

# PERIYAR UNIVERSITY

**SALEM – 636011**



## **DEGREE OF MASTER OF SCIENCE**

***CHOICE BASED CREDIT SYSTEM***

### **M.Sc. BIOCHEMISTRY**

**OBE REGULATIONS AND SYLLABUS**

**(SEMESTER PATTERN)**

**(For Candidates admitted in the Colleges affiliated to**

**Periyar University from 2021-2022 onwards )**

# REGULATIONS

***“Biochemistry reveals what living things are made of and how they work, beginning at the level of atoms and working up through the genes and proteins to the cells, tissues and organs of multi cellular life”***

## 1. Introduction

Biochemistry is a fundamental science between the exact sciences like physics, chemistry, computer science, and the biological sciences. It deals with the molecular structures and functions of living organisms in a wider sense, molecular biology, cell biology and biotechnology.

The primary objectives of the major are

- ❖ To give students a solid foundation in biology and chemistry;
- ❖ To develop analytical and critical-thinking skills that allow independent exploration of biological phenomena through the scientific method
- ❖ To introduce students to modern methods of biochemical experimentation within the disciplines of biology, chemistry and biotechnology.
- ❖ To impart analytical knowledge in Biochemistry and Molecular Biology.
- ❖ To provide students with practical skills in the areas of Biochemistry and Molecular Biology.
- ❖ To train students on relevant and recent advances in Biochemistry and Molecular Biology. Oncology, Clinical Chemistry and Cancer Research heavily depend on Biochemistry.
- ❖ The objective of the course has therefore been to consolidate students training in Biochemistry and other integrated sciences and encourage them to develop intellectual independence, critical thinking skills and versatility for problem solving in Biochemistry and other related courses. This and the core values have been the guiding principle of the research programmes.
- ❖ The Biochemistry Programme has pursued its curriculum and research agenda in recognition of the role of Biochemistry in contributing to both basic life sciences and applied research in industries.

**The degree program will be offered in collaboration with Biological and Physical Science departments.** The students will acquire practical and theoretical

understanding of basic metabolism, Molecular Biology and Biotechnology. Other areas included in the programme are cell and Molecular Immunology, Industrial and Nutritional Biochemistry, Biochemical Pharmacology and Medical Biochemistry. These courses are designed to expose students to a wider perspective in Biochemistry course to achieve these goals; the program has crafted a curriculum courses already offered in each participating department that cover the essential material listed in the scheme in each semester. These courses prepare students to participate in independent research. Depending on his/her background, a student required to complete as many as 17 theory papers and 6 practicals to complete the programme. On completing first year students have to participate in a capstone laboratory experience, in the second year, students must conduct an independent research projects on which they then base a thesis.

## 2. General Graduate Attributes

The graduate attributes reflect both disciplinary knowledge and understanding, skills, competencies, that students should acquire/attain and demonstrate while studying Biochemistry program. Some of the characteristic attributes that a graduate should demonstrate are as follows:

- ❖ **Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of Biochemistry
- ❖ **Communication Skills:** express thoughts and ideas effectively in writing and orally
- ❖ **Critical thinking:** Capability of analyzing, interpreting, discussion by following scientific approach to knowledge enrichment.
- ❖ **Problem solving:** apply one's learning to real life situations.
- ❖ **Analytical reasoning:** ability to analyze and solve problems quickly and effectively
- ❖ **Research-related skills:** Ability to define problems, analyse, interpret and draw conclusions from data and report the results of an experiment or investigation.
- ❖ **Cooperation/Team work:** Ability to work effectively as a member of a team rather than individually.
- ❖ **Scientific reasoning:** Ability to evaluate ideas and evidence of a particular problem and reason them based on scientific approach.
- ❖ **Reflective thinking:** ability to learn from experience
- ❖ **Information/digital literacy:** Capability to use ICT in a variety of learning situations.
- ❖ **Self-directed learning:** Ability to work independently with efficiency based on the knowledge acquired while learning.

- ❖ **Moral and ethical awareness/reasoning:** Ability to follow moral/ethical values in all aspects of work.
- ❖ **Leadership readiness/qualities:** Capability to guide people to the right destination, in a smooth and efficient way.
- ❖ **Lifelong learning:** Ability to acquire knowledge and skills through self-directed learning aimed at personal development

## 2.1. Program specific qualification Attributes

The cognitive domain involves knowledge and the development of intellectual skills (Bloom, 1956). This includes concepts that serve in the development of intellectual abilities and skills. There are six major categories of cognitive processes, starting from the simplest to the most complex

- ❖ Knowledge and understanding level (K1 and K2)
- ❖ Application level (K3)
- ❖ Analytical level (K4)
- ❖ Evaluation capability level (K5)
- ❖ Scientific or synthesis level (K6)

## 3. Program objectives and outcomes

### 3.1 PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The career perspectives of the Master's program in Biochemistry are

PEO 1: To prepare students for the future careers in the concerned/various relevant fields in which a core understanding of the chemistry of life is important.

PEO 2: To enable the graduates to exhibit leadership, make life long learners with professional and social ethics and make them communicate effectively.

PEO 3: To add highly skilled scientific workforce in the area of biomedical research sectors, academic, industry as well as for research laboratories across the country and the globe by following best practices for improving the professionalization and employability of students.

PEO 4: The practical and technical skills with laboratory-based work and the final year research project prepare the students for a research or technical position by defining specific and transferable skills.

PEO 5: To sensitize and train the students towards research with typical employers include pharmaceutical, biotechnology, food, water and agricultural companies and specialist services, such as toxicological studies.

PEO 6: To train the students in generic and competency skills so as to be able to work in potential places including scientific and medical publishers and the Intellectual Property Office

### 3.2 PROGRAMME SPECIFIC OBJECTIVES (PSOs)

The Overall objective of the Program is to promote education and research in biochemistry and provide academic and professional excellence for immediate productivity in industrial, or clinical settings for an ultimate benefit of society and environment.

PSO1:	To acquire necessary knowledge and skills in core themes, principles and components of basic Biochemistry
PSO2:	To demonstrate the knowledge of biochemical processes from the cellular and molecular aspects
PSO3:	To Integrate and apply the techniques studied and to compare and contrast the depth of scientific knowledge in the broad range of fields
PSO4:	to be able to understand, analyze and apply the studied basic and concepts in wide variety of applications including diagnostics, biochemical pathway regulation and drug development and use this knowledge and apply the same for multitude of laboratory applications.
PSO5:	To provide students with the knowledge and skill base that would enable them to go for self-employment and entrepreneurship

### PROGRAMME OBJECTIVES (POs)

PO1: To demonstrate comprehensive knowledge on various areas of Biochemistry. PO2: To acquire skills in areas related to the current and emerging developments.

PO3: To communicate the concepts, constructs and techniques of the subject learnt in a clear, concise and lucid manner.

PO4: To plan and execute the experiments to the relevant theories of Biochemistry.

PO5: To apply critical thinking, scientific reasoning and mathematical skills in studied areas of Biochemistry.

PO6: To train the students to acquire various relevant generic and competency skills in various aspects of biochemistry so as to be able to work independently in a group or individually

PO7: To make a student life long learner with moral and ethical values

### 3.3 PROGRAMME OUTCOME (PO'S):-

M.Sc programme in Biochemistry will provide students with the necessary knowledge and skills to undertake a career in research, either in industry or in an academic setting. The training provided will give students the breadth and depth of scientific knowledge in Biochemistry. On completion of the programme, students will be qualified to apply for a PhD or to gain employment in the pharmaceutical or biotechnology industries, which are among the strongest growth sectors. The programme will be based on a combination of taught modules, independent learning and an extended research project to be carried out either in the University departments or industry or in association with industry at the University. The programme incorporates a substantial element of hands-on research experience, with enhanced experimental skills being gained alongside experienced research workers.

It is intended that, on successful completion of the M.Sc degree programme, students will :

1. **be capable of demonstrating comprehensive knowledge** and have a fundamental/systematic or coherent understanding of major concepts, theoretical principles and experimental findings in biochemistry.
2. **acquire skills in areas related to the current and emerging developments** in the field of Biochemistry.
3. **be identifying and applying appropriate biochemical principles** and methodologies to solve a wide range of problems associated with Biochemistry.
4. **communicate the results of studies undertaken** in Biochemistry accurately in a range of different contexts using the main concepts, constructs and techniques of the subject learnt in a clear and concise manner in writing and oral skills.
5. **Plan and execute the experiments**, investigate, analyze and interpret data collected using appropriate experimental methods, and report the

findings of the experiment and relate the interpretations and conclusions to relevant theories of Biochemistry.

6. They will have the **ability to employ critical thinking, scientific reasoning and efficient problem solving** skills in the basic areas of biochemistry.
7. Be able to **demonstrate relevant generic skills and competencies** such as (i) problem solving skills, (ii) investigative skills, (iii) communication skills (iv) analytical skills, (v) ICT skills, (vi) skills such as the ability to work both independently and in a group.
8. **demonstrate professional behaviour** such as (i) unbiased and truthful in all aspects of work (ii) follow moral and ethical practices (iii) Life long learners aimed at personal development and for improving knowledge/skill development (iv) focusing on issues related to social cause.

#### **4. CONDITION FOR ADMISSION**

A candidate who has passed B.Sc degree in Biochemistry, Chemistry, Microbiology, Biotechnology, Botany, Zoology or an Equivalent B, Sc. Examination in Bachelor in Medical / Clinical Laboratory Technology Course or some other B.Sc board equivalence submitted by the respective University may be accepted by the syndicate as equivalent there to with Biochemistry shall be eligible for admission into M.Sc., course in Biochemistry.

#### **5. DURATION OF THE COURSE:**

The course for the degree of Master of Science shall consist of two academic years divided into four semesters.

#### **6. COURSE OF STUDY:**

The course of study for the M.Sc. Degree in the Branch Biochemistry shall comprise the following subjects according to the syllabus,

- a. Major: Biochemistry
- b. Extra Disciplinary Course (EDC)
  - c. Human Rights
  - d. Ad-on Course / Internship Training / Online course (SWAYAM/NPTEL)
  - e. Major Project

Extra Disciplinary course subjects may be chosen by the respective colleges in the Second semester and the same must be communicated to the University.

## 7. EXAMINATIONS

There shall be four examinations- two in the first year, two in the second year. Candidates failing in any subject / subjects will be permitted to appear for such failed subject / subjects at subsequent examinations. The Syllabus has been divided into four semesters. Examinations for I and III semesters will be held in November/ December and for II and IV semesters will be held in April / May.

The practical examination I to IV will be held in semester-II. Practical V & VI will be held at the semester-IV and individual Research Project should be performed and dissertation should be submitted and their report shall be evaluated in Viva -Voce examination conducted before the examiners at the end of IV - semester.

## 8. PASSING MINIMUM

A candidate shall be declared to have passed the examination if he /she secure not less than 50% of the marks in each paper / practical. Candidates who do not secure the required minimum marks for a pass in a paper / practical shall be required to appear for and pass the same at a subsequent appearance. For practical, the minimum for a pass includes the record notebook marks also. There is no passing minimum for the record notebook. However submission of a record notebook is a must.

