

## DEPARTMENT OF BIOCHEMISTRY

### PREAMBLE:

**UG** : Programme profile and the syllabi of courses offered in semester V and VI along with III and IV evaluation Components (with effect from 2018-2021 batches onwards)

### PROGRAMME PROFILE OF B.Sc BIOCHEMISTRY

#### B.SC BIOCHEMISTRY PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon completion of the Programme, the students will be able to

- Understand the various biological components present in living cells and its functions.
- Develop practical skills and strong speculative foundation in the interdisciplinary area.
- Analyze the applications of Biochemistry in the fields of Clinical Biochemistry, Genetic Engineering, Molecular Biology, Biotechnology etc.
- Expose the students to a wide range of careers that combine Biology, Plants & Medicine.

### PROGRAMME PROFILE B.Sc(Biochemistry)

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Hours Per Week	Credit
							Min / Max
I	I	Language	UTAL105/ UTAL106/ UHIL102/ UFRL102	Basic Tamil I/ Advanced Tamil I/ Hindi I / French I	UTAL103/ UTAL104/ UHIL101/ UFRL101	4	2/3
	II	English I	UENL107 /UENL108	General English I/ Advanced English I	-/ UENL106	5	3/4
	III	Core I	UBCM106	Fundamentals of Biochemistry	--	2	1
		Core II	UBCM105/	Cell Biology	UBCM201	6	5
		Core Practical I	UBCR101	Cell Biology Practical	--	3	3
		Allied I	UCHA102	Allied Chemistry - I	UCHA101	5	4
		Allied Practical	UCHR103/ UCHR403	Volumetric and Organic Analysis	--	3	2
	IV	Value Education				2	1
<b>TOTAL</b>						<b>30</b>	<b>21/23</b>
II	I	Language	UTAL205/ UTAL206/ UHIL202/ UFRL202	Basic Tamil II/ Advanced Tamil II/ Hindi II/ French II	UTAL203/ UTAL204/ UHIL201/ UFRL201	4	2/3
	II	English II	UENL207/ UENL208	General English II/ Advanced English II	-/ UENL206	5	3/4
	III	Core III	UBCM202	Biomolecules	UBCM102	5	5
		Core Practical II	UBCR201	Qualitative Analysis of Biomolecules	--	3	2
		Allied II	UMBA201	Microbiology	--	4	4

		Allied II Practical	UMBR201	Microbiology Practical	--	3	3	
	IV	Non Major Elective				4	2	
		Soft Skill				2	1	
	V	Extension Activity/ Physical Education/NCC				-	½	
<b>TOTAL</b>						<b>30</b>	<b>23/26</b>	
III	I	Language	UTAL307/ UTAL308/ UHIL302/ UFRL302	Basic Tamil III/ Advanced Tamil III/ Hindi III/ French III	UTAL303/ UTAL304/ UHIL301/ UFRL301	4	2/3	
	II	English III	UENL307/ UENL308	General English III/ Advanced English III	-/ UENL306	5	¾	
	III	Core IV	UBCM304		Biochemical Techniques	--	6	6
		Core Practical III	UBCR301		Biochemical Techniques practical I	--	5	5
		Allied III	UMAA305		Biostatistics	UMAA405	5	4
	IV	Online Course			NPTEL/Spoken Tutorial		3	½
		Value Education					2	1
<b>TOTAL</b>						<b>30</b>	<b>22/25</b>	
IV	I	Language	UTAL405/ UTAL406/ UHIL402/ UFRL402	Basic Tamil IV/ Advanced Tamil IV/ Hindi IV/ French IV	UTAL403/ UTAL404/ UHIL401/ UFRL401	4	2/3	
	II	English IV	UENL407/ UENL408	General English IV/ Advanced English IV	--/ UENL406	5	¾	
	III	Core V	UBCM403		Immunology	UBCO603	6	6
		Core VI	UIDM401		Pharmaceutical Chemistry	UIDM401	6	6
		Core Practical IV	UBCR401		Biochemical Techniques Practical II	UBCR401	5	5
		Core X	UBCP501		Project	UBCP601	2	-
	IV	Soft skill				2	1	
	V	Extension Activity/ Physical Education/NCC					-	-/2
<b>TOTAL</b>						<b>30</b>	<b>23/27</b>	
V	III	Core VII	UBCM504	Enzymes & Intermediary Metabolism	UBCM501	6	6	
		Core VIII	UBCM505	Human Physiology	UBCM502	6	6	
		Core IX	UBCM506	Basics of Bioinformatics	UBCM503	6	6	
		Core Practical V	UBCR501	Enzymology Practical	UBCM501	6	3	
		Core X	UBCP501	Project	UBCP601	4	4	
		Value Education					2	1

						<b>TOTAL</b>	<b>30</b>	<b>26</b>
VI	III	Core XI	UBCM605	Introduction to Biotechnology	UBCM601	5	4	
		Core XII	UBCM606	Clinical Biochemistry	UBCM602	5	5	
		Core XIII	UBCM607	Molecular Biology	UBCM603	5	5	
		Core XIV	UBCM604	Comprehensive Viva voce	--	-	1	
		Core Practical VI	UBCR601	Clinical Biochemistry Practical	--	5	3	
		Core Practical VII	UBCR602	Hematology & Urine Analysis	--	3	2	
		Major Elective	UBCO604	Stem Cell Biology	--	5	4	
	UBCO607		Molecular Endocrinology	UBCO605				
	UBCO606		Pathobiology of Human Diseases and Disorders	--				
	UIDM601		Nanotechnology in Medicine	--				
	IV	Soft Skill				2	1	
V	Extension Activity/ Physical Education/NCC				-	-/2		
						<b>TOTAL</b>	<b>30</b>	<b>25/27</b>
						<b>GRAND TOTAL</b>	<b>180</b>	<b>140/154</b>

### Experiential Learning for Clinical Biochemistry and Biotechnology Offered in Semester VI

Course Mapping				Collaborating Agency –MSME & E.S. Hospital		
Semester	Course Code	Course Title	Assessment	Course Title	Hours/Days / Month	Mode of Evaluation
VI	UBCM606	Clinical Biochemistry	Component III	Clinical Biochemistry	5 days	Reflection
VI	UBCM605	Introduction to Biotechnology	Component IV	Organic Farming	2 days	Reflection

## ENZYMES AND INTERMEDIARY METABOLISM

UBCM504

Semester : V  
Category : Core VII  
Class & Major: III B.Sc Biochemistry

Credits : 6  
Hours/Week : 6  
Total Hours : 78

### Objectives:

#### To enable the students

- Understand the rate of acceleration of the biochemical reactions in the presence of the biocatalyst (enzymes).
- Elucidate how enzymes catalyze the bio chemical reactions.
- Analyze the importance of biochemical metabolic pathways.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Acquire fundamental knowledge on enzymes and their importance in biological reactions.
- Understand the difference between a chemical catalyst and biocatalyst.
- Understand the importance of high energy compounds, electron transport chain and synthesis of ATP under aerobic and an aerobic conditions.
- Exposed with the fact that perturbations in the carbohydrate, lipid, protein and nucleic acid metabolism that lead to various disorders.

