M.SC. BIO-CHEMISTRY

FIRST YEAR

PAPERS	Subject	Max. Marks	Exam Hrs
1	Bio-molecules of stridulation Biology	100	3
2	Enzymology	100	3
3	Bio-Instrumentation	100	3
4	Genetics and Molecular Biology	100	3
5	Immunology of Pneumology	100	3
	Practical – I	100	6
	Practical – II	100	6

SECOND YEAR

PAPERS	Subject	Max. Marks	Exam Hrs
1	Bio-information Bio Statics	100	3
2	Physiology of Nutritional Bio-Chemistry	100	3
3	Advanced Enzymology and Engyme Technology	100	3
4	Clinical and Pant Bio-chemsitry	100	3
5	Advanced Enzymology and Engyme Technology	100	3
	Practical III	100	6
	Practical IV	100	6
	Project Work		

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.

Simple lipids: Physical and chemical properties of fats. Compound lipids: Structure and function of phospholipids, glycolipids and lipoproteins. Derived lipids: Fatty acid; Saturated and unsaturated.

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.

Peptides: Structure and properties. Identification of N and C terminal residues. Determination of primary structure of pepetides. Glutathione, and oxytocin.

Proteins: Structure and Properties of proteins; Its classification. Primary structure, secondary structure, tertiary structure and quaternary structure with examples. Properties of silk fibroin, collagen and hemoglobin. Forces in protein interactions - short range repulsions, electrostatic forces, Vanderwaals forces, hydrogen bonds and hydrophobic interactions. The Ramachandran plot.

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.

RNA: Types, Unusual bases. Enzymatic reactions of nucleic acids and its role in protein synthesis.

UNIT-V

Vitamins and Minerals:

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

Minerals: Essential minerals, sources and functions. A note on requirement.

Text book

1. Ambika Shanmugam, Fundamentals of Biochemistry for medical students.

References:-

1. Ambika Shanmugam, Fundamentals of Biochemistry for medical students.
2. Deb, A.C., Fundamentals of Biochemistry, New central Agency, Calcutta, 3 rd edition,1989.
3. Lehninger, A.L.,Nelson, D.L., Cox,M.M, Principles of Biochemistry, CBS Publishers, 2 nd edition, 1993.
4. Lubert stryer, Biochemistry, Freeman and company, 4 th edition,1995.

Paper – 2

ENZYMOLOGY

UNIT-I

Enzymes: Introduction, International classification of enzymes, six main classes of enzymes. Extraction, purification and characterization of enzymes.

UNIT-II

Coenzymes: Definition, structure and functions of Thiamine pyrophosphate, Nicotinamide coenzymes, Flavin nucleotides, coenzyme A, lipoic acid, biotin and folate coenzymes. Metal cofactors (Mechanism of action of coenzyme not required) Mechanism of action of Chymotrypsin. Allosteric enzymes. Asparate transcarbamylase (Mechanism) Model.

UNIT-III

Enzymatic actions: Single substrate, factors affecting rate of enzyme activity. Enzymatic reactions - Acid base, electrostatic, and covalent reactions. Michaellis-Menten equation-Derivation, transformation of MM equation to Lineweaver Burk plot. Enzyme Inhibition: Competitive, Non-Competitive and Un-competitive enzyme inhibition..

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:

1. Trevor Plamer, understanding Enzymes, Ellis Horwood limited. 3 rd edition, 1991.
2. Enzymes- Dixon and Web.
3. Enzymes Technology- Chapline & Bucke
4. Alan Weissman, Hand Book of Enzyme Biotechnology: 2 nd edition.

Paper – 3

BIO-INSTRUMENTATION

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.

4.Analytical Biochemistry, D.J.Homie and Hazal Peck, Longman group,3 rd edition, 1998.

5. Physical Biochemistry - Application of Biochemistry and Molecular Biology, David Friefelder, W.H.Freeman and Co., Second Edition, 1999.

6.Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H.Freeman and Co., Third Edition, 1999.

Paper – 4

GENETICS AND MOLECULAR BIOLOGY

UNIT I

Fine structure of gene-Classical definition of gene, cistron, muton, chromosomal structure. Chromosomal organization of genes. Coding and noncoding regions of DNA Transferable genes-plasmids, and Transposons. Structural organization of eukaryotic chromosomes.- chromatin structure-heterochromatin and euchromatin.

UNIT II

DNA replication- Mechanism of DNA replication in prokaryotes and eukaryotes. Different models of DNA replication. Enzymology of DNA replication.