## 9. GRADING SYSTEM

Evaluation of performance of students is based on ten-point scale grading system as given below

Ten Point Scale			
Grade of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	Absent

## 10. RANKING

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for University Ranking.



## **11. MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME**

The maximum duration for completion of the PG Programme shall not exceed EIGHT semesters.

## **12. COMMENCEMENT OF THIS REGULATION**

These regulations shall take effect from the academic year 2021-2022, i.e. for students who are to be admitted to the first year of the course during the academic year 2021-2022 and thereafter.

## **13. TRANSITORY PROVISION**

Candidates who were admitted to the PG course of study before 2018-2019 shall be permitted to appear for the examinations under those regulations for a period of three years i.e. up to and inclusive of the Examination of April/May 2022. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

## **14. PAPERS GIVEN BY THE BOARD AS EXTRA DISCIPLINARY COURSE**

### **Semester III**

Fundamentals of Human physiology (Or) Biochemistry and Health (Or) Biochemistry in Diagnosis

## **15. PATTERN OF QUESTION PAPER (FOR MAJOR, ELECTIVE AND EDC)**

Maximum – 75 marks

Duration – 3 hours

### **Section -A (1 x15 = 15 marks)**

Answer all the questions

(Multiple Choice Questions- Three questions from each unit)

### **Section -B (2x5 = 10 marks)**

Answer any two questions

(One question from each unit)

### **Section -C (5x10 = 50 marks)**

Answer all the questions (Either or Choice-Two questions from each unit)

## 16. PATTERN OF QUESTION PAPER (FOR PRACTICAL)

Internal – 40 marks (includes Attendance, Observation and Performance in the laboratory)

External – 60 marks

Question paper should contain two experiments with either or choice. First experiment is Major which has 25 marks and the second experiment is Minor question which has 20 marks. The mark distribution as follows

S No	Content	Experiment I	Experiment II
1	Principle	5	5
2	Procedure	5	5
3	Table / Graph	5	0
4	Observation / Calulation	5	5
5	Result	5	5
6	Spotters	5	5
7	Record	5	5
8	Viva	5	5

## FOR RESEARCH

S.No.	Particulars	Marks	Examiners
1	Dissertation	30%	Internal Examiner
		30%	External Examiner
2	Viva-voce	20%	Internal Examiner
		20%	External examiner

## 17.Credit calculation

S. No	Method of teaching	Hours	Credits
1	Lecture	1	1
2	Tutorial/demonstration	1	1
3	Practical/Internship/ Self-Learning	2	1

## M.Sc BIOCHEMISTRY

### COURSE OF STUDY AND SCHEME OF EXAMINATION

S.No.	Subject	Subject Title	Instructio nHrs /	Exam Hours	University Examination			Credits
					Internal (25%)	External (75%)	Total	
<b>I SEMESTER</b>								
1.	Core I	BIOMOLECULES	5	3	25	75	100	4
2.	Core II	ADVANCED ENZYMOLOGY	5	3	25	75	100	4
3.	Core III	CELL AND MOLECULAR BIOLOGY	5	3	25	75	100	4
4.	Elective I	BIOCHEMICAL TECHNIQUES	5	3	25	75	100	4
5.	Core Practical I	LAB - I	5	6	40	60	100	4
6.	Core Practical II	LAB - II	5	6	40	60	100	4
<b>II SEMESTER</b>								
1.	Core IV	INTERMEDIARY METABOLISM	5	3	25	75	100	4
2.	Core V	GENETIC ENGINEERING AND CANCER BIOLOGY	5	3	25	75	100	4
3.	Elective II	PLANT BIOCHEMISTRY ANDBIOTECHNOLOGY	4	3	25	75	100	4
4.	EDC	* Paper Supportive - III	4	3	25	75	100	4
5.	Common Paper	HUMAN RIGHTS	2	3	25	75	100	
6.	Core Practical III	LAB - III	5	6	40	60	100	4
7.	Core Practical IV	LAB - IV	5	6	40	60	100	4

Note: Online Course (SWAYAM/NPTEL) certificate should be submitted to the Institution at the end of third semester (Compulsory)

S.No.	Subject	Subject Title	Instruction Hrs /	Exam Hours	University Examination			Credits
					Internal (25%)	External (75%)	Total	
<b>III SEMESTER</b>								
1.	Core VI	ADVANCED CLINICAL BIOCHEMISTRY	4	3	25	75	100	4
2.	Core VII	CONCEPTS OF IMMUNOLOGY	4	3	25	75	100	4
3.	Core VIII	PHARMACEUTICAL BIOCHEMISTRY	4	3	25	75	100	4
4.	Core IX	BIostatISTICS AND RESEARCH METHODOLOGY	4	3	25	75	100	4
5.	Elective III	MICROBIAL BIOCHEMISTRY	4	3	25	75	100	3
6.	Core Practical V	LAB COURSE - V	5	6	40	60	100	4
7.	Core Practical VI	LAB COURSE - VI	5	6	40	60	100	4
<b>IV SEMESTER</b>								
1.	Core X	HUMAN PHYSIOLOGY AND ENDOCRINOLOGY	4	3	25	75	100	5
2.	Elective IV	BIOINFORMATICS AND NANOTECHNOLOGY	5	3	25	75	100	4
3.	Project						100	6
4.	<b>TOTAL</b>		<b>99</b>				<b>2300</b>	<b>90</b>

**\*(Choose from other departments EDC papers)**

No. Of Core papers/practical/project	:	17
Elective - Major	:	04
Non Major Supportive course -[ EDC]	:	03
Ad-on course/Online Course (Extra)		01

Subject Code:

<b>S. No</b>	<b>Type of paper</b>	<b>Title of the subject</b>	<b>Subject code</b>
1.	Core I	BIOMOLECULES	21PBC01
2.	Core II	ADVANCED ENZYMOLOGY	21PBC02
3.	Core III	CELL AND MOLECULAR BIOLOGY	21PBC03
4.	Elective I	BIOCHEMICAL TECHNIQUES	21PBCE01
5.	Core Practical I	LAB - I	21PBCP01
6.	Core Practical II	LAB - II	21PBCP02
7.	Core IV	INTERMEDIARY METABOLISM	21PBC04
8.	Core V	GENETIC ENGINEERING AND CANCER BIOLOGY	21PBC05
9.	Elective II	PLANT BIOCHEMISTRY AND BIOTECHNOLOGY	21PBCE02
10.	EDC	* Paper Supportive - III	
11.	Common Paper	HUMAN RIGHTS	21PHR01
12.	Core Practical III	LAB - III	21PBCP03
13.	Core Practical IV	LAB - IV	21PBCP04
14.	Core VI	ADVANCED CLINICAL BIOCHEMISTRY	21PBC06
15.	Core VII	CONCEPTS OF IMMUNOLOGY	21PBC07
16.	Core VIII	PHARMACEUTICAL BIOCHEMISTRY	21PBC08
17.	Core IX	BIOSTATISTICS AND RESEARCH METHODOLOGY	21PBC09
18.	Elective III	MICROBIAL BIOCHEMISTRY	21PBCE03
19.	Core Practical V	LAB COURSE - V	21PBCP05

20.	Core Practical VI	LAB COURSE - VI	21PBCP06
21.	Core X	HUMAN PHYSIOLOGY AND ENDOCRINOLOGY	21PBC10
22.	Elective IV	BIOINFORMATICS AND NANOTECHNOLOGY	21PBCE04
23.	Project		21PBCPR1

## M.Sc. BIOCHEMISTRY

### SEMESTER I

<b>Course Name: Biomolecules</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code : 21PBC01</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25      External – 75</b>	<b>Paper Type: Core I</b>				

#### OBJECTIVE

- ❖ **To study the structure and functions of macromolecules**

#### UNIT I- CARBOHYDRATES

Classification, Structure, functions, physical and chemical properties of Monosaccharides, Disaccharides; N-linked, O-linked and GPI linked oligosaccharides, glycoproteins structure, function and recognition, Polysaccharides; Homo & hetero polysaccharides, Bacterial Cell wall Polysaccharides. Structure, location and biological role of Proteoglycans (Glycosaminoglycans).

#### UNIT II - LIPIDS

Classification, structure, function, physical and chemical properties of lipids. Fatty acids- saturated, unsaturated and hydroxy fatty acids. Amphipathic lipids- micelles, emulsion & liposomes. Lipids in cell membrane, Diversity of biological membranes. Sterols – Structure, Properties and functions of cholesterol. Eicosanoids - Structure and biological role of Prostaglandins, Leukotrienes, Prostacyclins, Thrombaxanes and lipoxins. Lipoproteins - classification and functions.

#### UNIT III - AMINOACIDS AND PROTEINS

##### AMINOACIDS

Classification, structure, properties (physical and chemical) of amino acids and proteins. Ramachandran plot, linkage in Peptide bond.

##### PROTEINS

Protein sequencing (Sanger's method & Edmand reaction), Dansyl chloride protein degradation and evolution. Proteins: Primary structure, secondary structure:  $\alpha$ - helix,  $\beta$ -sheets & reverse turns, Keratin: Coil, Collagen-Triple helix, fibrous protein secondary structure, Tertiary structure: Super secondary structures;  $\beta \alpha \beta$  motifs, - heparin,  $\alpha\alpha$  motif, Greek Key motif. Quaternary Structure: Structure and functions of Hb, actin, myosin, elastin.

## **UNIT IV - NUCLEIC ACIDS**

**DNA:** Physical (Buoyant density, viscosity) and chemical properties (renaturation and denaturation). Structure of nitrogenous bases, nucleosides, nucleotides, DNA Double helix - Watson & Crick model of DNA, Other forms; A, B and Z DNA, Triple helix, Palindromes, Inverse repeats, cruciform and hairpins & quadruple structures, Cot value. Histone proteins, chromatin and non-histone proteins. Miscellaneous alternative confirmation of DNA - slipped mispaired DNA, parallel stranded DNA and anisomorphic DNA. **RNA** Classes; mRNA, tRNA and rRNA, hnRNA, SnRNA, miRNA structure and functions.

## **UNIT V – VITAMINS AND MINERALS**

Classification, structure and function of fat soluble and water soluble vitamins (including antioxidant properties). Minerals of biological significance: Na, K, Ca, Mg, Mn, P, Fe, Cu, I, Zn, Se, Co.

## **REFERENCE BOOKS**

1. Lehninger Principles of Biochemistry, Nelson, David L. and Cox, 2008.5th edition. W.H.Freeman and Co., New York
2. Fundamentals of Biochemistry, Donald Voet, Judith G.Voet and Charlotte W 2008, 3<sup>rd</sup> edition Pratt, John Wiley & Sons.
3. Outlines of Biochemistry Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Doi, John 2005. 5th edition. Wiley and sons, Singapore.
4. Biochemistry, Lubert Stryer , 1995.4th edition. WH freeman and Co, Sanfrancisco.
5. Text book of Biochemistry Thomas M Devlin, 1997.4th edition. A John Wiley, Inc publication, New York.
6. Biochemistry Zubay G L, 1988. 4th edition W M C Brown publishers.
7. Principles of Biochemistry, Garrette & Grisham, 1994. Saunders College publishing.
8. Biochemistry U. Sathayanarayana, 2006 3rd edition. Books and allied (P) Ltd., India

## **Course Outcome**

1. To explain about the structure, properties and functions of polysaccharides
2. Illustrate on structure, properties and functions of lipids, interactions of lipids in biological membrane.
3. Determine the classification, properties and significance of proteins
4. Explain about the DNA properties and functions, biological importance of histone proteins
5. To determine the significance of vitamins and its antioxidant activity, minerals of biological significance



**M.Sc. BIOCHEMISTRY**  
**SEMESTER I**

<b>Course Name: Advanced Enzymology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC02</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core II</b>				

**OBJECTIVE**

This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship, Understanding the enzyme kinetics and role of coenzymes/co-factors and an overview of Industrial application of enzymes.