### UNIT-I INTRODUCTION

16 Hrs

Enzymes - Introduction; Nomenclature and IUB Classification of Enzymes, Enzyme Units, Coenzymes and Isoenzymes. Active Site: Mode of action - Lock and Key theory and Induced fit theory. Factors influencing enzyme action, Michaelis Menten equation: Line weaver burke plot: Eadie – Hofstee plot; Enzyme Inhibition – Competitive, Non – Competitive and Uncompetitive Inhibition.

### UNIT-II CARBOHYDRATE METABOLISM

16 Hrs

Glycolysis - Aerobic and anaerobic pathway, Oxidation of Pyruvate, TCA cycle and its energetics - Anaplerotic reactions; Regulation, Gluconeogenesis, Glycogenesis, Glycogenolysis – pathway and Regulation. Pentose phosphate pathway.

### UNIT-III LIPID METABOLISM

15 Hrs

Biosynthesis of Fatty acid. Oxidation of Fatty acids -  $\alpha$ ,  $\beta$  and  $\gamma$  oxidation; Biosynthesis and Degradation of Lecithin, Cephalin, Phosphatidyl Inositol, Phosphatidyl Serine, Sphingomyelin and Plasmalogen. Biosynthesis and Degradation of Cholesterol.

### UNIT-IV PROTEIN METABOLISM

16 Hrs

Fate of Dietary Proteins. Catabolism of Aminoacids – Transamination, Oxidative and non-Oxidative Deamination, Transdeamination, Decarboxylation, Urea cycle and its Regulation and Biosynthesis of Creatinine.

## UNIT-V NUCLEICACID METABOLISM

15 Hrs

Metabolism of Purines - Biomedical importance. Biosynthesis of Purine Nucleotides by De novo and Salvage Pathway, Regulation and Degradation, Metabolism of Pyrimidines – Biosynthesis of Pyrimidine Nucleotides by De novo and Salvage pathway and Degradation.

### Text Books

- David L. Nelson, Michael M.Cox. (2017). *Lehninger-Principles of Biochemistry*. W.H.Freeman and company. (7<sup>th</sup> ed.,). Newyork
- Robert, K & Murray.et.al, (2015). *Harpers Biochemistry*. Prentices Hall International. (30<sup>th</sup> ed.,).

### Reference Books

- Trevor Palmer. (2001).*Understanding Enzymes*. Scientific Publishers. Jodhpur (5<sup>th</sup> ed.,)
- Voet &Voet, John Wiley & Sons, (2018). *Biochemistry*. Prentices Hall International.(5<sup>th</sup> ed.,)
- Champe, P.C and Richard A Harvey. (2017). *Lippincotts Biochemistry*. Williams & Wilkins Publishers. (7<sup>th</sup>ed.,).

### E-Resources

- <https://www.kobo.com/us/en/ebook/enzymes-6>
- <https://www.elsevier.com/books/the-enzymes/dalbey/978-0-12-373916-2>
- <https://www.kobo.com/us/en/ebook/metabolic-regulation>
- <https://www.kobo.com/us/en/ebook/hepatic-de-novo-lipogenesis-and-regulation-of-metabolism>
- <https://www.elsevier.com/books/metabolic-regulation/vogel/978-0-12-299255-1>

**HUMAN PHYSIOLOGY**  
**UBCM505**

**Semester** : V  
**Category** : Core VIII  
**Class & Major:** III B.Sc Biochemistry

**Credits** : 6  
**Hours/Week** : 6  
**Total Hours** : 78

**Objectives:**

**To enable the Students**

- Understand the physical structure and functioning of human body.
- Analyze the importance of human & human organs.
- Comprehend the functional organization of organ system of human body in the study of Biochemistry.

**Learning Outcomes:**

**On Completion of the course, the students will be able to**

- Explain the structure and functions of human organs and organ systems.
- Identify causes and effects of homeostatic imbalance
- Exposure with the blood and circulatory system and the function of heart.
- Exposure with the process of gaseous exchange in tissues and lungs, respiratory adaption to high altitude.

**UNIT - I BLOOD AND CIRCULATORY SYSTEM**

**15 Hrs**

Blood and Body fluids- Composition and Functions; Types of Blood Cells- Morphology and Function; Blood coagulation; Blood groups- ABO and Rhesus System. Circulation: Structure of Heart and Blood Vessels, Cardiac Cycles- Cardiac Factors Controlling Blood Pressure- Electrocardiogram- Functions of Heart.

**UNIT - II DIGESTION & EXCRETORY SYSTEM**

**15 Hrs**

Structure and Function of different components of Digestive System, Mechanism of Digestion and Absorption of Carbohydrates, Lipids and Proteins, Gastric Secretion - Mechanism of HCl formation in Stomach. Kidney structure and its organization, Mechanism of Urine Formation- Glomerular Filtration Rate (GFR), Selective Reabsorption (active and passive) of substances and Secretion

**UNIT –III RESPIRATION**

**16 Hrs**

Components of the respiratory system; Diffusion of gases in Lungs- Transport of oxygen from Lungs to Tissues, Transport of CO<sub>2</sub> from Tissues to Lungs.

**UNIT – IV NERVOUS SYSTEM**

**16 Hrs**

Central Nervous System- General organization. Functional Units. Resting and Action potential- Conduction of Nerve Impulse, Structure of Synapses, Synaptic transmission; Structure of Neuromuscular Junction and Mechanism of Neuromuscular transmission, Neurotransmitters. Biochemical aspects of learning and memory.

Enkephalin and Endorphins.

## **UNIT – V MUSCULAR SYSTEM**

**16 Hrs**

Types of Muscles and their Functions; Structure of Skeletal Muscle, Myosin, Actin and Regulatory proteins, Sarcomere unit, Mechanism of Contraction and Relaxation of Skeletal Muscles; Chemical changes during Muscle Contraction, Source of energy for Muscle Contraction.

### **Text Books**

- Chatterjee, C.C . (2018). *Human Physiology*: Vol I & II. (12<sup>th</sup>ed.,).
- Sembulingam, K and Prema Sembulingam. (2019). *Essentials of Medical Physiology*. Jaypee Brothers. (8<sup>th</sup>ed.,).New Delhi.

