B.Sc. (Hons.) Biochemistry Syllabus

Annexure-I

B.Sc. (Hons) Syllabus (SYLI)

BOS dated 26.08.2002

(to be introduced w.e.f. 2003-2004)

Department of Biochemistry

Faculty of Life Sciences

Aligarh Muslim University ,Aligarh.

BIOCHEMISTRY

B.Sc. (Hons) I Year

Paper I

BIOMOLECULES

Total Lectures : 60

Exam. Marks : 40

Sess. Marks : 10

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 Questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the units. However, there will be intra-unit choice. Each question shall carry 6 marks.

UNIT I : BIOCHEMISTRY OF CELL **(12 Lectures)**

Definition and scope of biochemistry, cellular basis of life, molecular composition of cells, elements and compounds of life; Biomembranes - plasma membrane and membranes of sub-cellular organelles. Biochemical functions of cell organelles (revise your knowledge of ultrastructure of cell as it shall not be discussed); molecular logic of cell; unit of length used in cell biology and

biochemistry; suitability of organic molecules as biomolecules, dimensions of cellular molecules and their packing in the cell.

Origin of Life:

Time scale of chemical and biological evolution; some working assumptions for origin of life, conditions leading to abiotic origin and organic compounds, current concepts of origin of life.

Water as Solvent of Life:

Physical properties and hydrogen bonding of H_2O; structure of liquid water and its solvent properties, hydrophobic interactions; ionisation of H_2O, ion product of water, the pH scale, definition of buffer, relationship between pH and pKa (Henderson-Hasselbach equation); fitness of aqueous environment for living organisms.

UNIT II : PROTEINS AND ENZYMES (14 Lectures)

Proteins :Definition, protein content of various type of cells; elemental composition, biological function of proteins; structure of twenty alpha-amino acids commonly found in proteins, Zwitterion nature of amino acid in aqeous solutions, abbreviations and classification of 20 amino acids, essential amino acids nutritive value of proteins; peptide bond formation, nomenclature of peptides backbone structure of protein/polypeptide, definition of N-terminal and C-terminal amino acids, properties of amino acids/proteins arising from their dipolar nature; basic understanding of primary, secondary, tertiary, quaternary and domain structure of proteins/peptides, classification of proteins based on solubility and shape; elementary ideas on protein denaturation and loss of biological activity.

Enzymes: Concept of enzyme nature of enzymes catalysed reaction, active site of enzymes, Michaelis-Menton equation, effect of temp & pH; role of co-enzymes, prosthetic groups, activator and inhibitors in enzyme catalysed reaction.

UNIT III : CARBOHYDRATES: (10 Lectures)

Definition, empirical formulae & biological functions; Classification into monosaccharides (aldoses and ketoses), oligosaccharides & polysaccharides; Optical isomerism, open chain and ring structure of carbohydrates, mutarotation, structure of biologically important carbohydrates (D-glucose, D-galactose, D-mannose, D-fructose, D-ribose, D-2, deoxyribose, D-maltose, D-lactose, D-sucrose), polysaccharides, starch, cellulose, glycogen and mucopolysaccarides, suitability of polysaccharides as storage material in plants.

UNIT IV: LIPIDS (12 Lectures)

Definition, biological function, general formulae of fatty acids, essential and non-essential fatty acids, nomenclature and properties, classification of lipids into simple, complex and derived lipids, the general structure and function of major lipid subclasses: acyalglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steriods, and prostaglandins; suitability of triglycerides as storage lipids; analytical characterization of fats and oils - saponification number and iodine number.

UNIT V: NUCLEIC ACIDS (12 Lectures)

Nature of genetic material; evidence that DNA is the genetic material, generalized structural plan of nucleic acid, nomenclature used in writing structure of nucleotides and nucleic acids, features of DNA double helix; Size of DNA in procaryotic and eukaryotic cells, central dogma of molecular biology; Gene, genome, chromosome, basic ideas of DNA replication, transcription and protein biosynthesis, role of DNA as genetic material, genetic code, codons, deciphering the genetic code, molecular basis of mutation.