**UNIT I**

Historical aspects of enzymology. Factors affecting rate of reactions - activation energy & transition state theory and catalysis. IUB Classification and Nomenclature, Intracellular localization of enzymes. Enzyme Units, Enzyme Turn over Number and its Significance. Active site - Investigation of 3D structure of active site, Isolation, Extraction, Purification and characterization of enzymes: Source and extraction procedures and criteria of purity. Isoenzymes.

**UNIT-II**

Enzyme Kinetics - Steady state theory, MM Equation, LB Plot, Eadie Hofstee Plot, Briggs - Hanes Plot, Factors affecting Enzyme activity. Enzyme catalysis and Mechanism of Enzyme catalysis – Serine proteases (Chymotrypsin) and Lysozyme. Mechanism of Bi Substrate reaction. Metalloenzymes and Metal - activated Enzymes. Coenzymes – Structure and functions of TPP, NAD, NADP, FAD, FMN, Coenzyme A.

**UNIT-III**

Enzyme Regulation: Mechanism, forward stimulation, Feedback inhibition- Allosteric Enzymes and its regulations, Allosteric inhibition, Sigmoidal Kinetics and their Significance, Hill's Equation, Scatchard Plot and their application. Enzyme Inhibition - Reversible and irreversible inhibition- types, Kinetics, Determination of Inhibitor constant and LB Plot.

**UNIT-IV**

Multi Enzyme complex-Structure and Mechanism of action and Regulation of Pyruvate Dehydrogenase Complex (PDC) and Fatty acid Synthase Complex (FAS). Enzyme

Immobilization- Source and techniques of immobilization. Effect of immobilization on enzyme activity. Application of immobilized enzymes. Enzymes as Biosensors - Calorimetric, Amperometric , Optical and Immuno biosensors.

### **UNIT-V**

Application of Enzymes - Enzymes as analytical reagents, Enzymes in Textile, Food and Detergent Industry. Clinical and diagnostic applications of enzymes in various disorder and diseases – Enzymes involved in Phenylketonuria and Alkaptonuria. Biotechnological applications of Enzymes. Enzyme Engineering: Artificial enzymes. Future prospects of Enzyme engineering.

### **REFERENCE BOOKS**

1. Enzymes. Dixon , E.C Webb, CJR Thorne and K.F. Tipton, Longmans , London
2. Fundamentals of Enzymology, Nicholas C.Price, Lewis Stevans. 2 ed., (1998), Oxford University Press,
3. Understanding Enzymes, Trevor Palmer, 1991. Third Edition Ellis Horwood Limited.
4. Protein Biotechnology. Gary Walsh and Denis Headon, 1994.John Wiley and Sons,
5. Protein Biochemistry and Biotechnology, Gary Walsh ,2002. John Wiley and Sons Ltd. .
6. Fundamentals of Enzymology- Price and Stevens: (Oxford University Press) 1999.
7. Handbook of Proteolytic Enzymes - Alan J. Barrett, J. Fred Woessner, Neil D. Rawlings, 2012.
8. Fundamentals of Enzymology (Oxford Science Publications) 2<sup>nd</sup> Edition, Nicholas C. 1989.
9. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry Kindle Edition-T Palmer , 2007.
10. Biochemistry- Stryer, I, (II Ed) W.H. Freeman & Co., New York) 1988.

### **Course outcomes**

#### **After the completion of this course, the student will be able to**

1. Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and Compare methods for production, purification, characterization of enzymes.
2. To derive the equations of Enzyme kinetics. Discuss the factors affecting enzymatic reactions. Mechanism of enzyme catalysis and structure and functions of coenzymes
3. Describe the concepts of co-operative behavior, enzyme inhibition and allosteric regulation.
4. Compare methods for production, purification, characterization and immobilization of enzymes. Describe the multi enzyme complex with example. To know about the biosensors and its functions.
5. Describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures. Develop new ideas for the development of enzyme-based drugs. Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

## M.Sc. BIOCHEMISTRY

### SEMESTER I

<b>Course Name: Cell and Molecular Biology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC03</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core III</b>				

#### OBJECTIVE

**To understand the structure and functions of the cells**

**To gain the knowledge about the concepts of central dogma of molecular biology and the details of Replication, Transcription and Translation process**

#### UNIT I:

Structure and function of prokaryotic and eukaryotic cell. Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility). Cytoskeleton - Microtubule and Microfilaments. Cell - Cell adhesion molecules - Cadherins, Integrins, Selectins, Collagen, Laminin and Fibronectins and Lignins. Classes of Cell Junctions: Gap, anchoring and tight junctions, desmosomes.

#### UNIT II:

Structure and organization of Membrane - Model membranes, Glyco conjugates and proteins in membrane systems; Active and passive transport, channels and Sodium- potassium pumps, Calcium pump, Proton pump of cells. Mitosis and Meiosis- Regulation of cell cycle, factors and genes regulating cell cycle. Cell signaling – types of cell signaling-G protein mediated, Tyrosine kinase mediated signaling. MAP Kinases mediated cell signaling.

#### UNIT III:

Organization of genes and chromosomes: Structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons, unique and repetitive DNA, interrupted genes, gene families. Models of replication. Rolling circle model of replication. Replication in prokaryotes and eukaryotes. Enzymes involved in replication. Recombination - Holliday model.

Mutations – Occurrence, kinds of mutation, Spontaneous mutations, natural mode DNA replication errors, spontaneous chemical changes. Induced mutations – environmental mutagenesis, radiation and chemical induced mutations. Mutagens – types, Detection of mutation, Lethal mutations. DNA repair – Excision repair, SOS repair and photo repair.

#### **UNIT IV:**

Transcription: RNA polymerases, Regulatory sequences in protein-coding genes, Transcription factors and enzyme machinery, formation of initiation complex, transcription activators and repressors, regulation of transcription factor activity, capping, elongation and termination, Processing of Pre- mRNA, splicing, polyadenylation; RNA transport, Cytoplasmic mechanisms of Post- transcriptional control, Processing of rRNA and tRNA.

Regulation of gene expression – Basic elements in control of gene expression, structural and regulatory genes. Mechanism of activation of gene expression; Lac operon, Trp operon, Arab operon, catabolic repression, attenuation, anti- termination and methylation.

#### **UNIT V:**

Translation: Ribosome, formation of initiation complex, aminoacylation of tRNA, tRNA-identity, initiation factors and their regulation, elongation and elongation factors, termination. Enzymes involved in translation and post translational modification. Translational proof-reading, translational inhibitors. Export and import of proteins from cytoplasm.

Genetic code – features of genetic code, properties of genetic code.

#### **REFERENCE BOOKS:**

1. Molecular cell Biology of the cell, 2008. B.Alberts, Alxendar Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter 5th Edition, G S Garland Sciences, Taylor & Francis Group, New York.
2. Molecular Cell Biology, Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell 2000. 4th Edition. W.H. Freeman and Company.
3. Cell Biology- Organelle structure and Function- David E Sadava 2004, Panima Publishing Corporation, New Delhi.
4. Cell - Biology by Chris A. Smith 2005. 2nd Edition, Editors; Smith and Wood, Garland Science.
5. Molecular Biology David Freifelder, 1987. 2nd edition. Narosa Publishing House, New Delhi.
6. Molecular Biology Robert F. Weaver, 2008, 5<sup>th</sup> edition, Mc Graw- Hill companies, Inc. India
7. Essential Molecular Biology: A Practical Approach Brown T.A 2007, 2nd edition. IRL Press, Oxford.
8. Molecular Biology of the cell 4<sup>th</sup> edition, Alberts, Johnson, Lewis, Raff, Roberts and Walter, 2002.4 Garland Publication, NY. (P) Ltd.
9. Molecular Biotechnology Glick B.R. and Pasternak J.J 2010. 4th edition. ASM Press, USA

**Course Outcomes:**

- ✓ Know about tissue types, organization and classes of cell junctions and describe the role of cell adhesion molecules and ECM components.
- ✓ Understand what happens during the cell cycle and cell death and explain about membrane transports and checkpoints in the cell cycle.
- ✓ To understand the basic structures, properties and organisation of eukaryotic and prokaryotic chromosomes.
- ✓ To emphasize the molecular mechanism of DNA replication and recombination involved in eukaryotes and prokaryotes.
- ✓ Deeply understand the transcription process in prokaryotes and eukaryotes.
- ✓ To know about the translation and post translational modification in prokaryotes and eukaryotes.
- ✓ Learn the changes and consequences in chromosome structure and its related disorders, thereby know how the DNA repair mechanism by anticancer therapeutics involved against DNA mutation and uncontrolled cell growth.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER I**

<b>Course Name: Biochemical Techniques</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCE01</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25      External – 75</b>	<b>Paper Type: Elective I</b>				

**COURSE OBJECTIVES:**

This course focus on the biochemical techniques includes spectrophotometry, centrifugation, electrophoresis, radioactivity etc., Learning these techniques will be very useful for operating instruments and become the basic knowledge in their future.

**UNIT –I**

**Microscopy and Electrochemical techniques:**

Light Microscopy, Dark field Microscopy, Phase contrast Microscopy, Fluorescence Microscopy, Electron Microscope-SEM, TEM .pH and Buffers, Measurement of pH – glass electrode, Ion selective and gas sensing electrodes, Clark oxygen electrode, and their applications, Biosensors.

**UNIT-II**

**Chromatography and Electrophoresis Techniques:**

Chromatographic techniques – General principle; adsorption and partition chromatography. Techniques and application of paper, column, thin layer, ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

**Electrophoresis Techniques:**

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – paper, Agarose, SDS-PAGE electrophoresis, Isoelectric focusing, 2D PAGE, blotting techniques, capillary electrophoresis. Pulse field Electrophoresis, Isotachopheresis.

**Unit-III**

**Spectroscopic Techniques:** Principle, Working mechanism and applications of Colorimeter, UV-Visible and FTIR spectroscopy, Flame and Flameless spectrophotometer, Basic principles of NMR, ESR, Atomic Absorption Spectroscopy, Luminometry, X-Ray Crystallography.

## **UNIT-IV**

### **Centrifugation Techniques:**

Basic principles of sedimentation, Types of Rotors, Types of Centrifugation: Ultra centrifuge, Analytical and Preparative centrifuges and applications. Molecular weight and density determination, Sub cellular fractionation, Ultra-filtration; Principle, instrumentation and application. Dialysis, principle and uses of equilibrium dialysis. Precipitation; methods and applications. Flow Cytometry; Principle and design of flow cytometer, cell sorting.