### **Reference Books**

- Guyton & Hall. (2010). *Textbook of Medical Physiology*. Reed Elsevier India Private Limited. (12<sup>th</sup>ed.,).New Delhi.
- Murray et al., (2012). *Harper's Physiological Biochemistry*. Tata McGraw Hill Publication. Co. Limited. (29<sup>th</sup>ed.,).New Delhi.
- Guyton, A.C.(1974). *Functions of the Human body*.

### **E-Resources**

- <https://openstax.org/details/books/anatomy-and-physiology>
- <https://open.umn.edu/opentextbooks/textbooks/anatomy-and-physiology>
- <https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1004&context=biology-collections>
- <https://opentextbc.ca/anatomyandphysiology/>
- <https://libguides.com.edu/c.php?g=649894&p=4556867>

## BASICS OF BIOINFORMATICS

UBCM506

<b>Semester</b> : V	<b>Credits</b> : 6
<b>Category</b> : Core IX	<b>Hours/Week</b> : 6
<b>Class &amp; Major:</b> III B.Sc Biochemistry	<b>Total Hours</b> : 78

### Objectives:

#### To enable the students

- Understand the basics concepts of Bioinformatics and its significance in Biological data analysis.
- Classify different types of Biological databases.
- Overview about the biological macromolecular structures.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Explain the concepts of biology in computer science and mathematics using software to extract relevant information from large database.
- Assess the interface between Computational and Biological Science.
- Apply the Bioinformatics tools in Research

### UNIT - I INTRODUCTION TO BIOINFORMATICS 12 Hrs

Bioinformatics- An overview and definition, Objectives and Scope-Genomics, Proteomics and Computer aided Drug Design. Bioinformatics and Internet – Challenges and Applications. Bioinformatics Programmes in India

### UNIT - II BIOLOGICAL DATABASE AND ITSTYPES 12 Hrs

Introduction to Data types and Source. General Introduction of Biological Database; Nucleic acid databases-NCBI, DDBJ, SWISS-PROT and EMBL. Protein information resources - Biological databases, Protein databases – Primary, Composite and Secondary. Specialized Genome databases, TIGR and ACeDB, Structure databases – CATH, SCOP and PDB sum. String Database

Lab demo class-NCBI, EMBL and DDBJ 09 Hrs

### UNIT - III DNA SEQUENCE ANALYSIS 12 Hrs

DNA sequence Analysis - DNA Sequence, Features of DNA sequence analysis, EST- differential approaches to EST analysis and c-DNA libraries.

### UNIT – IV SEQUENCE ALIGNMENT 12 Hrs

Pair wise alignment – Database searching (Needleman algorithm)- Comparing two sequences - Identity and Similarity, FASTA and BLAST, Multiple sequence alignment - Definition - ClustalW.

Lab demo class- FASTA, BLAST and ClustalW 09 Hrs



## UNIT – V BIOINFORMATICS APPLICATIONS

12 Hrs

Perl/Python for Bioinformatics: Basic concepts and application in Biological Sequence analysis. Bioinformatics tools for Primer designing and checking.

### Text Books

- Attwood ,T.K and D.J Parry.(2014). *Introduction to Bioinformatics*. Pearson Education Ltd. New Delhi.
- N. Gautham, (2018). *Bioinformatics-Database and Algorithm*. Narrosa publishing house.

### Reference Books

- Andreas, D Baxevanis and Francis Quellerie, B F. (2016). *Bioinformatics- A Practical guide to the analysis of genes and proteins*. Willey publication. New Delhi.
- Arthur, M. Lesk. (2013). *Introduction to Bioinformatics*. Oxford university press. (4<sup>th</sup>ed.).UK .
- Jerry Gu, Phlip E Bowrne. (2009). *Structural Bioinformatics*. Willey- Blockwell publication. New Delhi.

### E- Resources

- [www.aun.edu.eg/.../Procedure%20Bioinformatics22.../Xiong%20-%20Es...](http://www.aun.edu.eg/.../Procedure%20Bioinformatics22.../Xiong%20-%20Es...)
- [www.iasri.res.in/ebook/CAFT\\_sd/Concepts%20of%20Bioinformatics.pdf](http://www.iasri.res.in/ebook/CAFT_sd/Concepts%20of%20Bioinformatics.pdf)
- [goldenhelix.com/.../ebooks/Teaching-Bioinformatics-Concepts-Practical](http://goldenhelix.com/.../ebooks/Teaching-Bioinformatics-Concepts-Practical)
- [www.Bioinformatics.org](http://www.Bioinformatics.org)
- [www.bioinfo.mbb.yale.edu/mbb452a/intro/](http://www.bioinfo.mbb.yale.edu/mbb452a/intro/)
- [www.biology.ucsd.edu/others/dsmith/Bioinformatics.htm](http://www.biology.ucsd.edu/others/dsmith/Bioinformatics.htm)

# ENZYMOLGY PRACTICAL

## UBCR501

Semester : V  
Category : Core Practical V  
Class & Major: III B.Sc Biochemistry

Credits : 3  
Hours/Week: 6  
Total Hours : 78

### Objectives:

#### To enable the Students

- Understand enzyme activity
- Develop technical competence with respect to kinetics of specific enzymes
- Inculcate the ability to engage in critical enquiry.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Aware of the influence of enzyme structure on catalytic properties
- Understand the chemical principles of enzyme catalysts, including Cofactor Chemistry.
- Analyze the action of enzymes as biocatalysts and in factors that influence enzyme activity.

### Exercises

1. Assay of Salivary Amylase activity
2. Effect of pH on Salivary Amylase activity
3. Effect of Temperature on Salivary Amylase activity
4. Effect of Substrate Concentration on Salivary Amylase activity
5. Assay of Urease activity
6. Effect of pH on Urease activity
7. Effect of Temperature on Urease activity
8. Effect of Substrate Concentration on Urease activity
9. Assay of Serum Alanine Transaminase activity
10. Assay of Serum Alkaline Phosphatase activity
11. Assay of Serum Aspartate Transaminase activity

### Text Books

- David, T. Plummer. (1999). *An Introduction to practical Biochemistry*. (3<sup>rd</sup> revised ed.,).
- Jayaraman, J. (2011). *Laboratory Manual in Biochemistry*. New Age international limited publication.

### Reference Books

- Pattabiraman. (2015). *Laboratory Manual in Biochemistry* (4<sup>th</sup>ed.,).
- Singh .S.P.(2013). *Practical Manual of Biochemistry*. CBS Publication .(6<sup>th</sup> ed.,).