RECOMMENDED BOOKS

1. E.J. Wood & W.R. Pickering, INTRODUCING BIOCHEMISTRY (1982) ELBS/John Muray.

2. A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York.

3. E.E. Conn and P.K. Stumpf. OUTLINES OF BIOCHEMISTRY (1976) Wiley Eastern, New Delhi.

4. L. Stryer BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA.

B.Sc. (Hons) Syllabus (BSYL 3) Department of Biochemistry

BOS/ 26.08.2002 Faculty of Life Sciences

(to be introduced w.e.f. 2003-2004) Aligarh Muslim University,Aligarh.

BIOCHEMISTRY

B.Sc. (Hons) I Year

MICROBIOLOGY AND VIROLOGY

Paper - II

Total lectures: 60
Exam. Marks : 40
Sess. Marks : 10

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the units. However, there will be intra-unit choice. Each question shall carry 6 marks.

A. MICROBIOLOGY

UNIT I : CLASSIFICATION OF MICROORGANISMS (12 Lectures)

Types of microorganisms - general characteristics of main groups of microorganisms viz. prokaryotes, eukaryotes and archae; criteria used in the classification of bacteria - morphology, cytology, genetics, host specialization, serology, physiology etc; Mycoplasma.

UNIT II : MORPHOLOGY, NUTRITION & PHYSIOLOGY OF BACTERIA (12 Lectures)

(a) General organization of bacterial cells - gram positive and gram negative organisms; structure and function of peptidoglycan in gram positive and gram negative organisms; function of polymeric components in outer membrane and acidic polymers in gram negative organisms.

(b) Nutrition, physiology and growth of bacterial cells,different phases of growth, use of different types of media in bacterial cultivation.

UNIT III : APPLIED MICROBIOLOGY AND BACTERIA GENETICS (12 Lectures)

Role of bacteria in food spoilage, fermentation, food-borne infections and sewage (domestic and industrial) treatment, biofertilizer.

Microbial genetics and differentiation - Adaptation and mutation: types of mutation and induction of mutation; bacterial transformation, conjugation, sex types, transduction, transfection, protoplast fusion, genetic recombination, plasmids, IS elements and transposons.

B. VIROLOGY

UNIT IV : MORPHOLOGY & REPLICATION OF VIRUSES (11 Lectures)

Definitions of virus, viroids, virusoids and prion; Virus structure, virus proteins, virus classification emphasising importance of bacteriophage and virus as tool in modern biological research, methods of assay; replication of RNA viruses, negative strand (VSV), positive strand (polio), retroviruses (to include all events in the infection cycle), replication of DNA viruses (adenovirus or SV40).

UNIT V : VIRAL INFECTIONS (13 Lectures)

Acute virus infections - Influenza, dengue and yellow fever viruses, persistent virus infection Herpes/Hepatitis and AIDS; transformation and Cancer - RNA tumor viruses/papoviruses; vaccines in prevention of viral infections - smallpox, rabies, hepatitis polio and AIDS.

RECOMMENDED BOOKS

1. E. Alcamo, FUNDAMENTALS MICROBIOLOGY (1994). The Benjamin/Cummings Publishing Co., Inc. California, USA.
2. P. Tauro, K.K. Kapoor and K.S. Yadav, AN INTRODUCTION TO MICROBIOLOGY, Wiley Eastern Ltd., New Delhi (1985).
3. M. Pelczar, E.C.S. Chan and M.R. Krieg, MICROBIOLOGY, McGraw Hill Inc., Singapore (1997).

B.Sc. (Hons) Syllabus (BSYL6)

BOS/ 26.08.2002

(to be introduced w.e.f 2004-2005)

Department of Biochemistry

Faculty of Life Sciences

Aligarh Muslim University

Aligarh.