## **UNIT-V**

### **Tracer Techniques:**

Radioactive isotopes and Half life of isotopes, types of decay, rate of radioactive decay, half life, units of radioactivity. Detection and measurement of radioactivity, Design and applications of Geiger-Muller Counter, and Scintillation counters. Autoradiography-principles and applications. Applications of radio isotopes in biological sciences, ELISA and RIA-Principles and Applications.

### **REFERENCE BOOKS:**

1. Principles and techniques of practical biochemistry (5th Ed.): Wilson, K., Walker, J. (eds.) 2006.
2. An Introduction to spectroscopy for Biochemist, Brown. SB Academic Press.
3. Biophysical Chemistry – Principles and techniques, Avinash Upadhyaye and Nirmalendhe Nath, 2001. Himalaya Publishers.
4. The Tools of Biochemistry (Wiley-Interscience Publication) Terrance G. Cooper
5. Microscopy and Microtechnique-By R.Marimuthu.
6. Charles, R., Cantor, I. and Schimmel, P.R. (2004) Biophysical Chemistry, Part II, W.H.Freeman & Co., New York.
7. Basic Biophysics for Biologist, Daniel, M. (2007) Agrobios, India.
8. Upadhyay, A., Upadhyay, K. and Nath, N. (2002) Biophysical Chemistry – Principles and Techniques, Himalaya Publishing House, Mumbai
9. Campbell, I.D, Biophysical Techniques(2012) John Wiley and sons, USA

### **Course Outcome:**

Students who complete this course will be able to:

1. Have a strong and sound knowledge of the fundamental principles of Instrumentation.
2. Have the practical skills and techniques in biochemical analysis.
3. Have the practical knowledge of all the instrumental applications.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER I**

<b>Course Name: Lab Course I</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP01</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks : Internal – 25    External – 75</b>	<b>Paper Type: Practical I</b>				

**COURSE OBJECTIVE:**

This course aims to bring the skills of performing basic biochemical techniques which are important in clinical investigations. It helps in learning all the basic biochemical estimations and aids in hands on training.

1. Isolation and Estimation of Glycogen by Colorimetric method.
2. Determination of Maltose by DNSA method.
3. Estimation of Total Protein by Lowry's method
4. Estimation of Total Protein by Biuret's method
5. Estimation of Albumin by Bromocresol green method.
6. Determination of Acid number.
7. Determination of Saponification number
8. Estimation of Iodine value.
9. Estimation of Thiamine and riboflavin by Flourimetry
10. Estimation of Ascorbic Acid Vitamin C by 2 4-DNPH Method
11. Estimation of Total phenolics by modified Folin Ciocalteau method.
12. Separation of Amino acids by paper chromatography
13. Separation of Sugars by Paper chromatography.

**Reference Books:**

1. S.K. Sawhney & Randir singh, Introductory Practical Biochemistry, 2014, Narosa Publications house.
2. S. Sadhasivam, A. Manickam, Biochemical methods. New Age Publishers, 2009.
3. J. Jeyaraman, Laboratory/manual in Biochemistry. New age International Pvt. Ltd Publishers, 2011.
4. Laboratory Handbook on Biochemistry By K. Shanmugam, S. Sathish Kumar, T. Panneer Selvam, 2019.



**Course Outcome:**

**After the completion of this Lab Course I ,the student will be able to:**

1. Learn how to standardize the biochemical tests.
2. Can do chromatographic techniques.
3. Separate sugars and amino acids by Paper chromatography.
4. Can do titrations.
5. Isolate glycogen from tissues.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER I**

<b>Course Name: Lab Course II</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP02</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Practical II</b>				

**COURSE OBJECTIVE:**

This course aims to bring the skills of performing isolation, identification and purification of enzymes

**I. Enzyme Isolation and Assay of Enzyme/Specific Activity.**

- a. Extraction and Purification of Enzyme and Specific Activity - Peroxidase/Urease
- b. Molecular Weight Determination of Enzymes–Peroxidase/Urease by Molecular Sieve chromatography method
- c. Determination of Aspartate transaminase activity
- d. Determination of Alanine transaminase activity
- e. Determination of activity of Amylase
- f. Determination of specific activity of Lipase

**II. Immobilisation Enzyme**

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

**III. Enzyme Kinetics**

- a. Effect of pH, Temperature, Substrate and enzyme concentration of Lipase / Cellulase [determine Km value]
- b. Effect of pH, Temperature, Substrate and enzyme concentration of Peroxidase
- c. Effect of pH, temperature, Substrate and enzyme concentration of Urease.

**REFERENCE BOOKS (LAB COURSE –I & LAB COURSE – II)**

1. Practical clinical biochemistry, volume I and II- Harold Varley, et al., 1980. Fifth Edition. CBS publishers,

2. Biochemical Methods. II Edition. Sadasivam. S and Manickam, A New Age International private Ltd Publishers.
3. Laboratory techniques in Biochemistry and Molecular biology, Copyright 2017. Ed. T.S. Work and E.Work., 1969. Vol I & II, Elsevier.
4. A Biologist's guide to principles and Techniques of Practical Biochemistry, Modern Experimental Biochemistry Boyer, R III Edition, Benjamin Cummings Publishers.
5. A Text book of practical biochemistry. David Plummer
6. Enzymes Structure and Mechanism, Aln Fessht 1997.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER II**

<b>Course Name: Intermediary metabolism</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC04</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core IV</b>				

**COURSE OBJECTIVES:**

The Course aims

- to understand the major metabolic pathways involved in synthesis and degradation of biomolecules and energy generation

**UNIT I**

**Carbohydrate metabolism and regulation**

Introduction to metabolism of cells, Aerobic glycolysis & Fermentation - Energetics of glycolysis. Gluconeogenesis, substrate cycle & reciprocal regulation of glycolysis & gluconeogenesis. Metabolism of glycogen & regulation. Citric acid cycle and energetics. The amphibolic nature of the Citric acid cycle - Anaplerotic mechanism. HMP shunt, Uronic acid pathway, Cori's cycle, Glyoxalate pathway. Metabolism of fructose, Galactose & Mannose.

**UNIT II**

**Fatty acid metabolism and regulation**

Oxidation of saturated & unsaturated fatty acids. Oxidation of fatty acids with even & odd numbered carbon atoms. Alpha, Beta & Omega oxidation. Ketogenesis, Biosynthesis of saturated & unsaturated fatty acids. Regulation of fatty acid metabolism. Mitochondrial and microsomal chain elongation. Metabolism of triacyl glycerol, phospholipids & sphingolipids. Cholesterol biosynthesis & regulation. Degradation of cholesterol. Cyclic & linear pathways of Arachidonic acid metabolism – Prostaglandins.

**UNIT III**

**Amino acid metabolism and regulation**

Degradation of amino acids – transamination, oxidative and non - oxidative deamination, decarboxylation - Urea cycle and regulation. Biosynthesis and degradation of phenylalanine, tryptophan and glutamine. Catabolism of amino acids - carbon skeleton of amino acids to amphibolic intermediates, key role of glutamate dehydrogenase in nitrogen metabolism.

Conversion of amino acids to specialized products: Serotonin, Gamma amino butyric acid, Dopamine, Epinephrine, Nor - Epinephrine, Melanin, Creatinine, Creatine.

Integration of Metabolism - Interrelationship of Carbohydrates, Protein and Fat metabolism.

#### **UNIT IV**

Metabolism of Porphyrin - Biosynthesis and degradation of Porphyrin, Heme formation, Biosynthesis of Bilirubin, transport and excretion of bile pigment.

Metabolism of Nucleotides, De novo synthesis and Salvage pathway of Purine nucleotides, degradation of Purine nucleotides, De novo synthesis and Salvage pathway of Pyrimidine nucleotides. Degradation of Pyrimidine nucleotides, Inhibitors of Nucleotide metabolism.

#### **UNIT V**

##### **Bioenergetics**

Thermodynamics and biochemical equilibria – laws of thermodynamics, free energy,  $\Delta G$  - Endergonic and exergonic reactions

High energy phosphates. Components of Electron Transport chain and the sequence of electron transport. Mechanism of ATP synthesis; Oxidative phosphorylation – the chemiosmotic theory. Uncoupling of oxidative phosphorylation. Inhibitors of respiratory chain and oxidative phosphorylation. Mitochondrial transport systems, ATP/ADP exchange, malate/glycerol phosphate shuttle.

##### **REFERENCE BOOKS**

1. Lehninger Principles of Biochemistry D.L.Nelson and M.M.Cox, (7thEdition), W.H. Freeman,2017
2. Biochemistry, D. Voet and J. G. Voet, (4th Edition), Wiley & Sons,2011.
3. Outlines of Biochemistry(2010). 5<sup>th</sup> edition,Conn, E.E., Stumpf, P.K., Bruening, G., and Doi, R.H., John Wiley & Sons Inc,ISBN: 9788126509300..
4. J. M. Berg, J. L. Tymoczko and L. Stryer, Biochemistry (9th Edition), W.H. Freeman, 2019
5. Textbook of Biochemistry with Clinical Correlations (2011);Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 97804710281734..
6. Biochemistry, Garrett,R. and Grisham,C. 2010. 4<sup>th</sup> Edition, Saunders College Publishing.

##### **Course Outcomes:**

The learners will be able to:

- Understand the concepts of metabolism, characteristics of metabolic pathways and strategies used to study these pathways.
- To relate various metabolic interrelationship and its control
- Gain a detailed knowledge of various catabolic and anabolic pathways
- Understand the regulation of various pathways

## M.Sc. BIOCHEMISTRY

### SEMESTER II

<b>Course Name: Genetic Engineering and Cancer Biology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC05</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core V</b>				

#### OBJECTIVES

- ❖ To study the gene manipulation, cloning and gene expression techniques.
- ❖ To understand on biology and genetic basis of cancer

#### UNIT I

Techniques-Isolation and purification of Nucleic Acids. Agarose Gel Electrophoresis, Southern, Northern and Western hybridization. Restriction Modification enzymes in recombinant DNA technology and cloning: Restriction endonuclease (nomenclature, types, recognition sites, applications), DNA Ligase, Alkaline phosphatase, Reverse transcriptase, Nuclease, Terminal transferase, Polynucleotide kinase. Linkers and adaptors. Marker genes, selectable and screenable markers and aptamers. DNA sequencing – Sanger's method. PCR - principle, types and applications.

#### UNIT II

Cloning vectors – Plasmid vector - pBR322, pUC18. Bacteriophage vectors, cosmids, phagemids, YAC and BAC vectors, Viral vectors - SV 40

Gene expression in prokaryotes - Tissue specific promoter, wound inducible promoters, strong and regulatable promoters, Fusion proteins. Mammalian cell expression; Two – vector expression, two – gene expression vectors. Host cell types. Transformation, selection of transformed cells and identification of recombinants. DNA Transfer techniques; Chemical induction and electroporation.

#### UNIT III

Hybridization: RAPD, RFLP, types of probes and application, FISH, DNA Finger printing and Foot printing. Applications of rDNA technology, Gene targeting and gene tagging. Construction of genomic and cDNA libraries.