## E-Resources

- <https://www.worldcat.org/title/practical-enzymology/oclc/827358447>
- <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527659227>
- <https://www.kobo.com/us/en/ebook/practical-enzymology>
- [https://books.google.co.in/books/about/Practical\\_enzymology.html?id=dxZrAA AAMAA J&redir\\_esc=y](https://books.google.co.in/books/about/Practical_enzymology.html?id=dxZrAA AAMAA J&redir_esc=y)
- <https://www.amazon.in/Practical-Enzymology-Hans-Bisswanger-ebook/dp/B00DOX8ESA>

## PROJECT

### UBCP501

<b>Semester</b>	<b>: V</b>	<b>Credits</b>	<b>: 4</b>
<b>Category</b>	<b>: Core X</b>	<b>Hours/Week</b>	<b>: 4</b>
<b>Class &amp; Major:</b>	<b>III B.Sc Biochemistry</b>	<b>Total Hours</b>	<b>: 52</b>

### Objectives:

#### To enable the students

- Acquire knowledge in life science research.
- Develop problem solving and decision making skills.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Identify practical problem, Solve using the laboratory techniques and Biochemistry underpinning the set experiment.
- Provide students a hands-on experience of Designing, Performing, and Analyzing results from a Molecular Biology/Biochemical mini-project.
- Acquire effective knowledge in experiential learning for the students which plays a key role in bridging the gap between industry and Academia.

### Guidelines

- Mini project is offered for final year B.Sc Biochemistry students in Semester VI.
- Project can be done according to area of interest
- Project should do either as individual or as group with maximum of three /four students.
- Project can be field study, survey, experimentation, extraction of components from medicinal plants and waste water treatment.
- Evaluation scheme for the project will be Internal 60 and External40.

## Assessment

S. No	Internal		External	
	Component	Marks	Component	Marks
1	Review of the Literature	10	Dissertation	10
2	Area of Research	10	Presentation	20
3	Methodology	10	Viva - voce	10
4	Accuracy of result	10		-
5	Result and Discussion	10		-
6	Report preparation	10		-
	<b>Total</b>	<b>60</b>		<b>40</b>
	Maximum marks	100		

## INTRODUCTION TO BIOTECHNOLOGY

UBCM605

Semester : VI

Category : Core Paper XI

Class & Major: III B.Sc Biochemistry

Credits : 4

Hours/Week : 5

Total Hours : 65

### Objectives:

#### To enable the students

- Understand the Recombinant DNA technology and its methods.
- Application of various Molecular Biology techniques.
- Analyze the scope of Biotechnology in plant and animal cell line.

### Learning Outcomes:

#### On Completion of the course, the students will be able to

- Comprehend about the introduction & tools of Genetic Engineering.
- The scope in agriculture, medicinal & environment.
- Identify the techniques used for separation & isolation of molecules.

### UNIT - I TOOLS OF GENETIC ENGINEERING

12 Hrs

Introduction to Recombinant DNA technology -Restriction Enzymes, Ligases, Modifying Enzymes - Cloning Vectors: Plasmid, Phagemid, Cosmid, cDNA Clone Bank. Cloning Strategies-Screening and selection of Recombinants- Positive and negative stain

### UNIT - II METHODS OF GENE TRANSFER

15 Hrs

Gene Transfer Mechanism - Physical, Chemical and Biological methods. Gene Recombination and Gene transfer: Bacterial Conjugation- Transformation,

Transduction- Microinjection- Electroporation- Microprojectile- Shot Gun method- Ultrasonication- Liposome fusion.

### **UNIT – III PLANT BIOTECHNOLOGY**

**13 Hrs**

Plant Tissue Culture – Basic of Plant Tissue Culture, Plant Hormones – Their role in development of plant – Transgenic Plants - Herbicide resistance, Virus Resistance and Pest resistance. GMO's

### **UNIT – IV ANIMAL BIOTECHNOLOGY**

**15 Hrs**

Introduction to Cell Culture, Cryopreservation, Applications of Cell Culture. Culture Environment, Adherent Vs Suspension Culture, Cell Culture Laboratory, Cell Culture Equipment. Bioreactors and its applications. Transgenic animals and its applications

### **UNIT - V MOLECULAR BIOLOGY TECHNIQUES IN BIOTECHNOLOGY**

**10 Hrs**

Principles and techniques of Nucleic Acid- Hybridization, Northern, Southern and Western Blotting, Polymerase Chain Reaction(PCR), DNA Fingerprinting, Molecular Markers- Restriction Fragment length Polymorphism (RFLP) and Random Amplified Polymorphic DNA(RAPD).

#### **Text Books**

- Primrose. (1991). *Biotechnology. Black well Publishing house.* (2<sup>nd</sup> revised ed.,).
- Dubey R.C. (2014). *A text book of Biotechnology.* S.Chand Publications. (5<sup>th</sup> revised ed.,).

#### **Reference Books**

- Brown, T.A .(2016). *Gene Cloning and DNA Analysis.* Blackwell Publishing Co. (7<sup>th</sup> ed.,)
- Jack,W.Christian Maryland,(2006). *Biotechnology–Theory and techniques of plant biotechnology. Animal cell culture & immunobiotechnology.* CBS Publishers.
- John E Smith. (2012). *Biotechnology.* Cambridge University Press. (5<sup>th</sup> ed.,).

#### **E-Resources**

- [www.springer.com/la/book/9781617799822](http://www.springer.com/la/book/9781617799822)
- [www.freebookcentre.net](http://www.freebookcentre.net) > Medical Books
- [www.indiabiotech.in/Free-e-Books-Journals.html](http://www.indiabiotech.in/Free-e-Books-Journals.html)
- [nptel.ac.in](http://nptel.ac.in).
- <http://www.thanut-swu.com/images/BOT101/BiotechnologyBook.pdf>

**CLINICAL BIOCHEMISTRY**  
**UBCM606**

**Semester : VI**  
**Category : Core Paper XII**  
**Class & Major: III B.Sc Biochemistry**

**Credits : 5**  
**Hours/Week : 5**  
**Total Hours : 65**

**Objectives:**

**To enable the students**

- Understand the diagnostic and therapeutic methodologies available for selective diseases.
- Appraise the various clinical laboratory tests.
- Evaluate the effective information to correlate with clinical diagnostics.