Biochemistry

B.Sc.(Hon's) IInd year

Paper - III

ENZYMOLOGY

Total Lectures : 60

Exam. Marks : 40

Sess. Marks. : 10

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT - I: INTRODUCTION **(12 Lectures)**

Definition, historical perspective, IUB enzyme classification (rationale, overview and specific examples), Nature of non-enzymatic and enzymatic catalysis. Measurement and expression of enzyme activity, enzyme assays. Definition of IU, enzyme turn over number and specific activity. Role of non-protein organic molecules and inorganic ions co-factors, coenzymes, prosthetic groups. Role of vitamins as coenzyme precursors (general treatment), details of coenzyme function of NAD and pyridoxal phosphate.

UNIT - II: MECHANISM OF ENZYME ACTION **(12 Lectures)**

Concept of enzyme-substrate complex, evidences for the formation of enzyme-substrate complex. Nature of substrate binding sites, active sites of enzymes. Collision and transition state theory. Michaelis-Menten equation, determination and significance of Vmax and Km. Lock and key and induced fit model of enzyme-substrate interactions. Stereospecificity of the enzyme for substrates. Enzyme catalytic efficiency, proximity, orientation, distortion or strain, acid-base and nucleophilic catalysis.

UNIT - III: ENZYME KINETICS **(12 Lectures)**

Kinetics of zero and first order reactions, effect of enzyme concentration, substrate concentration temperature and pH on enzyme activity; enzyme inhibition (reversible and irreversible inhibition). Evaluation of Km, Ki and Vmax in the presence of inhibitors. Significance and evaluation of energy of activation and free energy.

UNIT - IV: ALTERNATIVE PLOTTING PROCEDURES **(12 Lectures)**

Lineweaver-Burk plot, Eadie-scatchard plot, Scatchard plot for equilibrium binding data, advantages and disadvantages of the plots. Bi-substrate enzymes (rapid equilibrium, random bi-bi, ordered bi-bi and ping-pong bi-bi reactions). Allosteric enzymes – definition, behaviour and physiological significance. Isoenzymes – physiological and diagnostic significance.

UNIT - V: INDUSTRIAL AND CLINICAL APPLICATION OF ENZYMES **(12 Lectures)**

Industrial uses of enzymes, production of glucose from maltose, starch, cellulose and dextran, use of lactase in dairy industry, production of glucose-fructose syrup from sucrose, use of proteases in food, detergent and leather industry; medical applications of enzymes; use of glucose oxidase in enzyme electrodes.

RECOMMENDED BOOKS

1. R.K.Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, HARPER'S BIOCHEMISTRY, 22nd edn. (1990), Prentice-Hall, International, USA.
2. P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4th edn. (1994), Wiley Eastern, New Delhi, (Chapters 7 & 8).
3. Nelson and Cox, LEHNINGER's PRINCIPLES OF BIOCHEMISTRY, (2000), Kalyani Publishers, Ludhiana/Worth Publishers, Inc., New York.
4. L. Stryer BIOCHEMISTRY 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
5. G.L. Zubay BIOCHEMISTRY 4th Ed. (1998) W.C. Brown Publishers, USA.

B.Sc.(Hon's) Syllabus (BSYL4) Department of Biochemistry

BOS/ 26.08.2002 Faculty of Life Sciences

(to be introduced wef. 2004 -2005) Aligarh Muslim University,Aligarh.

BIOCHEMISTRY
B.Sc. (Hon's) II Year

Paper - IV

METABOLISM

Total Lectures : 60

Exam Marks. : 40

Sess. Marks. : 10

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the Units. However, there will be intra-unit choice. Each question shall carry 8 marks.