Therapeutic applications - Insulin, Growth hormones, Hepatitis B vaccines. Gene therapy: Stem cell gene therapy, Somatic cell gene therapy, gene therapy for inherited diseases; familial hypercholesterolemia, ADA and Cystic fibrosis.

## **UNIT IV**

### **Cancer Biology**

Overview of cell cycle, check - points in cell cycle regulation. S-phase, mitotic phase and cytokinesis, control of cell division and cell growth. Programmed cell death or Apoptosis; mechanism, regulation, pro-apoptotic factors, Pro-apoptotic regulators. Benign and malignant tumors. Cancer transformation, Metastatic tumor cells - Alteration in cell - cell interaction - blood vessel formation - Tumor micro environment influence cancer development - Isolation of DNA from tumor cells - Transformation of normal cultured cells. Types of cancer cells and their morphological architecture.

## **UNIT V**

### **Carcinogenesis**

Aberrant metabolism in cancer, paraneoplastic syndrome. Tumor markers, stages in chemical carcinogenesis; Initiation, promotion and progression. Oncogenes, proto - oncogenes and viral oncogenes - mechanism of oncogene activation. Growth factors – EGF, TNF $\alpha$  and TNF $\beta$  and growth factor receptors. Tumor suppressor genes: Loss of heterozygosity, Over expression of glycoproteins, P53 & Bcl2 role in carcinogenesis, Retinoblastoma.

## **REFERENCE BOOKS**

1. Molecular Biotechnology Glick B.R. and Pasternak J.J 2010. 4th edition. ASM Press, USA.
2. Cloning 1 and 2, Glover D.M. and Hames B.D. 1995. IRL Press.
3. Recombinant DNA 2nd edition. Watson 1992, W.H, Freeman and Co., NY
4. Molecular Cell Biology, Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell 2000. 4th Edition. W.H.Freeman and Company.
5. Cell Biology- Organelle structure and Function- David E Sadava 2004, Panima publishing Corporation, New Delhi

## **Course Outcome**

1. Explain the basic techniques in gene manipulation and various enzymes used in gene transfer.
2. Analyze on basic characteristic features and significance of cloning vectors, gene transfer methods and various cloning techniques.
3. Depict on the significance and applications of recombinant DNA technology.
4. Pertain on Overview of cell cycle, cell growth, tumors, cancers and isolation techniques
5. Describe on carcinogenesis

**M.Sc. BIOCHEMISTRY**  
**SEMESTER II**

<b>Course Name: Plant Biochemistry and Biotechnology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC06</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core VI</b>				

**COURSE OBJECTIVES**

This paper aims to provide a basic understanding of structure and functions of cell, photosynthesis, nitrogen fixation, and phytohormones. This paper also provides the knowledge about secondary metabolites and gene transfer methods.

**UNIT I**

Plant Cell structure. Water absorption – Mechanism of water absorption, symplast and apoplast concepts. Transpiration – types, mechanism and factors affecting transpiration. Photosynthesis – Photosynthetic apparatus, role of photosynthetic pigments, Biochemistry of light reactions of Photosynthesis - photo systems, factors affecting photosynthesis, cyclic and non-cyclic photophosphorylation. Biochemistry of dark reactions of Photosynthesis - Carbon reactions in C3, C4 and CAM plants – Calvin cycle, Hatch – Slack pathway.

**UNIT II**

Nutrients – Role of macro and micronutrients in plants and hydroponics, Nitrogen fixation and its types. Biochemistry of symbiotic and nonsymbiotic nitrogen fixation. Physiology of nodule formation. Gene manipulation of nitrogen fixation genes. Nitrogen assimilation, Interrelationship between photosynthesis and nitrogen metabolism.

**UNIT III**

Biosynthesis, transport, distribution, mechanism of action and physiological effects of Phytohormones - Auxin, Gibberellins, Cytokines, Abscisic acid and Ethylene. Phytochrome, biological clock, physiology and biochemistry of seed germination. Dormancy – types and methods to overcome dormancy. Senescence.

**UNIT IV**

Secondary metabolites – Basic biosynthetic pathways. Functions of secondary metabolites – Flavonoids, alkaloids, terpenoids, anthocyanins, Tannins, steroids and lignin. Applications of secondary metabolites - Drug development, Biopesticides and Biofertilizers. Plant tissue culture



– Micropropagation, Callus induction, cell and protoplast culture, organogenesis and somatic embryogenesis. Applications of tissue culture for crop improvement in agriculture, horticulture and forestry. Haploid production – Anther, pollen, embryo and ovule culture and their applications. Soma clonal variation.

## **UNIT V**

Agrobacterium and crown gall tumors – Ti plasmid and Ri plasmid vectors. Mechanism of T-DNA transfer to plants. Plant viral vectors, Direct transformation of plants by physical methods. Selectable markers and reporter genes used in plant vectors. Transgenic plants – plant resistance to bacteria, fungi, virus, pest and herbicides. Transgenic plants for improved nutrition, crop yield and as bioreactors. GM foods.

## **REFERENCE BOOKS**

1. Plant Biochemistry, Dey J.B. Harborne, 2000. Academic Press.
2. Plant Biochemistry and Molecular Biology Peter J. Lea Richard. C. Lee good, 1999 2nd edition. John Wiley & Sons, NY.
3. Introduction to Plant Biochemistry Goodwin T.W. and Mercer E.I 1998. 2nd edition. CBS publication.
4. Plant pathology by Pandey B.P, S. 2009 Chand & Co.
5. An introduction to Plant Tissue culture. Razdan M.K. 2003. Oxford & IBH Publishing Co, New Delhi.
6. Plant Tissue culture, A Practical approach Dixon R.A and Gonzales R.A., 2nd edition.
7. Natural Products: A Laboratory Guide. Raphael Ikan. 1991. Academic Press
8. Biotechnology by David S. Goodsell
9. Plant Biotechnology by William G. Hopkins, 2007
10. Engineering Principles in Biotechnology, *Wei-Shou Hu, 2018*

### **Course outcome:**

- Understand the basic knowledge of mechanism of water transport and Photosynthesis
- Describe the nitrogen fixation mechanisms in plants and interrelationship between photosynthesis and nitrogen metabolism.
- Get the Knowledge about the Biosynthesis, transport, distribution, mechanism of action and physiological effects of plant hormones
- Understand the role of secondary metabolites in drug development
- Know about the isolation, fusion and culture of protoplast and also understand genetic manipulation of plants. Understand the gene transfer methods for plants and also know marker free gene methodologies and gene targeting.

- Know the transgenic plants and its applications & risks. Also understand the genetic modification in food industry and its applications, controversies over risks.
- Know the plant molecular biology techniques and its applications.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER II**

<b>Course Name: Lab Course III</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP03</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks :    Internal – 25    External – 75</b>	<b>Paper Type: Practical III</b>				

**OBJECTIVES**

- ❖ To study the basic concepts of techniques in isolation, identification and estimation of plant constituents.

**I. Plant tissue culture**

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

**II. 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

### **III. Quantitative analysis**

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

**M.Sc. BIOCHEMISTRY**  
**SEMESTER II**

<b>Course Name: Lab Course IV</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP04</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Practical IV</b>				

**OBJECTIVES**

- ❖ To study the basic concepts of techniques in isolation, identification and estimation of nucleic acids.

1. Estimation of DNA
  - a) Diphenylamine method
  - b) UV method
2. Estimation of RNA
  - a) Orcinol method
  - b) UV method
3. Comet Assay
4. Agarose Gel Electrophoresis
5. Isolation of plasmid DNA
6. Isolation of Genomic DNA
7. Isolation of RNA
8. Restriction digestion of DNA
9. Preparation of competent cell and Transformation
10. PCR – Demonstration
11. Southern Blotting – Demonstration

**Reference books**

1. Plant biochemistry – Practical. C.C. Giri & Archana Giri.
2. Introductory practical Biochemistry. S.K. Sawhney, Randhir Singh.

3. Biochemical methods, S.Sadasivam and A.Manickam 1992. Willey Eastern Limited, New Delhi.
4. J. Sambroke, E.F. Fritsch & T.Maniatis. Molecular cloning – A laboratory manual.
5. James .J. Greene, Veningalla.B.Rao. Recombinant DNA principles and methodologies
6. D.M. Glover and B.D.Hames. DNA cloning – a practical approach.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Advanced Clinical Biochemistry</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC06</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core VI</b>				

**Objectives:**

The aim of the study of this paper is clinical approach of blood and urine samples and their complications.

**UNIT I**

Approaches to clinical biochemistry: Concepts of accuracy, precision, sensitivity and reproducibility. Automation in clinical biochemistry laboratory and factors in quality control. Specimen collection and processing: Blood collection methods, anticoagulants. Collection of urine - urine preservatives, Timed urine specimens. Tests and Clinical significance of urinary compounds with reference to sugars, proteins, ketone bodies, bilirubin and porphyrins. Stool – chemical examination and clinical significance. CSF – collection and composition, chemical examination and clinical significance. Amniotic fluid: Origin, collection, composition and analysis of amniotic fluid.

**UNIT - II**

Disorders of carbohydrate metabolism – Diabetes mellitus - type I, II and gestational DM. metabolic abnormalities, diagnosis and management, acute and long term complications. glycogen storage diseases and Mucopolysaccharidoses.

Disorders of lipid metabolism, Lipid storage diseases - Tayssach's and Niemann picksdiseases, fatty liver and lipoproteinemias. Atherosclerosis – risk factors, biochemical findings and management. Obesity - types, metabolic changes.

**UNIT-III**

Disorders of amino acid metabolism: Inborn errors of Branched chain amino acids, aromatic aminoacids, aliphaticaminoacids.

Disorders of Nucleic acid metabolism: Purine and Pyrimidine metabolism – Hyper uricemia, Hyper uricemia, Gout, Lesch Nyhan syndrome and hereditary Ortotic aciduria.

**UNIT– IV**

Liver function test: clinical significance of AST, ALT, ALP and GGT. Jaundice – types and differential diagnosis.

Renal function test: clearance tests, tests for renal blood flow, concentration and dilution tests. Acute and chronic renal failure, glomerulonephrities, nephrotic syndrome, urinary calculi and dialysis.

Pancreatic function test. Gastro intestinal function test: fractional gastric analysis, stimulation tests. Detection of inborn errors in fetus and heterozygous carriers by enzyme assay in amniotic fluid.

## **UNIT– V**

Disorders of mineral metabolism: Porphyrins, Hemoglobin - Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemia and anemia, Classification of anemia, blood clotting disorders.

