# M.SC. BIO-CHEMISTRY

## FIRST YEAR

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<th>PAPERS</th>
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<td>1</td>
<td>Bio-molecules of stridulation Biology</td>
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<td>Enzymology</td>
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<td>Bio-Instrumentation</td>
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<td>Genetics and Molecular Biology</td>
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<td>Immunology of Pneumology</td>
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## SECOND YEAR

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<td>Physiology of Nutritional Bio-Chemistry</td>
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<td>Project Work</td>
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SYLLABUS
FIRST YEAR

Paper – 1

PAPER I - BIOMOLECULES OF STRIDULATION BIOLOGY

UNIT-I

**Water:** Structure and properties of water; hydrogen bonding of water; Solvent properties of water; hydrophobic interaction.

**Carbohydrates:** **Monosaccharides:** classification, stereochemistry; cyclic structure and anomeric forms. Reactions of monosaccharides-characteristics of aldehyde and ketone groups. Action of acids and alkalies on sugars. Reaction of sugars due to hydroxyl groups.

**Disaccharides:** classification, structure, chemistry and function.

**Trisaccharides:** structure of raffinose.

**Polysaccharides:** starch, glycogen, dextrin and inulin;

**Structural polysaccharides:** cellulose, chitin and glycosaminoglycans.

UNIT-II

**Lipids:** Definition; classification of lipids-simple, compound and derived lipids.


**Fatty acids.** Essential fatty acids; Steroids-Structure of cholesterol.

UNIT –III

**Amino acids and Proteins:**

**Amino Acids:** Definition; amino acids as ampholytes, structure and classification of amino acids, chemical reactions of amino acids.


UNIT-IV

Nucleic Acids: Structure of purines and pyrimidines; nucleotides and nucleosides.

DNA: Double helix; A,B& Z forms; Coiling and supercoiling of DNA. DNA denaturation and renaturation. Chemical and physical properties of DNA. Proteins involved in DNA structure-histones.


UNIT-V

Vitamins and Minerals:

Vitamins: Definition, structure and classification; sources, role of Vitamins in animal physiology.


Text book


References:-

UNIT-I

UNIT-II

UNIT-III

UNIT-IV
Enzyme technology: Immobilized enzymes; sources and techniques of immobilization. Effect of immobilization of enzyme activity. Applications of immobilized enzymes in industry.

UNIT-V
Instruments in enzyme analysis; calorimetric, Potentiometric, optical and immunosensors Recent research of enzyme engineering.

References:
2. Enzymes- Dixon and Web.
3. Enzymes Technology- Chapline & Bucke
UNIT I
Chromatography – Principle, operative technique and applications of paper, TLC, adsorption chromatography, GLC, and HPLC. Ion-Exchange, molecular sieve

UNIT II
Electrophoretic techniques - Principle and technique of gel, SDS, high voltage and discontinuous electrophoresis, Isoelectric focussing. Pulsed field gel electrophoresis and capillary electrophoresis.

UNIT III
Spectrophotometry- Basic principles, instrumentation and applications of UV, Visible, IR spectrophotometers and Mass Spectrometry. Flame Photometry - Principles and applications.

UNIT IV
Centrifugation techniques – Principle, methodology and application of analytical centrifugation, differential centrifugation, density gradient centrifugation, ultra- centrifuge.

UNIT V
X-Rays - X-Ray diffraction, crystals and detectors, quantitative analysis and applications. Radio chemical methods - Basic concepts, counting methods and applications. Autoradiography.

UNIT VI
Tracer and other techniques- radioactive decay, units of radioactivity, detection and measurement of radio activity, Geiger-Muller counter, Scintillation counter. Applications of radioisotopes in biology.
References:-
1. An introduction to practical biochemistry by David T. Plummer.
2. Laboratory Manual in biochemistry by Pattabiraman and Acharya.
3. Practical biochemistry by J.Jayaraman.
UNIT I


UNIT II


UNIT III

Mutation-definition and types of mutation-spontaneous and induced. Mutagenic agents. Mechanism of different types of DNA damage and repair systems. Mutation rate and significance of mutation studies.

UNIT IV

Protein biosynthesis-Central dogma-different phases of protein synthesis-activation, transcription, translation, termination and post translational modifications. Recombination - Holliday model, Messelson model, site specific recombination.