(More stress would be laid on metabolism from human point of view)

UNIT I: ANAEROBIC CARBOHYDRATE METABOLISM (14 Lectures)

Definition, reactions of glycolysis, entry of galactose, fructose and mannose in glycolysis, utilization of sucrose and lactose, production of ATP and its utilization during muscle contraction; oxygen debt; alcoholic fermentation; glycogenolysis, gluconeogenesis, glycogenesis; hexose monophosphate shunt pathway and its significance; regulation of glycolysis; what happen in diabetes? disorder related to carbohydrate metabolism (e.g. galactosemia, glucose intolerance, glycogen in storage disorders)

UNIT II: AEROBIC CARBOHYDRATE METABOLISM (12 Lecturers)

History and background of the tricarboxylic acid (TCA) cycle; oxidation of pyruvate to acetyl CoA; individual reactions of the TCA cycle; energetics of the cycle, anabolic nature of TCA cycle; regulation of TCA cycle, electron transport oxidative phosphorylation; Energy coupling hypothesis, physiological implications of anaerobic vs aerobic metabolism.

UNIT III: LIPID METABOLSIM **(10 Lectures)**

Historical development and individual reactions of beta oxidation pathway; oxidation of unsaturated fatty acids and odd chain fatty acids; metabolism of triacytylglycerols; formation of ketone bodies; biosynthesis of fatty acid, acid and cholesterol; role of serum lipoproteins (LDL, HDL) in the development of coronary heart disease (CHD).

UNIT IV: NITROGEN METABOLISM **(12 Lectures)**

Introduction, metabolism of ammonia, urea cycle (preliminary account), nitrogen balance studies in man (normal, negative and positive nitrogen balance); transamination and deamination reactions, comparative biochemistry of nitrogen excretion; metabolism of purines and pyrimidines including regulation (preliminary account); amino acids as biosynthetic precursors & nucleotide and nucleoside coenzymes; biologically active amines (e.g. epinephrone, non-epinephrine, dopamine, serotonin, r-amino-butyric acid & histamine), glutathione as cofactor.

UNIT V: METABOLIC REGULATION **(10 Lectures)**

Energy metabolism: integration of metabolism - an overview of major pathways & strategies of energy metabolism; organ specialization - brain, muscle, adipose tissue and liver. Introduction, enzyme compartmentalization, opposing unidirectional reactions; product inhibition, role of allosteric enzymes in metabolic regulation; integration of metabolsim of carbohydrates, lipids and proteins as applicable in humans. Role of hormones in the regulation of the metabolsim of carbohydrates, proteins and lipids.

RECOMMENDED BOOKS

1. R.K. Murray; G.K. Granner, P.A. Mayes and V.W. Rodwell, HARPER'S BIOCHEMISTRY, 25th edn., (2000), Prentice-Hall International Inc., USA (Chapter 15, 16, 17, 18, 19, 20, 22, 23, 24 &for UNIT V: Chapter 29).

2. E.L. Smith, R.L. Hill, I.R. Lehman, R.J. Lefkowitz, P. Hander and A. White, PRINCIPLES OF BIOCHEMISTRY: Mammalian Biochemistry, 7th edn., (1987), Tata McGraw Hill International Book Co., Tokyo, Japan.

3. Nelson and Cox, Lehninger's, PRINCIPLES OF BIOCHEMISTRY, (2000), Kalyani Publish, Ludhiana/Worth Publish., Inc. New York (Chapters 13,14,15,16,17,18,19,20 & 21).

4. E.E. Conn and P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4th edn., (1994), Wiley Eastern, New Delhi (Chapters 10 to 14,16, & 17).

5. L. Stryer, BIOCHEMISTRY , 4th edn., (1995), W.H. Freeman Press, San Francisco, USA (Chapter 26 for UNIT V).

B.Sc. (Hons) Syllabus (BSYL) Department of Biochemistry

BOS/26.08.2002 Faculty of Life Sciences

(to be introduced w.e.f. 2005-2006) Aligarh Muslim University,Aligarh

Biochemistry

B.Sc. III Year

Paper V

Elementary Cell Biology and Physiology

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT-I: CELL IN PERSPECTIVE **(12 Lectures)**

Historical, viruses and viroids, mycoplasma, prokaryotes, archae and eucaryotes. Cellular specialization. Structural organisation of procaryotes and eucaryotes and their evolutionary relationship. Origin and evolution of cells, Cell differentiation. Dimensions of cells and subcellular structures. Differences between plant and animal cells. Cell cycles.

