DEGREE OF MASTER OF SCIENCE
CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR
M.SC. BIOCHEMISTRY
(SEMESTER PATTERN)
(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)
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 and cell biology, 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.

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.

MAJOR OBJECTIVES

- 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.
1. **PREAMBLE AND OBJECTIVES OF THE COURSE:**

   The syllabus aims to provide the strength to acquire an advanced knowledge and understanding of the core principles of Biochemistry.

   The major objectives of B.Sc., Biochemistry course are,

   - To study the structures and functions of biomolecules.
   - To understand the principles, instrumentation and applications of analytical techniques.
   - To study the principles of enzyme catalysis, bioenergetics and major metabolic pathways.
   - To study the expression of molecular genes and molecular techniques.
   - To understand human physiology and nutritional requirements.
   - To study molecular concepts of body defenses and its mechanisms.
   - To impart knowledge in principles and applications of clinical Biochemistry.
   - To obtain knowledge in Pharmaceutical, Microbial and Industrial Biochemistry.
   - To acquire skills for laboratory experiments.
   - To prepare candidates for a career in Pharmaceutical industries, food industries etc.

2. **CONDITION FOR ADMISSION**

   A candidate who has passed B.Sc degree in Biochemistry or an Equivalent B, Sc. Examination in Bachelor in Medical Laboratory 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.

3. **DURATION OF THE COURSE:**

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

4. **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,

i) Major: Biochemistry

ii) Integrated and Skilled Based Elective Course and Non Major Elective Course subjects

iii) Human Rights (Languages and English)

Non major elective course subjects may be chosen by the respective colleges and the same must be communicated to the University.

**SEMESTER I**

**SEMESTER II**

**SEMESTER III**

**SEMESTER IV**

5. 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&II will be held in semester-I. Practical III & IV will be held at the semester-II. Practical- V & VI will be held in semester –III and in semester-IV 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.

6. PASSING MINIMUM

A candidate shall be declared to have passed the examination if he /she secure not less than 40% of the marks in each paper / practical. Candidates who do not secure the required 6 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.

7. CLASSIFICATION OF SUCCESSFUL CANDIDATES
Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class. All other successful candidates shall be declared to have passed in the Second Class. Candidates who obtain 75% and above in the aggregate shall be declared to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

8. **RANKING**

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

9. **MAXIMUM DURATION FOR THE COMPLETION OF THE PG PROGRAMME**

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

10. **COMMENCEMENT OF THIS REGULATION**

These regulations shall take effect from the academic year 2017-2018, i.e. for students who are to be admitted to the first year of the course during the academic year 2017-2018 and thereafter.

11. **TRANSITORY PROVISION**

Candidates who were admitted to the PG course of study before 2015-2016 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 2020. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

12. **PAPERS GIVEN BY THE BOARD AS NON – MAJOR ELECTIVE COURSE**

**Semester III**

Fundamentals of Human physiology (Or) Biochemistry in Nutrition

**Semester IV**

Biochemistry and Health (Or) Biochemistry in Diagnosis
13. PATTERN OF QUESTION PAPER (FOR MAJOR, ELECTIVE AND EDC)

Maximum – 75 marks       Duration – 3 hours

Section –A (1 x10 = 10 marks)

Answer all the questions

(Multiple Choice Questions- Two questions from each unit)

Section –B (5x5 = 25 marks)

Answer all the questions

(Either or Choice-Two questions from each unit)

Section –C (3x9 = 45 marks)

Answer any three questions (One question from each unit)
## COURSE OF STUDY AND SCHEME OF EXAMINATION

