adaptation, Neurohormones and neuromodulators, Biochemical aspects of neuronal behavior such as sleep, learning and memory.

**Unit III – (15 Hrs.): Sensory systems-** 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 smell.

**Unit IV – (15 Hrs.): Neurodegenerative disorders-** Dementia, Schizophrenia, Huntington's disease, Parkinsonism disease and Alzheimer's disease, Neuromuscular diseases - Muscular dystrophy, Tetanus and botulism.

**Unit V – (15 Hrs.): Pharmacology of nervous System-** CNS depressants (sedative, hypnotics), CNS stimulants, analgesics, antipsychotics and mood stabilizing drugs, Drug therapeutic actions of Huntington's disease, Parkinsonism and Alzheimer's disease.

### 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>  
[www.drive5.com/muscle/](http://www.drive5.com/muscle/)

**PEDOGOGY: CHALK and Talk , PPT**

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

Paper	: Core XII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: <b>18P4BC12</b>	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	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

### **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, Paragastogi (2000).

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

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

4. Janusz M. Bujnicki (2008) **Practical Bioinformatics** Springer Berlin.

### **REFERENCE BOOK**

1. Nanotechnology – **Fundamentals and Application** – Mansi Kar Kare

2. Liebler, Humana (2002) **Introduction to proteomics: Tools for new biology** Liebler, 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)

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**YEAR II – SEMESTER IV  
HUMAN PHYSIOLOGY**

Paper	: Core XIII	Total Hours	: 75
Hours/Week	: 5	Exam Hours	: 03
Credit	: 4	Internal	: 25
Paper Code	: 18P4BC13	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 Skeletal Muscle - Structure of skeletal muscle, contraction of muscle fibre, chemical changes during muscle

contraction, sources of energy of muscle contraction.

**Unit II – (15 Hrs.): Blood and Body fluids:** Composition and function, Red blood cells, Hemoglobin, white blood cells and platelets. Blood coagulation, blood groups and blood transfusion, Formation and functions of lymph, Body buffers, Digestive system - Secretion of digestive juices, digestion and absorption of carbohydrates, proteins and fats.

**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 - Mechanism of formation of urine, composition of urine, Micturition, Renal regulation of acid balance, hormone of the kidney.

**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.): Male Reproductive system:** 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.

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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

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[www.drive5.com/muscle/](http://www.drive5.com/muscle/)

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