UNIT-II: SUBCELLULAR ORGANELLES **(12 Lectures)**

(a) Ultrastructure, organization and functions of mitochondria, nucleus, endoplasmic reticulum, golgi apparatus, lysosomes and microbodies, peroxisome.

(b) Structure of a typical plant cell. Cell wall – composition, structure and functions. Ultrastructure of chloroplast. Light and dark reactions of photosynthesis. Photophosphorylations. Vacoules – special functions in plants.

UNIT-III: MEMBRANE STRUCTURE AND FUNCTION **(12 Lectures)**

Functions of biological membranes. Composition - nature of lipids, proteins, carbohydrates and other molecules. Model membranes - monolayer, trilayer, liposomes. Singer and Nicholson model (fluid-mosaic model). Cytoskeleton, Transport function of membranes. Selective reabsorption and secretion, active and passive transport of various substrates; synapse: chemical and electrical synapse. Membrane potential and nerve impulses.

UNIT-IV: BLOOD AND LYMPH **(12 Lectures)**

Components of blood and their functions, erythrocytes and leucocytes, granular and agranular elucocytes, resistance of the body to infection: the macrophage system and inflammation, phagocytosis by neutrophils and machrophages, immunity and allergy: Humoral and cellular immunity (or innate and acquired immunity), antigens and hapten T and B lymphocytes, blood groups, the ABO system, the Rhesus sytem, intrinsic and extrinsic pathways for blood clotting, composition and functions of lymph and lymphatic system

UNIT-V: ENDOCRINE EXCRETORY SYSTEM **(12 Lectures)**

(a) Endocrine system: A brief outline of various endocrine glands and their physiological roles, hormones: storage and secretion, feed back regulation, receptors and their activation, mechanisms of extracellular and intracellular hormones, plant hormones.

(b) Excretion: The structure and functions of the kidney. Nephron, glomarular membrane, glannular filtration rate (GFR); function of tubules, selective reabsorption by active and passive transport of sugars, amino acids, urea and creatinine, urine formation, role in acid base balance.

RECOMMENDED BOOKS

1. G.Karp, CELL BIOLOGY, (1999), McGraw Hill, New York, USA.
2. B. Alberts, D. Bray, J. Lewis, M. Reff, K. Roberts & J.D. Watson MOLECULAR BIOLOGY OF THE CELL, 3rd edn: (1989) Garland publishjing Inc. New York, USA.
3. J. Darnell, H. Lodish and D. Baltimore. MOLECULAR CELL BIOLOGY, (1986), Scientific American Books (a subsidiary of W.H. Freeman Press, USA).
4. C.J. Avers, A MOLECULAR CELL BIOLOGY, (1986), Addison Wesley Pub. Co. Inc. USA.
5. S.C. Rastogi, CELL BIOLOGY, (1988), Tata McGraw Hill Publishing Co., Ltd. New Delhi.
6. Guyton: Textbook of Medical Physiology. 10th edition (2000)

B.Sc. (Hons) Syllabus (SYLI)

BOS / 26.08.2002

(to be introduced w.e.f. 2005-2006)

Department of Biochemistry

Faculty of Life Sciences

Aligarh Muslim University

Aligarh.

BIOCHEMISTRY

B.Sc.(Hons) III year

Paper – VI

Environmental Biochemistry and Immunology

Total Lecture : 60
Exam marks : 40
Sess. Marks : 10

NOTE:- All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five Units. Three more questions shall be set from any of the Units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT I : ENVIRONMENT AND ECOLOGY (10 Lectures)

Concept and dynamics of ecosystem components - food chain and energy flow; Productivity and biogeochemical cycles; Types of ecosystems; Population ecology and biological control; Interaction between environment and biota; Concept of habitat and ecological niches; Biotic community-concept; Ecological pyramids and recycling.