**Learning Outcomes:**

**On Completion of the course, the students will be able to**

- Understand the good Clinical Laboratory Practices and the skills to be developed.
- Acquire in-depth knowledge on diseases and disorders in human life.
- Learn about the normal constituents of urine, blood and their significance in maintaining good health.
- Exposure to the mechanisms of causation of diseases of Liver and Kidney.
- Develop understanding of the current concepts related to mechanism of Cancer.
- Acquire knowledge on various diagnostic methods for renal, hepatic, pancreatic functions

**UNIT - I INTRODUCTION TO CLINICAL BIOCHEMISTRY**

**14 Hrs**

Organization of Clinical laboratory, Introduction to Instrumentation and Automation in Clinical Biochemistry laboratories safety regulation and First aid. General comments on specimen collection, Types of specimens for Biochemical analysis. Reference ranges for clinical laboratory tests. Eligibility and personal skills required for clinical Biochemistry.

**UNIT - II GLUCOSE HOMEOSTASIS-COMPLICATIONS, DISORDERS**

**13 Hrs**

Glucose homeostasis, Diabetes mellitus, hypoglycemia, metabolic complications, GTT and its Significance- Glycosylated Hb-Glycosuria- Glycogen storage diseases, Galactosemia- Fructosuria- Ketoacidosis.

**UNIT - III LIPIDS-DISORDERS**

**13 Hrs**

Hypo and Hyperlipoproteinemias, Lipidosis, Fatty liver, Obesity and Cardio vascular diseases- Hypertension-Atherosclerosis- Myocardial Infarction-Congestive Heart Failure.

**UNIT - IV INBORN ERRORS OF METABOLISM**

**12 Hrs**

Clinical manifestation of Phenylketoneuria, Tyrosinemia, Alkaptonuria, Homocysteinuria, Cystinuria, Cystinosis, Maple syrup urine disease, Hartnups disease and Gout.

## UNIT - V DIAGNOSTIC METHODS

13 Hrs

Assessment and Clinical manifestation of Renal, Hepatic, Pancreatic Functions- RFT, LFT. Water and Electrolyte Balance and Imbalance. Jaundice and its types.

### Text Books

- Shaun ,C A Anderson, Suncokayne, S A. (2015). *Clinical Chemistry concepts and applications*. CBS Publishers. New Delhi.
- Vasudevan (2019). *Text book of Medical Biochemistry*. ViJaypee Brothers Medical Publishers (P) Ltd.. (9<sup>th</sup>ed.,).

### Reference Books

- Harold Varley. (2006). *Practical Clinical Biochemistry*. CBS Publishers. (6<sup>th</sup> ed.,). New Delhi
- Bhagavan N.V. (2001). *Medical Biochemistry*. Fourth edition. Academic Press (4<sup>th</sup> ed.,).
- Victor, W Rodwell, David A Benda, Kathean M, Botham. (2015). *Harpers illustrated Biochemistry*. MC Graw Hill Education (13<sup>th</sup> ed.,).

### E-Resources

- <https://www.elsevier.com/books/clinical-biochemistry/murphy/978-0-7020-7298-7>
- <https://bookboon.com/en/introduction-to-clinical-biochemistry-ebook>
- <https://www.kobo.com/us/en/ebook/clinical-biochemistry-e-book-1>
- [http://web.mef.hr/web/images/pdf/i\\_clin\\_bioch.pdf](http://web.mef.hr/web/images/pdf/i_clin_bioch.pdf)
- <https://www.worldscientific.com/worldscibooks/10.1142/7126>

## MOLECULAR BIOLOGY

UBCM607

Semester : VI

Category : Core Paper XIII

Class & Major: III B.Sc Biochemistry

Credits : 5

Hours/Week : 5

Total Hours : 65

### Objectives:

#### To enable the students

- Understand the history and scope of Molecular Biology.
- Acquire working knowledge of gene & to know how genes are expressed.
- Appreciate how genetic engineering & biotechnology influence a health care in the next century.

### Learning Outcomes:

#### On completion of the course, the students will be able to

- Study the discovery of DNA as genetic material, DNA Replication, Transcription, DNA Repair and Translation.
- Analyze coding and non-coding regions of prokaryotic genome and their importance.
- Understand the fundamentals of DNA damage and repair, including types of mutation & repair mechanisms.

- Exposure with the importance of E. coli Lac Operon, PCR, expression vectors and their importance in Biotechnology.

### **UNIT-I INTRODUCTION**

**13 Hrs**

History of Molecular Biology- Discovery of DNA -Experimental evidence to prove DNA as a carrier of Genetic material-Bacterial Transformation, Transduction and Conjugation. Replication - Evidence to show DNA Replication is Semi Conservative; Messelson and Stahl experiment. DNA Replication in Prokaryotes -Types.DNA repair mechanism.

### **UNIT-II TRANSCRIPTION**

**14 Hrs**

Transcription in Prokaryotes: Central Dogma, DNA dependent RNA Polymerases, Mechanism - Various sites of Transcription, rho dependent and independent termination. Post transcriptional modification-mRNA, rRNA and tRNA processing. RNA Splicing, editing. Inhibitors of Transcription, Eukaryotic RNA Polymerases. Reverse transcription.

### **UNIT-III GENETIC CODE AND TRANSLATION**

**13 Hrs**

Genetic Code-Definition, deciphering of the Genetic Code, Codon Dictionary, salient features, Experimental evidences, Wobble Hypothesis. Translation in Prokaryotes Initiation, Elongation, Translocation, Termination, Post translational modification. Protein targeting

### **UNIT-IV OPERON**

**13 Hrs**

Operon model - Lac operon positive and negative control, repression and attenuation (Trp operon), Recombination, Gene amplification.

### **UNIT-V GENE AND CHROMOSOME MUTATION**

**12 Hrs**

Mutation- Base pair substitution- Frame shift mutation- Missense mutation, nonsense mutation- Mutation in termination codons- Silent mutation- Chromosome mutation.

#### **Text Books**

- David, L.Nelson. (2005). Michael M.Cox,*Lehninger -Principles of Biochemistry*. W.H.Freeman and Company. (4<sup>th</sup> ed.,). Newyork
- David Freifelder. (2004).*Molecular cell Biology*.Narosa publishing house New Delhi.

#### **Reference Books**

- Karp,G. (2005). *Cell and Molecular Biology*. Willey International edition (4<sup>th</sup> ed.,).
- Harvey Lodish, David Baltimore, Adrenold berk, S.Lawrence Zipursky, Paul Matsudaira, James Darnell, (2015). *Molecular Cell Biology*. W.H.Freeman & Company. (5<sup>th</sup>ed.,). New York .
- Twyman, R.M. (2001). *Advanced Molecular Cell Biology*. W.WisdenViva books private Ltd. New Delhi.