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Subject Title</th>
<th>Instruction Hrs / Week</th>
<th>Exam Hours</th>
<th>University Examination (25%)</th>
<th>University Examination (75%)</th>
<th>Total</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core I</td>
<td>BIOMOLECULES</td>
<td>5</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Core II</td>
<td>ADVANCED ENZYMOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Core III</td>
<td>CELL AND CANCER BIOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Elective I</td>
<td>BIOCHEMICAL TECHNIQUES</td>
<td>5</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Core Practical I</td>
<td>LAB - I</td>
<td>6</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical II</td>
<td>LAB - II</td>
<td>6</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>II SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core IV</td>
<td>INTERMEDIARY METABOLISM</td>
<td>5</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Core V</td>
<td>MOLECULAR BIOLOGY AND GENETIC ENGINEERING</td>
<td>5</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Elective II</td>
<td>PLANT BIOCHEMISTRY AND BIOTECHNOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>EDC</td>
<td>* Paper Supportive - III</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Common Paper</td>
<td>Human Rights</td>
<td>2</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical III</td>
<td>LAB - III</td>
<td>5</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Core Practical IV</td>
<td>LAB - IV</td>
<td>5</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>S.No.</td>
<td>Subject</td>
<td>Subject Title</td>
<td>Instruction Hrs / Week</td>
<td>Exam Hours</td>
<td>University Examination</td>
<td>Credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------------------------------------------------</td>
<td>------------------------</td>
<td>------------</td>
<td>------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal 25%</td>
<td>External 75%</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Credits</td>
<td>Credits</td>
<td>Credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core VI</td>
<td>ADVANCED CLINICAL BIOCHEMISTRY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Core VII</td>
<td>CONCEPTS OF IMMUNOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Core VIII</td>
<td>PHARMACEUTICAL BIOCHEMISTRY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Core IX</td>
<td>BIOSTATISTICS AND RESEARCH METHODOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Elective III</td>
<td>MICROBIAL BIOCHEMISTRY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>Core Practical V</td>
<td>LAB COURSE - V</td>
<td>6</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>Core Practical VI</td>
<td>LAB COURSE - VI</td>
<td>6</td>
<td>6</td>
<td>40</td>
<td>60</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>IV SEMESTER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Core X</td>
<td>HUMAN PHYSIOLOGY AND ENDOCRINOLOGY</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Elective IV</td>
<td>BIOINFORMATICS AND NANOTECHNOLOGY</td>
<td>5</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>200</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>99</td>
<td>2300</td>
</tr>
</tbody>
</table>

*(Choose from other departments EDC papers)*

- No. Of Core papers/practical/project : 17
- Elective - Major : 04
- Non Major Supportive course - [ EDC ] : 02
M.Sc. BIOCHEMISTRY

SEMESTER I

CORE I - BIOMOLECULES

UNIT I - CARBOHYDRATES
Classification, Structure, functions, physical and chemical properties of Mosaccharides, 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) and peptidoglycans.

UNIT II - LIPIDS

UNIT III - AMINOACIDS AND PROTEINS

AMINOACIDS
Classification, structure, properties (physical and chemical) of amino acids and proteins.

Amino acid sequencing, Ramachandran plot, Peptide bond link. Polypeptide synthesis.

PROTEINS

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, Cott 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

2. Fundamentals of Biochemistry, Donald Voet, Judith G.Voet and Charlotte W 2008, 3rd edition Pratt, John Wiley & Sons,
M.Sc. BIOCHEMISTRY
SEMESTER I
CORE II - ADVANCED ENZYMEOLOGY

UNIT I
Factors affecting rate of reactions - activation energy & transition state theory and catalysis. IUB Classification and Nomenclature, Intracellular Location of Enzymes, Enzyme Units, Active site - Determination of 3D structure of active site, Enzyme Turn over, Significance of Enzyme Turn over. Extraction, Purification and characterization of enzymes: Source and extraction procedures. Iso Enzymes, Antioxidant Enzymes.

UNIT-II

UNIT-III

UNIT-IV

UNIT-V
M.Sc. BIOCHEMISTRY

REFERENCE BOOKS


5. Protein Biochemistry and Biotechnology, Gary Walsh, 2002. John Wiley and Sons Ltd.
M.Sc. BIOCHEMISTRY

SEMESTER I

CORE III - CELL AND CANCER BIOLOGY

UNIT I

Cell and Sub cellular organelles


UNIT II

Cell Membrane architecture and Functions

Membrane structure; Lipid bilayer and membrane proteins [Types], Endocytosis and Exocytosis. Principle of Membrane transporters; Active transport - Na⁺- K⁻ ATPases like P-Type ATPase, F-Type ATPase [ATP synthases], Passive transport and Facilitated transport with relevant illustrations. Co - transporters - Symporters and antiporters. Electrical properties of membrane; Ion channels, Ion pores and Voltage - gated channels. Epithelial transporters. Compartmentalization of cells. Peroxisomes in transport and communication

UNIT III

Cell Signaling

Cell Signaling; Extracellular signal molecules - Receptors, Types of cells - Types of signaling. Three largest classes of cell surface receptor proteins - Ion-channel linked, G-Protein coupled, Enzyme-linked receptors. Signal transduction; Receptor Tyrosine Kinases and Ras, MAP Kinase pathways. Second messengers. Interaction and regulation of signaling pathways. 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


REFERENCE BOOKS


M.Sc. BIOCHEMISTRY
SEMESTER I
ELECTIVE I - BIOCHEMICAL TECHNIQUES

UNIT I


UNIT-II
Chromatography - Fundamental concepts, Types, Principle, Instrumentation and application of Chromatography – Paper, TLC, Ion- Exchange, Molecular sieving, Affinity, Adsorption, GLC, HPLC and FPLC.