UNIT III

Mutation –difinition 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. rRegulation of gene expression in simple eukaryotes. Eukaryotic gene control, hormonal regulation, regulations by histones, regulation by heterochromatin. Recombination: Mechanism; forms of recombination

References:

1. Weaver,F. Robert, Hedrick, W.Philip. (1997) 3 rd ed.
Genetics. Wm.C.Brown publishers.
2. David Freifelder (1983) Jones & Bartlett publishers. 2ed Molecular biology. Reprint

(1993) Narosa Publishing House.
3. Gardner, Simmons 8 ed. Principles of Genetics.

Paper – 5

IMMUNOLOGY OF PNEUMOLOGY

UNIT I

Immunity- definition, innate immunity-Mechanisms of innate immunity. Acquired immunity- active and passive immunity with examples. Antigens- definition and determination of antiginicity. Antibodies- definition, types, and functions of antibodies. Monoclonal antibodies.

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 maturarion, 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

Complement system - general properties of complement. Complment activation. Classical pathway and alternative pathway. Regulation of complement activation. Biological effects of C. Hypersensitivity – classification –Immediate and delayed types. Type I, II, III and IV Hypersensitivity reactions and its mechanisms.

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UNIT V

Autoimmunity – Classification of auto immune disease – haemocytolytic auto immune disease, localized auto immune disease, and systemic auto immune disease. Pathogenesis of auto immune disease. Immunology of transplantation- autograft, allograft, isograft and xenograft.

.

Reference:-

1. Immunology-An Introduction, Tizard R.Jan, 1995.

2. Immunology- Roitt Ivan, Jonathan Brastoff, David male, 1993

3. Text book of microbiology- AnanthanarayananR. And Jayaraman Panikar, 1996.

4. Immunology- Janis kuby, 3 rd edition.

SECOND YEAR

Paper – 6
BIO-INFORMATICS AND BIO-STATISTICS

BIO-INFORMATICS

UNIT – I

Introduction – Goals – Scope – Fundamentals or Biological system – cells – cell transport through plasma membrane – energetic and respiration – Cell cycle – Fundamentals of genetics – Immune system – triology of environment – basic principles and population ecology – Food chain, Food web in ecosystem.

UNIT – II

Molecular modeling – Introduction – Molecular structure and internal energy – application macromolecular modeling – Molecular mechanics and molecular dynamics of oligopeptides, Nucleotides, Proteins, Drug molecules, molecular design – emerging areas in Bioinformatics – Bio-computing.

UNIT – III

Database systems – Introduction – Data abstraction – Data models – Instances and schemes – network data model – basic concepts – Hierarchial data model – basic concepts – ORCALE – RDBMS – Visual basic – Client / Server technology – Data types – strings – variant – constant – Data – Arrays – Looping – Genomic data banks – Microbial and cellular data banks – computer networking – LAN, WAN, MODEMS – Internet.

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

Correlation and Regression – Positive and negative correlation – Simple, Partial, multiple, linear and non-linear correlation – types of regression analysis – regression equation – test for significance – ‘t’ test, ‘chi’ square test.

Paper – 7

PHYSIOLOGY OF NUTRITIONAL BIO-CHEMISTRY

UNIT-I

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

UNIT-II

Essential and noessential amino acids—. Synthesis of non essential amino acids ; Protein metabolism- products of protein digestion; protein catabolism- endogenous and exogenous catabolism-minomum 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

Dynamics of energy - definition of kilocalories, Joule. Exergonic and endergonic reactions. Caloric value of foods. Basal metabolism and BMR. Respiratory quotient-factors affecting and clinical aspects. Caloric requirements.

UNIT-IV

Nutritional aspects : Protein factors in nutrition : quality of protins- classification. Quantitative aspects. Protein deficiency. Role of carbohydrates in diet. Role of lipids in diet. Role of minerals in diet. Balanced diet. Obesity – importance , types, pathogenesis, metabolic changes in obesity and clinical features. Diet in pregnanacy and lactation

UNIT-V

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

References:

1. Essential of food and nutrition-Vol.I and II M.Swaminathan.
2. Human Nutrition and dietetics- Davidson S. Passmover

3. Text book of medical biochemistry –MN CHATTERJEA, RANA SHINDE, 4th edition, jaypee brothers.
4. Food, Nutrition and Diet therapy 6 th Edition. Kraure and Mohan.
5. WB Saundaers Company, London
6. Clinical Dietetics and Nutrition. Anitha.F.P.

Paper – 8

ADVANCED ENZYMOLOGY AND ENZYME TECHNOLOGY

UNIT I

Enzyme Techniques **:** Activity of enzymes, Handling of enzymes, Enzyme assays. Analysis of enzymes activity(methods), expression of the activity coupled reactions. Isolation and purification of enzymes. Importance of pure enzymes. Separation of Isoenzymes.