#### **E-Resources**

- <http://www.freebookcentre.net/Biology/Molecular-Biology-Books.html>
- <https://www.amazon.in/Molecular-Biology-N-Vidyavathi-ebook/dp/B078KWF9BN>



- <https://pothi.com/pothi/book/ebook-kaushlendratripathi-introduction-molecular-biology>
- <https://www.worldcat.org/title/molecular-biology/oclc/1062496183>
- <https://www.us.elsevierhealth.com/medicine/molecular-biology>

**CLINICAL BIOCHEMISTRY-PRACTICAL  
UBCR601**

<b>Semester</b>	<b>: VI</b>	<b>Credits</b>	<b>: 3</b>
<b>Category</b>	<b>: Core Practical VI</b>	<b>Hours/Week</b>	<b>: 5</b>
<b>Class &amp; Major</b>	<b>: III B.Sc Biochemistry</b>	<b>Total Hours</b>	<b>: 65</b>

**Objectives:**

**To enable the students**

- Develop good Clinical practice of Diagnostic Biochemical tests.
- Develop competence and confidence in the associated calculation skills.
- Understanding of the basic Principles of Clinical Analysis.

**Learning Outcomes:**

**On completion of the course, the students will be able**

- Analyze the appropriate specimen collection procedures, staining methods, and Biochemical techniques used in the laboratory.
- Acquire practical training for qualitative and quantitative analysis of biological materials/molecules such Glucose, Cholesterol, Protein, Urea, Uric acid, Creatinine, Phosphorus, etc. and their estimation using multiple methods
- Perform and interpret Body fluid tests, detect abnormalities, assign a diagnosis and prescribe follow-up testing.

**Colorimetric Estimations:**

1. Estimation of Blood Glucose by
  - a) Folin's Wu method
  - b) Ortho Toluidine method
2. Estimation of Cholesterol by Zak's method
3. Estimation of Creatinine by Jaffe's method.
4. Estimation of Urea by Diacetyl monoxime method.
5. Estimation of Albumin/Globulin ratio in serum.
6. Estimation of DNA by Diphenylamine method
7. Estimation of RNA by Orcinol method
8. Estimation of Bilirubin by Malley Evelyn method.
9. Estimation of Protein by Biuret method.
10. Estimation of Inorganic Phosphorous by Fiske and Subbarow method.

### Text Books

- Harold Varley.(2005). *Practical Clinical Biochemistry*. CBS Publication.
- Shirish , M. Kawthalkar. (2018). *Essentials of Clinical Pathology*. Paperback.

### Reference Books

- Chatterjea, RanaShinde. (2008). *Textbook of Medical Biochemistry*. Jaypee publication.
- Chawla, Ranjna. (2014). *Practical Clinical Biochemistry*. Jaypee Publisher.(3<sup>rd</sup> ed.,).
- Saini, A.S. (2011). *Clinical Biochemistry in Diagnosis &Management*. B. S Publishers (1<sup>st</sup> ed.,).

### E-Resources

- [https://books.google.co.in/books/about/Fundamentals\\_of\\_Practical\\_Clinical\\_Biochemistry.html?id=oqrOT5xnbekC&redir\\_esc=y](https://books.google.co.in/books/about/Fundamentals_of_Practical_Clinical_Biochemistry.html?id=oqrOT5xnbekC&redir_esc=y)
- <https://in.pinterest.com/pin/746049494494648558/>
- <http://clinicalbiochemistryupdates.blogspot.com/2010/01/biochemistry-ebook-links-free-download.html>
- [https://books.google.co.in/books/about/Practical\\_Clinical\\_Biochemistry.html?id=HP2YA\\_wAAQBAJ&redir\\_esc=y](https://books.google.co.in/books/about/Practical_Clinical_Biochemistry.html?id=HP2YA_wAAQBAJ&redir_esc=y)
- <https://www.amazon.in/Basic-Concepts-Clinical-Biochemistry-Practical-ebook/dp/B07BTJ12SR>

## HEMATOLOGY AND URINE ANALYSIS UBCR602

<b>Semester</b>	<b>: VI</b>	<b>Credits</b>	<b>: 2</b>
<b>Category</b>	<b>: Core Practical VII</b>	<b>Hours/Week</b>	<b>: 3</b>
<b>Class &amp; Major:</b>	<b>III B.Sc Biochemistry</b>	<b>Total Hours</b>	<b>: 39</b>

### Objectives:

#### To enable the students

- Understand good clinical practice of various diagnostic biochemical tests.
- Evaluate different test and procedures related to clinical lab.

### Learning Outcomes:

#### On completion of the course, the students will be able

- Demonstrate the theoretical knowledge and technical skills in the performance of routine Clinical laboratory testing
- Distinguish normal and abnormal microscopic characteristics of Blood cells through performance of a complete Blood count.

### 1. Hematology

- RBC Count
- Total and differential WBC count
- PCV

- ESR
- Hemoglobin.

## 2. Urine Analysis

- I. Qualitative analysis of normal and abnormal constituents of Urine (Sugar, Protein, Aminoacids, Ketone bodies, Bile salts, Bile pigments, Bence jones protein)
- II. Quantitative estimations in urine
  - Glucose by Benedict' smethod.
  - Urea by Diacetyl Monoxime Method.
  - Creatinine by modified Jaff's method.

### Text Books

- Varley. (2005). *Practical Biochemistry*. CBS Publishers.
- Sawhney, S. K, Randhir Singh. (2011). *Introductory practical Biochemistry*. Narosa Publishing House.

### Reference Books

- Rajagopal, G, Toora, BD. (2014). *Practical Biochemistry for medical Dental and Allied Course*. Ahuja Publishing House. (3<sup>rd</sup> ed.,).
- Kanai, L Mukherjee. (2004). *Medical Laboratory Technology*. Tata Mc GRAW-Hill publishing company Limited. (15<sup>th</sup> ed.,).
- David T Plummer. (2004). *An Introduction to Practical Biochemistry*. Tata Mc GRAW- Hill Publishing Company Limited. (15<sup>th</sup> ed.,).