Electrophoresis - Separation methods and fundamental concepts. Types, Principle, Instrumentation, Applications of Paper, Gel (Starch, Agarose, Polyacrylamide) SDS, Native Gel, Isoelectric Focusing, Pulse Field Electrophoresis, Capillary Electrophoresis.

UNIT-III

UNIT IV
Centrifugation - Sedimentation - Principle, Instrumentation: Low speed and high speed centrifuges. Types of Rotors. Types of Centrifugation; Ultracentrifuge, Analytical and Preparative centrifuges and applications, Ultracentrifuge; Instrumentation, applications - molecular weight and density determination. Density – gradient centrifugation - Rate zonal and Isopycnic types - Sub-cellular fractionation, Cellular disruption, homogenization and extraction - Membrane bound proteins.
UNIT V


REFERENCE BOOKS

M.Sc. BIOCHEMISTRY

SEMESTER I

PRACTICAL I - LAB COURSE I - BIOCHEMICAL TECHNIQUES

1. Isolation and Estimation of Glycogen by Colorimetric method.
2. Estimation of Calcium from Milk by Titrimetry.
3. Estimation of Magnesium from leaves/fruit
4. Estimation of Vitamin C from fruit juice
5. Estimation of Thiamine and Riboflavin by Flourimetry method
7. Separation of Lecithin from Egg yolk by TLC.
10. Separation of Amino acids, Sugars and Lipids by Paper Chromatography (Ascending, Descending and Circular).
11. Separation of plant pigments by column chromatography
12. Separation of Serum LDH by SDS PAGE.
M.Sc. BIOCHEMISTRY

SEMESTER I

PRACTICAL II - LAB COURSE II - BIOCHEMICAL TECHNIQUES

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
   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
   g. Determination of specific activity of ACP
   h. Determination of specific activity of ALP

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)
UNIT I

Carbohydrate metabolism and regulation


UNIT II

Fatty acid metabolism and regulation


UNIT III

Amino acid metabolism and regulation

Degradation of amino acids – transamination, oxidative and non - oxidative deamination, decarboxylation - Urea cycle and regulation. 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. Metabolism of individual amino acids; few important amino acids.
UNIT IV

Bioenergies in metabolism


UNIT V

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.

REFERENCE BOOKS

UNIT I


UNIT II

Genetic code – features of genetic code, exceptions to the nearly universal genetic code, One DNA sequence can determine more than one protein. Translation in prokaryotes and eukaryotes, translation of mRNAs and the role of ribosomes and tRNAs in protein synthesis. 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 III


UNIT IV

Gene expression in prokaryotes - Tissue specific promoter, wound inducible promoters, strong and regulatable promoters, Fusion proteins. Mammalian cell

UNIT V

Isolation and purification of nucleic acids. Hybridization: RAPD, RFLP, types of probes and application, Southern, Northern and Western blotting techniques. FISH, DNA Finger printing and Foot printing. DNA sequencing – Sanger's method. PCR - principle, types and applications. Applications of rDNA technology,. DNA Transfer techniques; Chemical induction and electroporation, Gene targeting and gene tagging. Construction of genomic and cDNA libraries.

REFERENCE BOOKS


M.Sc. BIOCHEMISTRY

SEMESTER II

ELECTIVE II - PLANT BIOCHEMISTRY AND BIOTECHNOLOGY

UNIT I

UNIT II

UNIT III

UNIT IV

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


REFERENCE BOOKS

M.Sc. BIOCHEMISTRY

SEMESTER II

PRACTICAL III - LAB COURSES III

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
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 (LAB COURSE –III & LAB COURSE –IV)**

6. D.M. Glover and B.D.Hames. DNA cloning – a practical approach,
M.Sc. BIOCHEMISTRY

SEMESTER III

CORE VI - ADVANCED CLINICAL BIOCHEMISTRY

UNIT I


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 - Taysach’s and Niemann picks diseases, 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 amino acids, aliphatic amino acids.


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, glomerulonephritities, 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 erythrocye metabolism, hemoglobinopathies, thalassemia and anemia, Classification of anemia, blood clotting disorders.

REFERENCE BOOKS
UNIT I

UNIT II

UNIT III
Organization and functions of MHC, structure of MHC molecules, Antigen processing and presentation. Classes of MHC molecules. Hypersensitive reactions [all types]. Immune response to infectious diseases. Transplantation types, MHC antigens in transplantation, Mechanism of graft rejection and Immunosuppressive therapy. Autoimmunity and Immunodeficiency diseases ; types, mechanism of HIV organization and pathogenesis