UNIT V

Regulation of gene action: Regulation of gene action in Prokaryotes – enzyme regulation of gene action, operon hypothesis, example of lac operon. Regulation of gene expression in simple eukaryotes. Eukaryotic gene control, hormonal regulation, regulations by histones, regulation by heterochromatin. Recombination: Mechanism; forms of recombination

References:

UNIT I


UNIT II

Antigen - antibody interaction in vitro - precipitation, agglutination, RIA, ELISA, complement fixation techniques and applications.

UNIT III

Structure and functions of immune system: Central thyroid organs and peripheral lymphoid organs. Cells of lymphoreticular system- lymphocytes, T-cell maturation, B-cell maturation. Null cells, phagocytic cells. Antigen processing and presentation. MHC - Organization, MHC molecules and genes, cellular distribution, regulation of MHC and immune Antigens. MHC and disease

UNIT IV


UNIT V

Reference:-

2. Immunology- Roitt Ivan, Jonathan Brstoff, David male, 1993
4. Immunology- Janis kuby, 3 rd edition.
SECOND YEAR

Paper – 6

BIO-INFORMATICS AND BIO-STATISTICS

BIO-INFORMATICS

UNIT – I


UNIT – II


UNIT – III


BIO-STATISTICS

UNIT – IV

Introduction – definition – Functions, Scope and Limitations of biostatistics – Collection of data, sampling, sampling design, Classification and tabulation – Types bar diagrams, Pie diagrams and Curves – measures of Central tendency – Mean, Mode, Median, Geometric mean.
UNIT – V

PHYSIOLOGY OF NUTRITIONAL BIO-CHEMISTRY

UNIT-I

Carbohydrates and their metabolism: Digestion of sugars and starch. Digestion of complex polysaccharides—absorption and storage of carbohydrates—transformation of sugar into fat—tissue carbohydrates—catabolism of carbohydrates.

UNIT-II

Essential and nonessential amino acids—Synthesis of non essential amino acids; Protein metabolism—products of protein digestion; protein catabolism—endogenous and exogenous catabolism—minimum and optimum protein intake. Urea cycle. Protein calorie malnutrition.
Lipid Metabolism: fatty acid anabolism and catabolism. Regulation of fatty acid. Role of hormones; effect of diet on fatty acid synthesis.

UNIT-III


UNIT-IV


UNIT-V

Constituents and Nutritive value of common foods: milk, egg, meat and fish, pulses and legumes, green leafy vegetables, and role of dietary fibres.

References:
2. Human Nutrition and dietetics—Davidson S. Passmover


5. WB Saundaers Company, London

ADVANCED ENZYMEOLOGY AND ENZYME TECHNOLOGY

UNIT I

UNIT II

UNIT III
Coenzymes: Coenzymes & Cofactors, substrate enzyme relationship. Classification of coenzymes as group transfer, hydrogen transfer, coenzymes, structure of coenzymes function of nucleotide coenzymes, CoA, NAD/NADP, FMN/FAD, Biotin, Folic acid, vit. B12, Biosynthesis of puridine and flavin nucleotides and CoA.

UNIT IV
UNIT V

References
1. Enzymes - Dixon & Webb
2. Biological Chemistry - Mahler & Cordes
3. Principles of Biochemistry - Lehninger
4. Human Nutrition - Biochemical Basis of Inherited Diseases Fredrickson et. al.
CLINICAL BIOCHEMISTRY

UNIT I

UNIT II
Normal Water and electrolyte balance: distribution of body water and electrolytes; normal water balance and normal electrolyte balance; regulatory mechanisms. Abnormal water and electrolyte metabolism: dehydration; pathological variations; water intoxication.

UNIT III

PLANT BIOCHEMISTRY

UNIT IV
Cell: Cell Wall detailed study of the chemical composition and structure of the cell wall layer compounds. Organisation of the wall Properties of walls, formation of walls - initiation of wall during cell division and growth of walls.

UNIT V
Role of water: Movement of water in plants: Roles of water in plants, structure and properties of water, water potential concept, movement of water in cells, measurement of water potential, osmotic potential and pressure potential; Water transport: Water in the soil, water uptake, ascent of sap, stomata and mechanism of stomatal movement, transpiration; Movement of Photosynthate / Phloem translocation: Pathways of translocation, materials translocated, rates of movement, phloem loading and unloading, mechanism of translocation; Transport systems and plant growth.