UNIT II

Enzyme Kinetics : Velocity of a reaction, order of a reaction, progress curve for enzyme catalysed reactions. Factors influencing velocity of enzyme catalysed reaction. Michaelis Menten Kinetics, Km and Vmax. Effect of pH, temperature on enzymatic reactions. Anomalous kinetics of competitive and non-competitive inhibition. End product inhibition with examples.

UNIT III

Coenzymes : Coenzymes & Cofactors, substrate enzyme relationship. Calssification of co-enzymes as group transfer, hydrogen transfer, conenzymes, structure of conenzymes function of nucleotide coenzymes, CoA, NAD/NADP, FMN/FAD, Biotin, Folic acid, vit. B12, Biosynthesis of puridine and flavin nucleotides and CoA**.**

UNIT IV

Mechanism of Enzyme action : Enzyme specificity, Active site, Study of Mechanism of enzyme reaction – pathway of enzyme catalysed reactions. Mapping of active site,. Mechanisms at active site of enzymes – Covalent – catalysis, acid base catalysis. Proximity and orientation effect. Structure and mechanism of action of representative enzymes. Chymotrypsin and Ribonuclease.Regulation of enzyme activity – Covalent modulated regulatory enzymes. Allosteric regulation.

UNIT V

Enzyme Technology : Application in Food and Pharmaceutical industries- large scale enzyme extraction, purification and stabilisation. Industrial application of carbohydrates, proteolytic enzyme, lignocellulose degrading enzyme, pectin and pectic enzyme. Applications of enzymes in food industry. Clinical enzymology – Serum enzymes in health and diseases. Immobilised enzyme technology – designer enzymes – Abzymes Biosensors – Ribozymes.

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.
5. Alan Weissman, Hand Book of Enzyme Biotechnology: 2 nd edition.

Paper – 9

CLINICAL AND PLANT BIOCHEMISTRY

CLINICAL BIOCHEMISTRY

UNIT I

Enzymes and Isoenzymes - clinical importance : enzyme; clinical significance of enzymes(serum enzymes). Isoenzymes- value and significance. Renal function test- classification and types in detail. Liver function test- function of liver; classification of liver function test. Gastric function test-classification and analysis Thyroid function test – classification; blood hormone analysis. Immunological test for thyroid function.

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

Acid base balance : acid base balance in normal health; mechanism of regulation of pH(role of respiration in acid – base balance). Renal mechanism for regulation of acid base. Acid base imbalance : acidosis, alkalosis. CSF: Appearance of csf; biochemical changes of csf .Urine analysis : aminoacidurias, proteinuria.

PLANT BIOCHENISTRY

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, absicic acid florigin and giberallins Photochemical and hormonal control in plants. Photomorphogensis- structure properties functions and mechanism of action of phytochromes senescence Biochemical changes regulation.

Secondary plant products – Structure and functions of tannins terpenes, allkaloids, protocate chuic 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
2. Plant Biochemistry -James Bonner & J. R Varner
3. Introduction to plant Biochemistry - Goodwin
4. Plant physiology -Salisbery
5. Plant Biochemistry & Molecular Biology – P.J. Lea & R. G. Heagood

PAPER – 10

MICROBIAL BIOCHEMISTRY

UNIT I

Structue of bacteria : Structure of Gram positive and negative bacterial cell wall, Nucleus, cytoplasm, ribosomes, capsule,slime layer and fimbriae. Endospores of bacteria. Growth: nutrient requirements of bacteria. Factors affecting growth- nutrition, oxygen, carbondioxide, temperature and hydrogen on concentration.

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 foodm—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.
3. Microbial Biotechnology – Alexander N.Glazer, Hiroshni - Kaido, W.H.Freeman and Co.1995.
4. Chemical Microbiology, Antony H.Rose, Butterworths,Third Edition, Plenum Press,1976.
5. Principles of fermentation technology, P.F. Stanbury, A. Whitaker, S.J.Hall, Second Edition, Pergamon Publishers, 1995.
6. Biotechnology, A text of "Industrial Microbiology, Wulf Crueger and Anneliese Crueger , Second Edition, Sinauer Associates Inc, Sanderland, 1989c.

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.
6. Estimation of Niacin.
7. Determination of Vitamin E.
8. Estimation of Beta- Carotene from carrot.
9. Estimation of Total free amino acids in plant tissues.
10. Estimation of lecithin from egg yolk..
11. Determination of plant hormones – IAA or Gibberllin.

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

PRACTICAL – II

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)
8. Estimation of RNA – UV and visible method.
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.