### E-Resources

- [https://www.researchgate.net/publication/284722237\\_Laboratory\\_Manual\\_and\\_Review\\_on\\_Clinical\\_Pathology](https://www.researchgate.net/publication/284722237_Laboratory_Manual_and_Review_on_Clinical_Pathology).
- [https://www.academia.edu/36985667/Dacie\\_and\\_Lewis\\_Practical\\_Haematology](https://www.academia.edu/36985667/Dacie_and_Lewis_Practical_Haematology)
- <http://vetbooks.ir/laboratory-urinalysis-and-hematology-for-the-small-animal-practitioner/>
- [http://uploads.worldlibrary.net/uploads/pdf/20150424022016laboratory\\_feb14.pdf](http://uploads.worldlibrary.net/uploads/pdf/20150424022016laboratory_feb14.pdf)
- <http://medsoulsmedicine.com/clinical-pathology-hematology-and-blood-banking-for-dmlt-students-3e-true-pdf/>

**STEM CELL BIOLOGY**  
**UBCO604**

**Semester : VI**  
**Category : Major Elective**  
**Class & Major: III B.Sc Biochemistry**

**Credits : 4**  
**Hours/Week : 5**  
**Total Hours : 65**

**Objectives:**

**To enable the students**

- Understand physiology of stem cells at cellular level.
- Understand the culture of stem cells.
- Identify the diagnosis and management of diseases and disorders with stem cells

**UNIT –I INTRODUCTION TO STEM CELLS 15 Hrs**

Stem cell definition, kinds of stem cells - Embryonic and adult stem cells. Characteristics of stem cells. Totipotent, Unipotent, oligopotent and pluripotent cells.

**UNIT- II GROWTH INDUCING AGENTS 10 Hrs**

Role of bone marrow in cell synthesis, Growth factors – Types and their role in cell development.

**UNIT- III CELL LINES 12 Hrs**

Cell lines – Types, Commonly used cell lines and selection of cell lines; maintenance of cell culture; Sub culture – Mono layer culture, Criteria for sub culture of mono layer, technique; Suspension cultures.

**UNIT- IV EMBRYONIC STEM CELLS 13 Hrs**

Stem cell culture – Embryonic stem cell, methods to produce differentiated cells, maintenance of stem cells. Stem cell bank.

**UNIT- V APPLICATIONS OF STEM CELLS 15 Hrs**

Human embryonic stem cell research- Parkinson's Diseases, Diabetes, Heart muscle repair. Applications of stem cells in study of tissue differentiation, molecular signals and testing of new drugs.

**Text Books**

- U. Sathiyarayanan (2007). *Biotechnology*. Books & Allied (P) Ltd.
- V. Kumaresan (2009). *Biotechnology*. Saras publication. Nagercoil revised edition.

**Reference Books**

- Old ,R.W, PrimroseS.B (2003). *An introduction to Genetic Engineering*. Blackwell Science.
- Sasidhara,(2006). *Animal Biotechnology*. MJP publishers.

**MOLECULAR ENDOCRINOLOGY**  
**UBCO607**

**Semester : VI**  
**Category : Major Elective**  
**Class & Major: III B.Sc Biochemistry**

**Credits : 4**  
**Hours/Week : 5**  
**Total Hours : 65**

**Objectives:**

**To enable the students**

- Understand hormonal influence in human physiology
- Determine the familial and medical history relevant to endocrine problems

**Learning Outcomes:**

**On completion of the course, the students will be able**

- Identify the integration of the endocrine system in general with focus on specific interactions
- Apply endocrinological principles to determine the pathophysiological basis and consequences of specific endocrine disorders.

**UNIT-I INTRODUCTION**

**15 Hrs**

Hormones - Definition, Classification, Biosynthesis, Characteristic features. Hormones receptors - Features and Structure, Regulation of receptor levels. Mechanism of Hormone action. Signal transduction.

**UNIT-II PITUTUARY HORMONES**

**15 Hrs**

Secretion, biological action, and regulation of growth hormone. Adreno corticotropic hormone, Prolactin, Gonadotropic hormone, Follicle stimulating hormone. Leutinizing hormone, Antidiuretic hormone and oxytocin. Hyper and Hypopituitarism Disorders - Dwarfism, Gigantism, Acromegaly, Cushing's disease and Diabetes Insipidus.

**UNIT-III THYROID HORMONES**

**15 Hrs**

Biosynthesis, secretion, transport, regulation and Biological action of thyroid stimulating hormones. Thyroxine. Disorders: Hyperthyroidism & Hypothyroidism disorders- Cretinism, Myxoedema and Hashimoto's diseases, Graves's diseases, Exophthalmoses, Toxic Goiter and Non-toxic Goiter.

**UNIT-IV PANCREATIC HORMONES**

**10 Hrs**

Synthesis, Regulation, Biological action of Insulin, Glucagon, Somatostatin and insulin growth factor, Disorders- Diabetes Mellitus, Hypoglycemia.

**UNIT-V ADRENAL AND GONADOL HORMONES**

**10 Hrs**

Glucocorticoids and Mineralocorticoids - Synthesis-Secretion- Transport, Biological effects-Metabolism and Excretion. Gonadal hormones-Biological action of Androgens and Estrogens.

### Text Books

- Lohar, S.Prakasa (2006). *Endocrinology- Hormones & human health*.MJP Publishers.
- Devlin, Thomas, M (2010).*Textbook of Biochemistry (with clinical correlation)*.John Wiley & Son's publishers. (7<sup>th</sup> ed.,).

### Reference Books

- Austin and Short (2019). *Mechanism of hormone action*. Prema Jaypee Brothers.
- Robert, K. Murray *et al* Appleton and Lange Stanford Connecticut, (2005). *Harper's Biochemistry*.(25<sup>th</sup> ed.,).

### E-Resources

- <https://www.elsevier.com/books/molecular-endocrinology/bolander/978-0-12-111232-5>
- <https://www.amazon.in/Molecular-Endocrinology-Franklyn-Bolander-ebook/dp/B01D4CI1AQ>
- <https://www.amazon.in/Molecular-Endocrinology-Human-Genetics-ebook/dp/B01E3EUF8U>
- <https://www.kobo.com/us/en/ebook/molecular-endocrinology-1>
- <https://www.ebooks.com/en-ao/297039/molecular-endocrinology/franklyn-f-bolander/>

## PATHOBIOLOGY OF HUMAN DISEASES AND DISORDERS

UBCO606

<b>Semester</b>	<b>: VI</b>	<b>Credits</b>	<b>: 4</b>
<b>Category</b>	<b>: Major Elective</b>	<b>Hours/Week</b>	<b>: 5</b>
<b>Class &amp;Major</b>	<b>: III B.Sc Biochemistry</b>	<b>Total Hours</b>	<b>: 65</b>

### Objectives:

#### To enable the students

- Understand pre-clinical and clinical education in Pathobiology
- Categorize the contemporary in health issues
- Compare normal and abnormal cells in humans that generates new knowledge in Pathology

### UNIT –I DIGESTIVE TRACT DISORDERS 13 Hrs

Diseases related to digestive tract - Inflammatory Bowel Syndrome, Electrolyte disorder, Liver cirrhosis, Food poisoning, GI tract cancers, Peptic ulcer -H.pylori infection.