## **REFERENCE BOOKS**

1. Teitz Fundamentals of Clinical Chemistry, Burtis, C. and Bruns, D. 2007 3<sup>rd</sup> Edition, W.B. Saunders Company.
2. Practical Clinical Biochemistry, Volume I and II, Harold Varley, 1988 5<sup>th</sup> Edition, CBS Publishers.
3. Clinical Biochemistry in diagnosis and treatment, Philip. D. Mayne, 1994, 6<sup>th</sup> edition, ELBS publication.
4. Text Book of Biochemistry for Medical Students. Vasudevan D.M and Sreekumari S. 2007 5<sup>th</sup> Edition. Jaypee Publishers.
5. Textbook of Biochemistry. Thomas M. Devlin. 1997. 4<sup>th</sup> Edition. John Wiley, Inc Publication, New York.
6. Clinical Biochemistry – Metabolic and clinical aspects, William J. Marshall and Stephen K Bangert 1995. Pearson professional Ltd.
7. Biochemistry Jeremy M .Berg, John L Tymoczko and Lubert Stryer. 2007. 6<sup>th</sup> Edition. W H Freeman and Co, New York.

## **Course Out come:**

- ✓ Understand the collection and analysis of blood and urine samples.
- ✓ Understand the role of carbohydrates and lipid metabolism in various diagnostic and therapeutic approaches.
- ✓ Have a clear knowledge about inborn error and hereditary defects in amino acids metabolism.
- ✓ Know about the gastric function test for diagnosis and therapeutic complications.



- ✓ To learn the differentiate blood tests that are used to evaluate renal function test and liver functions.
- ✓ Know in detail about the disorders of mineral metabolism and Erythrocyte metabolisms

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Concepts of Immunology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC07</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core VII</b>				

**OBJECTIVES:**

To study the immune responses of human body against antigen, immunological techniques and vaccine synthesis.

**Unit I**

The Immune System: History of immunology - Cells and Organs of the immune system- primary and secondary lymphoid organs. Differentiation and Generation of T-cells and B-cells from bone marrow. Stem cells - sources, types, properties & applications. Antigens – types, properties that influence antigenicity & immunogenicity, epitopes, cross reactions. Haptens and mitogens. Adjuvants- types and properties. Antibodies –structure, types of immunoglobulins-structure, properties and functions, immunoglobulin super family. Complement cascades - components, mechanism of Classical, Alternative and other pathways, biological consequences of complement cascades and their fragments.

**Unit II**

Immunity and Immune Response:

Types of immunities -Innate and Acquired. Immune response-Humoral and Cellular immune responses-their characteristics & effector mechanisms. Regulation of immune response. Immune response to infections-bacterial, viral, fungal and others. Immunodeficiency diseases-primary and secondary. Immunogenetics- antibody diversity- theories of antibody formation, organization of immunoglobulin genes and their expression, class switching. Major Histocompatibility Complex- organization, structure and functions of MHC and HLA genes and non - MHC molecules. Gene products. Role in antigen processing and presentation.

**Unit III**

Hypersensitivity and Autoimmunity: Hypersensitivity – classification, causes, mechanism, clinical manifestations, diagnosis and treatment of Types I – IV hypersensitivities. Autoimmunity- classification, role of MHC, TH cells and TCR in autoimmunity, spectrum of autoimmune diseases, overlap, pathogenesis, diagnosis and treatment of autoimmune diseases.

## **Unit IV**

Transplantation Immunology: Immunology of Allogeneic Transplantation, Types of Graft Rejection, Specific Immunosuppressive Agents, Immunology of Xenogeneic Transplantation, Transplantation- types of grafts, principles involved and mechanism of transplantation of various organs, immunosuppressive therapy, Graft Versus Host Disease. Role of MHC in transplantation, disease susceptibility and resistance and genetic control of primary histocompatibility.

## **Unit V**

Immunotechniques: Antigen-antibody interactions-. Precipitation techniques. Agglutination techniques, ABO blood grouping & Rh typing. Tagged assays- RIA, ELISA, immunofluorescence, immunoblotting, immunoelectron microscopy. Isolation of pure antibodies, Assays for complement, FACS, Flow cytometry. Antibody engineering - Hybridoma technology- polyclonal and monoclonal antibody production and their applications. Recombinant antibody production.

Vaccine production- types of vaccines, principles of vaccine production, production of conventional and modern vaccines, new vaccine strategies and vaccines under development. Vaccination strategies, immunization schedules.

## **Reference books for immunology**

1. Basic Immunology by Abul K. Abbas and Andrew H. Lichtman, Saunders, 2010.
2. Basic immunology by Jacqueline Sharon. Williams and Wilkins, Baltimore MD.
3. Kuby Immunology. W. H. Freeman & Co. Fourth edition, 2005.
4. Cellular and molecular immunology, by Abul Abbas, Andrew Lichtman, and Jordan Pober. W. B. Saunders.
5. Immunobiology - the immune system in health and disease, by Charles Janeway, Jr. and Paul Travers. Garland Publishing, Inc.
6. Immunology by Ivan Roitt, Jonathan Brostoff, and David Male. Mosby, London. 6th edition, 2001.
7. Clark WR, The experimental foundations of modern immunology. John Wiley and Sons Inc. New York. 1991.
8. Noel R. Rose, Herman Friedman, John L. Fahey. Manual of Clinical Laboratory Immunology. ASM. 3rd ed., 1986.

## **Outcomes:**

- ✓ Understand the humoral and cell mediated immunity.
- ✓ Know the primary and secondary lymphoid organ.

- ✓ Describe the theories of antibody formation and factors influencing antibody production.
- ✓ To learn the types of transplantation and understand how its malfunction linked with autoimmune disease and hyper sensitivity.
- ✓ Understand the active and passive immunization and learn how to make recombinant vector vaccines.
- ✓ Clear knowledge about the agglutination and precipitation techniques involved in research level.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Pharmaceutical Biochemistry and Toxicology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC08</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core VIII</b>				

**COURSE OBJECTIVES:**

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

**UNIT-1: General Pharmacology**

Introduction to pharmacology, Sources of drugs, Classification and Nomenclature of drugs, Dosage forms, Routes of Drug administration, Factors influencing dosage and drug action, Absorption of drugs and factors affecting absorption, Distribution of drugs, Factors affecting distribution, Bioavailability, Dose response relationship, ED50 and LD50. Combined effect of drugs.

**UNIT-II: Pharmacodynamics:**

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

**UNIT-III**

**Drug design and Discovery:**

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

## **UNIT-IV**

### **Systemic Pharmacology:**

Anticholinergic drugs, Diuretics and anti diuretics, Antiarrhythmic drugs, Anti hypertensive drugs, Antibacterial agents, Antiviral agents, anticancer agents, Antiulcer agents, Anaesthetics-General and Local, Tranquillizers, Anti histamines, Non steroidal Anti inflammatory drugs-NSAIDS, Sedatives ,Analgesics, Anti tussives.

## **UNIT-V**

### **Toxicology:**

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

### **REFERENCE BOOKS:**

1. Essentials of Pharmacotherapeutics, F.S.K.Barar, 2000. S.CHAND
2. Text Book of Medicinal Chemistry-Vol-I, V.Alagarsamy. 2013.
3. An Introduction to Medicinal Chemistry, GrahamL.Patrick, 2017.Sixth Edition, Oxford University Press.
4. Fundamentals of Toxicology-P.K.Gupta, 2016.BS Publications.
5. Textbook of Pharmacology for Dental and Allied Health Sciences, Padmaja Udaykumar, 2017.
6. Pharmacology and Pharmacotherapeutics, Satoskar.R.S. *et al.*, 2017. 25<sup>th</sup> Edition, Popular Prakashan, Bombay.
7. Principles of Medicinal chemistry , 1974. By William O.Foye.
8. Goodman And Gillmann's. The Pharmacological basis of Therapeutics,1941.By Louis S.Goodman and Alfred Gilman 10<sup>th</sup> edition, published by (2002)Spring.
9. Lippincotts An Illustrated Reviews: Pharmacology by Karen Whalen, 2018.7<sup>th</sup> Edition, LWW Publisher, Philadelphia.

### **Course Outcome:**

- Students who complete this course will be able to:
- Understand clearly about the basic concepts of pharmacology

- Have a thorough knowledge about the mechanism of drug action, Drug interaction, Receptors.
- Know the aspects of New discovery of drugs and drug designing.
- Recognize the principles of toxicology, Antidotes and the management of poisoning.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Biostatistics And Research Methodology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBC09</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core IX</b>				

**COURSE OBJECTIVES:**

**To study this paper we can understand methods which are used to implement in Research.**

**UNIT I**

Organizing a statistical survey, Planning and executing the survey. Source of data -Primary and secondary data collection. Classification and tabulation of data. Diagrammatic and graphic presentation of data.

**UNIT II**

Measure of central tendency - arithmetic mean, median, mode, quartiles, deciles and percentiles. Measure of variation - range, quartile deviation, mean deviation, standard deviation, Coefficient of variation. Correlation analysis - Scatter diagram, Karl's Pearson's coefficient of correlation and Spearman's rank method. Regression analysis.

**UNIT III**

Sampling distribution and test of significance – Concepts of sampling, 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 and goodness of fit. Analysis of variance - one way and two way classification. Duncan's Multiple Range test.

**UNIT IV**

Meaning and significance of research, characteristics and types of research, the research process, features of good research study. Research applications. Research report - Structure and components of scientific reports, types of report, writing and documentation of research report, developing successful research proposals,



## **UNITY**

Research problem - components of research problem, formulation of research problem, Research Design - Classification of research designs, need for research design, features of good research design, experimental research design

### **REFERENCE BOOK**

1. Biostatistics analysis 1984, ZAR, J.H, Prentice Hall, Newjersey
2. Statistical methods for biologists. Palanichamy. Sand Manoharan. M 1990.
3. Statistical methods S.P Gupta, 2011. 4<sup>1st</sup>edition. . S. Chand & Co.,
4. Biostatistics– A foundation for analysis in health science. Daniel 2006.
5. Research methodology- methods and techniques. Daniel 2006.
6. Research methods for biological science. Gurumani.N, 2007.MJP pub.
7. Research methods in biological science. Dr.S.Palanichamy, & M. Shanmugavelu,
8. Biochemical calculation and biostatistics. Dr. E.Padmini

### **Course Outcome:**

- ✓ On completion of this course, students are able to understand about biostatistics, bioethics, IPR and legal protection, patent filling and infringement and biosafety.
- ✓ Understand the sample, population and statistical inference.
- ✓ Gain knowledge about concept, philosophical consideration and epistemology of science, ethical terms, principles and theories of bioethics

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Microbial Biochemistry</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCE03</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Elective III</b>				

**COURSE OBJECTIVES:**

The aim of the study is to get knowledge about microorganisms and their characters. Gain knowledge about the applications of microorganisms.

**UNIT I**

Microbes; Bacteria, fungi, algae and protozoa. Viruses: Classification, characteristics. Ultra structure of bacteria - cell wall, cell membrane, cytoplasmic structures and cell inclusions. Cyanobacteria, Archeabacteria; Occurrence and classification. Classification and structure of bacterial, plant, animal and tumor viruses. Microbial growth–growth curve, measurement of growth, synchronuous growth, continuous culture, factors affecting growth. Microbial culture-sterilization, preparation of culture media, enrichment culture techniques for isolation of autotrophs and heterotrophs.