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UNIT II: ENVIRONMENTAL POLLUTION (10 Lectures)

Concept of environment and its pollution; primary and secondary pollutants; pollution of water, air, soil, noise; radioactivity; major industrial accidents, oil slick, eutrophication, biomagnifications; Green house effect and global warming; Ozone hole and its causal agents.

UNIT III: ENVIRONMENTAL TOXICOLOGY & ERADICATION OF POLLUTION (16 Lectures)

(a) Toxic chemicals in the environment; Pollution hazards; Impact of toxic chemicals on enzymes; Biochemical effects of –As, Cd, Pb, Hg, Co, NO_x , SO_x , O_3, CN, PAN, hydrocarbons,

particulate matter, pesticides, carcinogens; sampling, monitoring and analysis of environmental pollutants; Toxicity testing systems

(b) Air and water treatment strategies; Bioremediation and biotransformation of pollutants.

UNIT IV: BASIC ASPECTS OF IMMUNITY (12 Lectures)

(a) Resistance to disease: Historical perspective of immune systems, cellular and humeral immunity, clonal selection hypotheses.
(b) Definition of antigen, antibody, hapten, antigenic and haptenic deteriment, structure of antibody molecules, classes of antibodies, polyclonal and monoclonal antibodies.
(c) Primary and secondary immune response, idea of vaccination, adjuvant.

UNIT V: INFECTION AND DISEASE (12 Lectures)

(a) Host-parasite relationship: normal flora, pathogenecity, disease progress, transmission and types of diseases, disease establishment and diagnosis with special reference to AIDS.
(b) Hypersensitivity reactions, Gel and Coombs classification, Type I, II, III IV types of hypersensitivity. Interleukins and interferon.
(c) Brief introduction to autoimmunity, major autoimmune disorders and antigen involved.

RECOMMENDED BOOKS

1. A.K. De "Environmental Chemistry" Wiley Eastern Limited, New Delhi, 3rd Edition (1994).

2. S.M.H. Rizvi "Fundamentals of Environmental Pollution" CBS Publishers and Distributors (1994).

3. E.P. Odum "Fundamentals of Ecology" Published by Mrs. Veena Arora for Natraj Publishers, Publications Division, Dehradun.

4. Ambasht & Ambasht "Enviroment and Pollution – An Ecological Approach" Students Friends & Co., Lanka, Varansi – 221005 (1990).

5. E.P. Odum "Ecology – A Bridge between Science and Society" Senauer Associates, Inc. Publishers, Sunderland, Massachusetts 01375, USA (1997).

6. E. Alcamo "Fundamentals of Microbiology" 3rd edn. The Benjamin/Cumming Pub. Co. USA.

B.Sc. (Hons) Syllabus (BSYL7) Department of Biochemistry

BOS/ 26.08.2002 Faculty of Life Sciences

(to be introduced w.e.f. 2005-2006) Aligarh Muslim University,Aligarh.

BIOCHEMISTRY

B.Sc. (Hons) III Year

Paper VII

BIOCHEMICAL TECHNIQUES

Total Lectures : 60

Exam. Marks : 40

Sess. Marks : 10

NOTE: - All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT I : SPECTROSCOPIC TECHNIQUES (10 Lectures)

Basic principles of radiation energy and atomic structure, different types of spectra and their biochemical usefulness, Beer Lamberts law, principle and use of colorimeters and spectrophotometers(UV,Vis). Atomic absorption spectroscopy, fluorescence spectroscopy.

UNIT II : CHROMATOGRAPHIC TECHNIQUES (12 Lectures)

General techniques of chromatography; column chromatography (ion exchange, affinity, gel permeation, covalent, hydrophobic metal affinity chromatography) HPLC; thin layer, chromatography and paper chromatography - basic principles, material, practical procedures and applications.