UNIT IV
Oncogenes, tumor antigens and cancer induction, metastasis, immune response to tumors, cancer immunotherapy. Immunization – Active and passive Immunization, types of vaccine and vaccine technology; Peptide vaccine, toxoids, Recombinant vector vaccine, DNA vaccine, Synthetic peptide vaccine. Hybridoma techniques- HAT media, Production of monoclonal and polyclonal antibodies. Gene transfer into mammalian cells – cultured cells and mouse embryosUNIT V
Experimental animal models – Inbred strains, Adaptive - transfer systems, Hemolytic plaque assay, SCID mice. Cell – culture systems - primary, cloned and hybrid lymphoid cell lines. Protein labeling techniques. Antigen - Antibody reactions –
M.Sc. BIOCHEMISTRY


REFERENCE BOOKS


4. The Immune System. Peter Parham Publisher Garland publishing

5. Cellular and Molecular Immunology. Abbas et al., 2011. Elsevier
M.Sc. BIOCHEMISTRY
SEMESTER III
CORE VIII - PHARMACEUTICAL BIOCHEMISTRY

UNIT I

UNIT II

UNIT III

UNIT-IV
M.Sc. BIOCHEMISTRY

UNIT-V


REFERENCE BOOKS


M.Sc. BIOCHEMISTRY

SEMESTER III

CORE IX - BIOSTATISTICS AND RESEARCH METHODOLOGY

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,

UNIT V
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
7. Research methods in biological science. Dr.S.Palanichamy, & M. Shanmugavelu,
8. Biochemical calculation and biostatistics. Dr. E.Padmini
UNIT I

UNIT II

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.

UNIT IV
Industrial Production: Antibiotics - Penicillin and streptomycin. Vitamins - B12 and riboflavin. Amino acid – Glutamic acid , Lssine , Threonine and Phenylalanine and Enzymes production; commercialpurposes 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.

UNIT V


REFERENCE BOOKS

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
PRACTICAL VI - LAB COURSE VI

I IMMUNOLOGY
1. Blood grouping and Rh typing.
2. Cross matching.
3. VDRL Test
4. Pregnancy / Slide test
5. Immunodiffusion- Ag & Ab estimation
   a. Single/ Radial Immuno diffusion
   b. Double diffusion- Ouchterlony Method
   c. Counter Current Immunoelectrophoresis
   d. Immunoprecipitation
   e. Rocket Immunoelectrophoresis

II MICROBIOLOGY
1. Microscopic examination of bacteria, fungi, yeast morphology
2. Staining & Identification of microorganisms
   a. Simple staining
   b. Differential staining
   c. Acid fast staining
   d. Capsule staining
   e. Endospore staining
3. Culture of micro organisms
   a. Sterilization of glass wares
   b. Preparation of basal and selective media
   c. Pure culture tech – Streak plate (Different types), Pour plate, Screw plate
   d. Enumeration of microbes in soil and water (Serial dilution)
4. Biochemical characterization of organisms [Fermentation, Citrate utilization, VP-Test, Methyl Red test]
5. Determination of growth curve [Log phase – death phase]
6. Antibiotic sensitivity pattern comparison with natural phyto specimens

REFERENCE BOOKS
PRACTICAL QUESTION PAPER PATTERN

LAB COURSE V [60 marks]

Experiment- I [25 marks]
Estimation in Serum/Blood sample

Experiment –II [20 marks]
Estimation of metabolites in urine sample

Viva [5 marks]
Record [10 marks]

LAB COURSE VI [60 marks]

Experiment- I [20 marks]
Staining and Identification of organism

Experiment –II [20 marks]
Enumeration of colonies [Serial dilution] in the given sample

Spotters [5 marks]
Viva [5 marks]
Record [10 marks]
M.Sc. BIOCHEMISTRY

SEMESTER IV

CORE X - HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

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

M.Sc. BIOCHEMISTRY


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

UNIT V


REFERENCE BOOKS

3. Principles of biochemistry. Emil I. Smith,
M.Sc. BIOCHEMISTRY

SEMESTER IV

ELECTIVE IV - BIOINFORMATICS AND NANOTECHNOLOGY

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

UNIT V

Synthesis and applications of Nanomaterials

Top-down (Nanolithography, CVD), Bottom-up (Sol-get 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

M.Sc. BIOCHEMISTRY

EDC - PAPER II - HUMAN PHYSIOLOGY AND NUTRITION

UNIT I


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

UNIT - II


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


UNIT - IV


UNIT - V

Nutritional consequences and Dietary Allowances Nutritive value of protein' Protein calorie malnutrition in children. protein and energy/ requirements Nitrogen balance

**REFERENCE BOOKS**

1. Food Science, Potter.
2. Text book of Medical Physiology - Guyton A.C, W. B. Saunders publications
10. Human nutrition and dietetics I.S. Garral, W.P.T. James ILPs co3
M.Sc. BIOCHEMISTRY
EDC - PAPER III - HOSPITAL MANAGEMENT AND MEDICAL CODING

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 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

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