**UNIT II**

Microbial metabolism – overview. Photosynthesis in microbes. Role of chlorophylls, carotenoids and phycobilins, Calvin cycle. Chemolithotrophy; Hydrogen – iron – nitrite oxidising bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis, fermentations – diversity, syntrophy - role of anoxic decomposition. Entner Doudoroff pathway, stickland reaction, Bacterial photosynthesis, pectin and aldo-hexuronate pathway. Nitrogen metabolism, nitrogen fixation, hydrocarbon transformation. Anaphlerotic reactions. Autotrophic metabolism. Amino acid synthesis in microbes.

**UNIT III**

Introduction to fermentation technology: Isolation and screening of industrially important microbes, Inoculum preparation - primary and secondary strain improvement. Detection and assay of fermentation products. Fermentation – Submerged and solid state fermentation. Fermenter - Types, Downstream processing. Microbes in mineral recovery and petroleum recovery - Bioleaching and Biosorption, Production of Biomass, Production of Single cell protein and Mushrooms.. Organic acids – Acetic acid, lactic acid, citric acid and gluconic acid. Solvent production - Ethanol and Butanol.

## **UNITIV**

Industrial Production: Antibiotics - Penicillin and streptomycin. Vitamins - B12 and riboflavin. Amino acid – Glutamic acid, Lysine, Threonine and Phenylalanine and Enzymes production; commercial purposes and industrial production - Amylases, Lipases, Proteases, Cellulases and Pectinases. Whole cell immobilization and industrial applications, nutritional values and safety evaluation, advantages. Types and sources of microorganisms in food. Factors influencing microbial growth in food. Fermented foods- Yoghurt, cheese. Production of beer, wine and vinegar.

## **UNITV**

Wastewater treatment- physical, chemical and biological treatment processes. Effluent treatment. Bioremediation, oil spill clean-up. Microbial mining. Bio fertilizers

- bacteria and blue-green algae. Biopesticides in integrated pest management – Bacillus and Pseudomonas as biocontrol agents. Soil microbiota. Biogeochemical role of soil microorganisms. Microbial degradation of xenobiotics in the environment.

## **REFERENCE BOOKS**

1. Basic Biotechnology Ratledge and Kristiansen 3<sup>rd</sup> edn., 2006. Cambridge Univ. Press.
2. Understanding Biotechnology, Borem, Santos, Bowen. 2003. Prentice Hall.
3. Industrial Microbiology, Casida L.E. JR 1987, 3<sup>rd</sup> Wiley Eastern reprint. John Wiley and Sons Inc.
4. Biotechnology. Smith JE. 4<sup>th</sup> edn Cambridge University Press.
5. Elements of Biotechnology, Gupta PK. 1998. Rastogi Publication.
6. Environmental Microbiology, Scragg A. 2005. 1<sup>st</sup> ed. Amer Society for Microbiology.
7. Industrial and Environmental Biotechnology, 2001 Ahmed N.. Horizon Scientific Press.
8. Principles of gene manipulation, Primrose Twyman and Old. 2001. 6<sup>th</sup> Blackwell Science.

## **Course Outcomes:**

- ✓ Understand the classification and controlling of microbes and study isolation of microbes and maintenance.
- ✓ Describe important characteristics of microorganisms, thereby identify different types of microorganisms.
- ✓ Study about various types of microorganisms involved in infection of food products.

- ✓ Recognise the sources and transmission of infections and how the factors involving in infection.
- ✓ Know about the different types of microscopes and its functioned.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Lab course V</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP05</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Practical V</b>				

**COURSE OBJECTIVES:**

To study the basic concepts of techniques in isolation, identification and estimation of clinical samples.

**I. Haematology**

1. Enumeration of RBC and WBC
2. Differential count
3. Estimation of Haemoglobin
  - a) Colorimetric method
  - b) Sahli's method
4. Bleeding Time and Clotting time
5. ESR and PSV

**II. Blood/ Serum Analysis**

1. Estimation of total blood sugar
2. Estimation of Total protein by Lowry's method
3. Determination of A:G ratio by Biuret method
4. Estimation of Urea DAM method
5. Estimation of Creatine and Creatinine- Alkaline picrate method
6. Estimation of Cholesterol- Zak's method
7. Estimation of Bilirubin [TB, DB & IB]
8. Estimation of Triglycerides
9. Estimation of Free Fatty Acids
10. Estimation of Vitamin C
11. Determination of LDH activity

12. Determination of AST & ALT activity
13. Determination of tissue antioxidant enzyme activity – SOD/CAT

### **III. Urine Analysis**

1. Estimation of Urea, Uric acid, Creatine and Creatinine
2. Estimation of Titrable acidity
3. Estimation of Phosphate
4. Estimation of Na & Ka
5. Estimation of Chloride- Vanslyke's method

### **IV. Urinary Calculi analysis**

- V. Internship- 30 days training in fully automated Diagnostic laboratory Score; 20 out of 40 marks in practical Internals

\*Note: Practical + Internship combined for 3+1 credits

**M.Sc. BIOCHEMISTRY**  
**SEMESTER III**

<b>Course Name: Lab course VI</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP06</b>		<b>0</b>	<b>0</b>	<b>5</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Practical VI</b>				

**COURSE OBJECTIVES:**

To study the basic concepts of techniques in isolation, identification and estimation of Nucleic acids.

1. Blood Grouping and Rh Typing
2. RA test
3. CRP test
4. Pregnancy Test
5. Radial Immunodiffusion (RID) by Mancini's technique.
6. Double Immunodiffusion (DID) by using Ouchterlony method
7. Immuno Electrophoresis
8. Rocket Immuno Electrophoresis
9. Counter Current Immuno Electrophoresis
10. Immunoprecipitation test
11. Total Leukocytes Count (TLC) of the given sample
12. Lysis of red blood cells (hypotonic lysis with H<sub>2</sub>O and ammonium chloride)
13. ELISA
14. Western Blotting

**REFERENCE BOOKS**

1. Practical immunology Frank L Hay and Olywn M R 4 thEdn. Westwood
2. Practical Manual of Biochemistry S.P. Singh, 2013. CBS publishers
3. Laboratory techniques in Biochemistry and Molecular Biology, Work and Work.
4. Bioinformatics – A Practical Guide to the analysis of gene and proteins.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER IV**

<b>Course Name: Human Physiology And Endocrinology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCP10</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Core X</b>				

**COURSE OBJECTIVES:**

**To study the mechanism of human body systems and mode of action of Hormones**

**UNIT I**

Digestive system – Structure, Digestive juices; composition and functions; digestion and absorption of carbohydrates, lipids, proteins. Intestinal and bile secretion and functions

Respiratory system - components and functions – transport and exchange of respiratory gases.

Circulatory system – structure and functions of heart, functions of blood, blood coagulation mechanism.

**UNIT II**

Excretory system – structure of nephron, formation of urine, tubular reabsorption; glucose, water, electrolytes and tubular secretion. Normal and abnormal constituents of urine.

Reproductive system - structure and functions of male and female reproductive system. Physiology of pregnancy and lactation. Spermatogenesis and Oogenesis. Brief account on the biological actions of testosterone and estrogen.

**UNIT III**

Nervous system – organization, conduction of nerve impulse and neuro transmission, action potential. Anatomical structure and function of nervous system, Gross anatomical structure of brain; CNS - Cerebral hemisphere, Diencephalon, brain stem, the spinal cord.

Muscle; Types of muscle. Structure of skeletal muscle. proteins - myosin, actin, troponin, tropomyosin and other proteins. Action potential, Reflex action, Mechanism and regulation of contraction and relaxation of skeletal muscle. The neuromuscular junction, Role of acetylcholine and Ach Receptor.

**UNIT IV**



Hormones; classification and mechanism of action of peptide hormones. Concepts of receptors – G protein coupled receptors – adenylate cyclase. Second messengers; types and mechanism of action and Neurohormones. Mechanism of action of steroid hormones, structure of steroid receptors – functional domain – DNA binding sites. Nuclear transport mechanism, transcriptional and posttranscriptional mechanism.

The hypothalamus-pituitary axis. Hypothalamic hormones, Anterior and posterior pituitary hormones: Biological functions and regulation.

## **UNIT V**

Thyroid hormones: synthesis (no structures), secretion, regulation and biological actions. Hyperthyroidism and Hypothyroidism. Structures, synthesis, secretion, mechanism of action and Pathophysiology of hormones parathyroid.

Adrenal cortical hormones: synthesis (no structure), secretion, regulation and biological actions. Cushing's syndromes and Addison's disease. Adrenal medullary hormones: synthesis (no structures), secretion, regulation and biological actions of catecholamines. Pancreatic hormones: synthesis (no structures), regulation and biological actions of insulin and glucagon.

## **REFERENCE BOOKS**

1. Endocrinology, Mac E. Hadley Publishers – prentice hall international Inc, 4<sup>th</sup> edition.
2. Text book of medical physiology Guyton, (2001). 10<sup>th</sup> edition. W.B. Saunders publishers
3. Principles of biochemistry. Emil I. Smith,
4. William's Endocrinology, Shlomo Melmed Kenneth Polonsky P. Reed Larsen Henry Kronenberg, 2015. 13<sup>th</sup> Edn. Elsevier publishers
5. Thompson. Molecular medical biochemistry., J.P. Luzio, R.J. Thompson, 1999. Cambridge University
6. Cell signaling, John T. Hanuck (2006). 2<sup>nd</sup> edition. Oxford University.

## **Course Outcomes:**

- ✓ To understand the fundamental mechanisms of body fluids and blood cells.
- ✓ Illustrate the circulatory system includes heart structure, cardiac cycles and cardiac factors and respiratory system includes anatomy, physiology, gas exchange and explain the role of lungs in acid base balance.
- ✓ Learn about the anatomy of digestive system and secretions, composition and functions of gastric and biliary system thereby learn how to digest the biomolecules in intestine.
- ✓ Understand the classification, biosynthesis and mechanism of anterior and posterior pituitary hormones in biological regulation and know about its deficiency diseases.

- ✓ Know in detail about synthesis, secretion, regulation, transport, metabolic fate and biological actions of thyroid hormone and learn about thyroid function test.
- ✓ To learn clear picture about adrenal hormone's synthesis, regulation, transport, metabolism and biological effects.
- ✓ Recognize a role of gonadal hormones and know about biological effects of oestrogen and progesterone. Know what kind of biochemical changes occur during pregnancy.
- ✓ Understand the signal transduction pathway through cytoplasmic and nuclear level and its role in cellular function.

**M.Sc. BIOCHEMISTRY**  
**SEMESTER IV**

<b>Course Name: Bioinformatics And Nanotechnology</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCE04</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: Elective IV</b>				

**COURSE OBJECTIVES:**

**To study different levels of Bioinformatics tools and applications. To gain knowledge about nanoparticles and their applications in science.**

**UNIT I**

History, Scope and Importance

Important contributions - Aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - internet basics – HTML - introduction to NCBI data model - Various file formats for biological sequences.

Databases -Tools and their uses

Primary sequence databases - Composite sequence databases - Secondary databases

- Nucleic acid sequence databases - Protein sequence data bases - Structural databases -- Protein structure visualization tools (RasMol, Swiss PDB Viewer)

**UNIT II**

Sequence Alignment Methods

Sequence analysis of Biological data - Significance of Sequence alignment - Pairwise sequence alignment methods - Use of Scoring matrices and Gap penalties in sequence alignments - Multiple sequence alignment methods – Tools and application of multiple sequence alignment. Definition of genome and genomics. Types of gene map- genetic, cytogenetic and physical. Molecular markers for mapping - RFLPs, microsatellites and SNPs. Assembling a physical map of the genome - chromosome walking and jumping.