UNIT VI

Plant hormone- structure and functions of plant hormones such as ethylene, cytokinins auxins indole acetic acid, abscic acid florigin and gibberallins Photochemical and hormonal control in plants. Photomorphogenesis- structure properties functions and mechanism of action of phytochromes senescence Biochemical changes regulation.

Secondary plant products – Structure and functions of tannins terpenes, allkaloids, protocatechuic acid digallic acid catechin, quinoline nicotine morphine, flavanols coniferyl alcohol menthol myrcene linalool, geraniol camphor borneol abietic acid Aboitoc acid, Quercetin

Reference
1. Text book of medical biochemistry -MN Chaterjea, Rana Shinde
3. Introduction to plant Biochemistry - Goodwin
4. Plant physiology -Salisbery
UNIT I

UNIT II
Metabolism: Carbohydrates and energy metabolism - fermentation or glycolysis, TCA cycle and oxidative phosphorylation, Ammonia metabolism. Biosynthesis of glutamate. Purine and pyrimidine biosynthesis. Synthesis of DNA and RNA. Biosynthesis of cell wall - Peptidoglycan, and Teichoic acid.

UNIT III
Isolation of microbes from air, water and soil. Biochemical activities of microbes - IMViC reaction, starch hydrolysis, casein hydrolysis, production of hydrogen sulfide gas, fermentation of sugar and gas production test, hydrogen peroxide test. Pure culture cultivation. Analysis of growth cycle - Batch culture, fed batch culture, and continuous culture.

UNIT IV
Microbial fermentation - Screening for industrially important microbes, strain selection and improvement for better yield. Ethanol fermentation, propionic acid, formic acid, butyric acid and lactic acid fermentation. Production of antibiotics. Production of bacterial and fungal polysaccharides, Commercial production of Xanthan Gum. Single cell production
UNIT V
Food fermentation: Microorganisms as food—single cell protein, bread, malt beverages, wines, distilled liquors, vinegar, fermented vegetables, and fermented dairy products. Production of enzymes.

References
1. Microbial physiology--Albert G.Moat and John W. Foster- Wiley-interscience publication
2. Food microbiology- W.C. Frazier and D.C. Westhoff, tata Mcgra Hill publication.
PRACTICAL –I FOR PAPER I, II, III

Colorimetric experiments
1. Isolation and estimation of Starch from potato.
2. Isolation and estimation of Glycogen from liver tissue (rat or goat)
3. Isolation and estimation of Ascorbic acid from citrus fruit.
4. Estimation of Fructose in fruits.
5. Estimation of Riboflavin from legumes.
7. Determination of Vitamin E.
8. Estimation of Beta- Carotene from carrot.
10. Estimation of lecithin from egg yolk.
11. Determination of plant hormones – IAA or Gibberellin.

Enzymes studies
1. Assay of glutamine synthase or glutamate dehydrogenase.
2. Isolation, purification, properties and inhibitor studies of any one of the enzyme
   Cellulase.
3. Estimation of albumin
4. Determination of Na + , K + using flame photometer
5. Determination of glucose, protein and chloride in CSF

Separation techniques
1. Separation of amino acids by paper chromatography – circular,ascending &
   descending.
2. Separation of lipids by TLC
3. Separation of plant pigments by column chromatography
Genetics and Molecular Biology

1. Polyacrylamide gel electrophoresis of DNA
   a. Non-denaturing b) Denaturing
2. Restriction analysis of DNA
3. Preparation of competent E coli - transformation
4. Plasmid DNA isolation
5. Genomic DNA isolation
6. Southern blot hybridization (demonstration)
7. Polymerase chain reaction for amplification of DNA (demonstration)
9. Isolation and Estimation of DNA from spleen or Liver – UV and Visible method

Immunology

1. Immuno diffusion – Single radial and double immunodiffusion
2. Immunoelectrophoresis
3. Rocket immunoelectrophoresis
4. Agglutination tests
5. Raising of antibodies – Single soluble and particulate antigen
6. Identifying blood grouping and Rh typing.