### UNIT- II HAEMODYNAMIC DISORDERS AND CLINICAL PATHOLOGY 13 Hrs

Mechanism of Blood Coagulation, Intrinsic and extrinsic pathways of blood clotting, List the blood clotting factors, Fibrinolytic system, Importance of coagulation. Blood coagulation profile determination, Examination of Bone marrow and its uses

### UNIT- III CELL INJURY AND PARASITIC INFECTIONS 13 Hrs

Normal and abnormal cell, Cell Injury- Types of cell injury, Etiology of cell injury,

morphology of cell injury, Cellular swelling. Diagnosis of blood parasites like Malarial, Filariasis, Viruses like Hepatitis virus, Vibrio cholera.

**UNIT- IV INFLAMMATION** **13 Hrs**

Inflammatory markers – C Reactive protein, Estimation of C - reactive protein, Rheumatoid Arthritis, Rheumatoid fever, Tuberculosis and Neoplasia.

**UNIT- V DISEASES DUE TO MISFOLDED PROTEINS** **13 Hrs**

Introduction to protein folding and proteosome, Removal of misfolded proteins; Etiology and Molecular basis for Alzheimer's, Prion diseases, Huntington's chorea, Sickle cell anemia and Thalassemia.

**Text Books**

- Chakraborty Gargi Chakraborty,P (2005).*Practical Pathology*. New Central Book Agency. Kolkotta.
- Praful, B. Godkar(2014).*Text Book of Medical Laboratory Technology*. Bhalani publishing house.

**Reference Books**

- Sir John Dacie (2011).*Practical Hematology*. Churchill Livingstone. London (5<sup>th</sup> ed.,).
- Todd & Sanford (2009).*Clinical Diagnosis & Management by Laboratory Methods*. All India traveler Book sellar. New Delhi.
- Harsh Mohan (2010).*Text Book of Pathology* .Jaypee Brothers. (6<sup>th</sup> ed.,).

**E\_Resources**

- <https://www.elsevier.com/books/clinical-biochemistry/murphy/978-0-7020-7298-7>
- <https://bookboon.com/en/introduction-to-clinical-biochemistry-ebook>

**NANOTECHNOLGY IN MEDICINE**

UIDM601

<b>Semester</b> : VI	<b>Credits</b> : 4
<b>Category</b> : Major Elective	<b>Hours/Week</b> : 5
<b>Class &amp;Major</b> : III B.Sc. Biochemistry	<b>Total Hours</b> : 65

**Objectives:**

**To enable the students**

- Identify the various types of Nano medicine.
- Determine the importance of Nano materials in Nano medicine

**UNIT- I OVERVIEW OF NANOTECHNOLOGY** **13 Hrs**

Basics of nanotechnology - State of art of nanotechnology- Relevance of nanotechnology- impact on economy and future development- Applications.

**UNIT- II NANOTECHNOLOGY IN EVERYDAY LIFE** **13 Hrs**

Nanotechnology based products- Daily usage- Associated concepts-Advantages of using

nanotechnology products. Applications of nanotechnology in Biomedical fields.

### **UNIT -III NANOMEDICINE**

**13 Hrs**

History of the idea – Nanomedicine taxonomy – Bio pharmaceuticals –implantable materials – surgical Aids – diagnostic Tools – imaging. Polymer micelles as drug carriers: polymer micelle structures – drug loading and release – Pharmacokinetics and Biodistribution – Drug delivery applications – clinical trials.

### **UNIT -IV NANOCAPSULES**

**13 Hrs**

Introduction – preparation – Characteristics of Nano Capsules – Drug release – Applications.

### **UNIT- V NANOTECHNOLOGY IN MEDICINE AND HEALTH**

**13 Hrs**

Cardiovascular diseases, Cancer, Diabetes . Nanotechnology - Implants and prosthetics - nanotechnology and burn victims - Diagnosis and therapy - Drug delivery using nanoparticles - Nanotechnology fights infections - Pharmaceutical nanotechnology research.

#### **Text Books**

- John Mongillo (2007).*Nanotechnology 101*. Greenwood Press.
- Chattopadhyay , K.K. and BanerjeeA.N (2009).*Introduction to Nanoscience and Nanotechnology*. PHI Learning Ltd. New Delhi.

#### **Reference Books**

- Joe Anne Shatkin ,(2008).*Nanotechnology: Health and Environmental risks*. CRC press.
- Parag Diwan and Asish ,Bharadwaj,(2006).*Nanomedicines*. Ed. By, Pentagon Press.
- Vladimir P Torchilin (2006). *Nanoparticles as Drug Carriers*. Imperial College Press. North Eastern University. USA.

#### **E\_Resources**

- <https://booksfree4u.tk/download-nanomedicine-ebook-pdf-free>
- <https://sites.google.com/site/.../The-Handbook-of-Nanomedicine.pdf>
- [nptel.ac.in](http://nptel.ac.in)



### III & IV Evaluation Components of CIA

I Semester	II Semester	Credit
Paper I (6 hours)	-	5
Paper II (6 hours)	-	5
Paper III (Special area study paper)	-	5
Paper IV (Research And Publication Ethics)(2 hours)	-	<b>2</b>
-	Dissertation & Viva voce	13
<ul style="list-style-type: none"> <li>▪ <b>Paper Presentation (minimum one) &amp;</b></li> <li>▪ <b>Publication of articles in Journals (minimum one)</b></li> </ul> <b>are mandatory for submission of Dissertation.</b>		<b>30</b>

### M.Phil PROGRAMME PROFILE – ALLOTMENT OF HOURS & CREDITS (With effect from 2020-2021 batches onwards)

Semester	Category	Course Code	Course Title	Component III	Component IV
V	Core VII	UBCM504	Enzymes & Intermediary Metabolism	Assignment	Seminar
	Core VIII	UBCM505	Human Physiology	Model presentation	Seminar
	Core IX	UBCM506	Basics of Bioinformatics	Creating protein database	Assignment
VI	Core XI	UBCM605	Introduction to Biotechnology	Model presentation	Experiential Learning
	Core XII	UBCM606	Clinical Biochemistry	Experiential Learning	Seminar
	Core XIII	UBCM607	Molecular Biology	Assignment	Seminar
	Major Elective	UBCO604	Stem Cell Biology	Culture preparation	Seminar
		UBCO607	Molecular Endocrinology	Poster Presentation	Seminar
		UBCO606	Pathobiology of Human Diseases and Disorders	Case Study	Seminar
		UIDM601	Nanotechnology in Medicine	Model presentation	Seminar