**UNIT III**

Proteomics and Genomics

Genome projects: E.coli, D.melanogaster, A. thaliana and mouse. The human genome project: goals, mapping strategies, markers, sequencing technologies, results of final sequence, potential benefits and risks, ethical, legal and social issues (ELSI).

## **UNIT IV**

Introduction to Nanotechnology

Introduction, Definition, and Nanoscale, Classification of Nanomaterials: Quantum Dots, Wells and Wires. Carbon-based Nanomaterials - Nanotubes, Metal based Nanomaterials (Nanogold, Nanosilver and metal oxides). Properties of nano- structured materials

## **UNIT V**

Synthesis and applications of Nanomaterials

Top-down (Nanolithography, CVD), Bottom-up (Sol-gel processing, chemical synthesis). Biological methods of Synthesis: Use of Plant extracts, bacteria, fungi, yeast and other biological particles. Applications of Nanotechnology in Biomedical and Pharmaceutical Industries.

### **REFERENCE BOOKS**

1. Bioinformatics - Concepts, Skills, and Applications ” S.C. Rastogi & others 2003, “CBS Publishing.
2. "Bioinformatics - A practical guide to analysis of Genes & Proteins ", Andreas D Baxevanis & B F Francis, 2000. John Wiley.
3. ”Introduction to Bioinformatics”, Pearson Education, T K Attwood, D J parry – Smith, 2005. 1<sup>st</sup> Edition, 11<sup>th</sup> Reprint.
4. Nano: The Essentials Understanding Nanoscience and Nanotechnology, Pradeep.T (2007).I Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi.
5. Nanotechnology Lakshman Desai ,2007. 1<sup>st</sup> Edition, Paragon International Publishers.
6. ”Bioinformatics”, C S V Murthy 2003, Himalaya Publishing House, 1<sup>st</sup> Edition.
7. “Basic Bioinformatics', S. Ignacimuthu, S.J., 1995. Narosa Publishing House,
8. An Introduction to Computational Biochemistry, C.S. Tsai, 2002. Wiley Liss, New York

### **Course Outcomes:**

- ✓ Understand the basic concepts of bio-informatics databases and tools on internet. Learn how to apply computational facility in different fields of life sciences, physical and chemical sciences.
- ✓ Have a clear detail about different protein structure and its predicting method.
- ✓ To learn how can utilise the BLAST and FASTA analysis for biological sequence.
- ✓ Recognise how can visual the structures and classification of proteins by visualization tools and learn to utilise this tools for alignment and analysis.
- ✓ Understand the drug designing through computer based modification programs using synthetic or natural source.

**M.Sc. BIOCHEMISTRY**  
**EXTRA DISCIPLINARY COURSE I**

<b>Course Name: Biochemistry in Human Health</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCED1</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: EDC I</b>				

**UNIT - I**

Carbohydrate - Source of carbohydrates, significance of carbohydrates in cellular activities and organism life system. Mucopolysaccharidosis, Lactose and Fructose intolerance. Normal level of sugar, alterations; Diabetes mellitus, types and its complications. Control and Management of diabetes mellitus.

**UNIT - II**

Protein -Sources of proteins and amino acids. Importance of proteins in living organisms. Normal level of protein in human. Protein deficiency disease-Kwashiorkor and Marasmus Protein quality 'Inborn error of amino acid metabolism.

**UNIT - III**

Fatty acids - source of fats and importance of fats and lipids in living organism and. Role of LDL, VLDL, HDL and chylomicrons in human body. Normal levels of cholesterol hypercholesterolemia and role of cholesterol in Blood pressure. Atherosclerosis and Heart attack' Prevention and control of heart related diseases

**UNIT – IV**

Water structure, physical and chemical properties. Vitamins- water soluble and fat soluble vitamins; Sources, chemical composition, Biological function and property, Deficiency diseases in human.

**UNIT - V**

Minerals Source and deficiency disorders of Macro-minerals; Sodium, Potassium, Calcium, Magnesium, Micro-minerals: Copper, phosphorus, Iron, Iodine, Zinc and Selenium in human Prevention and control of Anemia.

## REFERENCE BOOKS

1. Text book of Medical Physiology - A.C . Guyton,8th Edn.1991, W.B.Saunders, Harcourt Brace Company, Bangalore.
2. Text book of Medical Biochemistry 2002.M.N. Chatterjea and Rana Shinde, 5th Edn. JayPee Publications, New Delhi
3. Text book of Medical Biochemistry 2008.M.N. Chatterjea and Rana Shinde, 7th Edn. JayPee Publications, New Delhi
4. Fundamentals of Biochemistry, Dr.A.C.Deb 2006, New Central Book Agency(P)Ltd. Kolkota.
5. Essentials of Biochemistry Sathyanarayanan.U. 2002, Books and allied (P) Ltd.
6. Fundamentals of Biochemistry for Medical Students by Ambika shanmugam 2006.Published by author;West CIT Nagar ,Chennai-35
7. Essentials of Medical Physiology , K.Sembilingam and Prema Sembulingam, 2010. 5th Edn.Jaypee Bros, medical Publishers(P)Ltd. Chennai.
8. Text Book of Biochemistry, S.Nagini, 2002. Scitech Publications(P) Ltd., Chennai.

**M.Sc. BIOCHEMISTRY**  
**EXTRA DISCIPLINARY COURSE II**

<b>Course Name: Human Physiology And Nutrition</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCED2</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: EDC II</b>				

**UNIT I**

Digestive system: outline of digestive system. Buccal, gastric and Intestinal digestion. Role of liver in digestion. Intestinal- Absorption and assimilation- hormonal influence in digestion.

Excretory system ; Structure of kidney and ultra-structure of nephron. Formation and composition of urine. Outline of excretory system - 'Micturition'.

**UNIT - II**

Respiratory and Circulatory system: Types of respiration. - Outline of respiratory system' respiratory pigments, Transport of O<sub>2</sub> and CO<sub>2</sub>. Factors affecting oxygen dissociation curve and carbondioxidedissociation curve. Chloride shift.

Circulatory organs, composition of blood, systemic, pulmonary circulation, Heartbeat, cardiac cycle, origin and conduction of heart beat, Regulation of heart beat, human heart' coronary circulation, ischemic heart disease, ECG, Blood pressure and cardiac output.

**UNIT - III**

Nervous and Muscular system: outline of nervous system, structure of neuron, types of neuron, neurotransmitters. Condition of nerve impulse transmission, synaptic transmission. Muscle – Types of muscle- Role of Actin and Myosin.-Action Potential. Neuro muscular junction. Reflex action.

**UNIT - IV**

Introduction on Nutrition: Food factors for human being. Nutritional classification, foods, Energy – Energy value of food and its determination, energy expenditure – components – basal metabolism, physical activity and thermogenesis- foods' Basal metabolism: Definition, determination of basal metabolic rate (BMR). Standards of BMR factors affecting BMR, energy utilization in cells and energy balance. Dietary fiber- Definition, types of fiber in plant foods, sources, composition, role of dietary fiber and resistant starch in nutrition, effect of over consumption of fiber.

## **UNIT- V**

Nutritional consequences and Dietary Allowances Nutritive value of protein' Protein calorie malnutrition in children. protein and energy/ requirements Nitrogen balance and imbalance. Deficiency Disease of Vitamins and Minerals (Iron, sodium, potassium, fluoride, magnesium and calcium.) Infant nutrition, nutrition for preschool children, school children, adolescents, pregnant and lactating mothers. Industrial workers. Geriatric nutrition and Lathyrism. Obesity: Aetiology and occurrence, physiological regulation of foods intake assessment, complication, treatment and prevention of obesity. Therapeutic diets.

## **REFERENCE BOOKS**

1. Food Science, Potter.
2. Text book of Medical Physiology - Guyton. A.C, W. B. Saunders publications
3. Text Book of Medical Biochemistry ,M.N, Chatterjea and Rana Shindhe 2002. 5th Edition Chatterjee. JayPee publications, NewDelhi.
4. Food facts and principles, 1987. Shakuntala Manay , John Wley and Sons
5. Modern nutrition in Health and disease , Robert S. Goodhart, Maurice, E. Shils. 1980. Michael G. Wohl, Robert S. Goodhart and Maurice E. Shils (Editor)
6. Review of Medical Physiology by Ganong .W.F .2016, 25th Edition, A& L Langeseries
7. Concise Human Physiology, Sukkar. M.Y, EI-Munshid. H. A and Ardawi. M. S. M. 2000, John Wiley and Sons.
8. Human nutrition and dietetics, S.Davidson and J.R.Passmore. ELBS, Zurich.
9. Nutrition in health and disease, Whol & Gccd hart.
10. Human nutrition and dietetics I.S. Garral, W.P.T. James ILPs co3



**M.Sc. BIOCHEMISTRY**  
**EXTRA DISCIPLINARY COURSE III**

<b>Course Name: Hospital Management And Medical Coding</b>	<b>Hours</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Course code: 21PBCED3</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>Total Marks : Internal – 25 External – 75</b>	<b>Paper Type: EDC III</b>				

**UNIT I**

Introduction on Hospital management: Eligibility and personal skills required for Hospital management .Job opportunities in Hospital management. Important hospital management Institutes in India and World Hospital management. Concept of Modern Hospital & privatization in Health Sector, Public Sector Hospitals and Level of care f offered, facilities, Effects of Globalization in Health care, Concept of Corporate Hospital in developing countries,.

**UNIT - II**

Infrastructure and lay out of an ideal corporate hospital, -l Functioning of modern hospitals & changing need of patients Hospitality in Hospital Care, - Invasive and non- invasive diagnostic facilities in modern hospital Care offered in Specialty and Super specialty Hospitals. Hospital management system: Benefits of Hospital management systems, Modules of Hospital management system .Interfacing of analyzer Pathology lab management. Radiology, Blood Bank, Pharmacology management softwares.

**UNIT - III**

History of Medical Transcription: Drawbacks of MRP system, Advent of Medical Transcription .Web friendly operating system. Market information on companies. What Medical Transcription does? Benefits in a nut shell. Planning on Medical Transcription set up Induction and orientation.

**UNIT - IV**

Impact of Medical Transcription: Medical Transcription impact on its stock holders Impact during the implementation process. Impact on Departments, Organization as whole, Employment, Nature of job, Information access and Individual employees. Advantages in corporate entity, Disadvantages.

**UNIT - V**

Medical Transcription implementation: Medical Re engineering, Choosing appropriate

transcription, Customise to suit the changes Medical Transcription: Best practices Costs, Failure, Gap analysis. Implementation, Life cycle Medical Transcription- Trouble and their solutions.

### **REFERENCE BOOKS**

1. Hospital Management module II- NIHFV, New Delhi
2. G. D. Kunders. Hospital Administration.
3. Tabish. Hospital Administration. calorie malnutrition in children. protein and energy/ requirements Nitrogen balance