UNIT – III .CENTRIFUGATION AND ELECTROPHORESIS (16 Lectures)

(a) Principles of centrifugation, sub-cellular fractionation, sedimentation velocity and sedimentation equilibrium, density gradient centrifugation and ultracentrifugation, applications of centrifugation techniques.

(b) Basic principles of agarose, starch gel electrophoresis and PAGE; factors affecting migration rate (sample electric field, buffer and supporting medium).SDS- PAGE two dimensional electrophoresis, applications, Detection of proteins on gels (staining general, specific, activity staining).

UNIT – IV.MICROSCOPIC TECHNIQUES (8 Lectures)

Microscopy – light microscopy, phase contrast microscopy, transmission and scanning electron microscopy. Frrze fracture and freeze etching techniques. Cell and somatic cell tissue culture. Protoplast fusion, regerneration ofplant and calluses.

UNIT – V. IMMUNOLOGICALAND RADIOISOTOPE TECHNIQUES (14 Lectures)

Immunological Techniques –

Single and double immunodiffusion, immunoelectrophoresis. Radioimmuneassay, ELISA, complement fixation assay and immunofluorescence, immunoblotting.

Radioisotopes Techniques –

Nature of radioactivity and radiation, type of radioactive assay; detection and measurement of radioactivity (absolute or relative counting, methods based upon gas ionization); Geiger-Muller counting and liquid scintillation counting; use of radioisotopes in biological sciences; autoradiography and fluorography,

RECOMMENDED BOOKS

1. K. Wilson and K.H. Goulding, A. BIOLOGIST' GUIDE TO PRINCIPLES AND TECHNIQUES OF PRACTICAL BIOCHEMISTRY, (1986), ELBS/Edward Arnold.
2. D. Friefolder, PHYSICAL BIOCHEMISTRY, (1992), W.H. Freeman and Co., New York.
3. T.G. Cooper, TOOLS OF BIOCHEMISTRY, (1977), John Wiley and Sons, New York.
4. D.T. Plummer, AN INTRODUCTION TO PRACTICAL BIOCHEMISTRY, (1979), Tata McCraw Hill Publishing Co., Ltd., New Delhi.
5. C.K. Mathews and K.E. Van Holde, BIOCHEMISTRY, (1990), The Benjemin/Cummings Publishing Company, Redwood City, California, USA (See under Tools of Biochemistry, Chapters 6, 10, 11, 12 & 16).
6. R.F. Boyer, MODERN EXPERIMENTAL BIOCHEMISTRY, (1986), The Benjamin/Cummings Publishing Co., Redwood City, California, USA (particularly for UNIT 5)
7. A Upadhyay, K. Upadhyay and N. Nath BIOPHYSICAL CHEMISTRY (2000) Himalaya Publishing House
8. R.L. Dryer and G.F. Lata, EXPERIMENTAL BIOCHEMISTRY, (1989), Oxford University Press, New York (particularly for UNIT 5).
9. B.N. Misra and M.K. Misra, INTRODUCTORY PRACTICAL BIOSTATICS, Naya Prokash, 206 Bidhan Sarani, Calcutta 700 006, India; students may purchase it (Rs. 30.00)

B.Sc.(Hon's) Syllabus (BSYL10) Department of Biochemistry

BOS/ 26.08.2002 Faculty of Life Sciences

(to be introduced w.e.f 2005-2006) Aligarh Muslim University,Aligarh.

BIOCHEMISTRY

B.Sc.(Hon's) III Year

Paper VIII

NUTRITIONAL AND CLINICAL BIOCHEMISTRY

Total Lectures : 60
Exam. Marks : 40
Sess. Marks : 10

NOTE:- All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five Units. Three more questions shall be set from any of the Units. However, there will be intra-unit choice. Each question shall carry 8 marks.

HUMAN NUTRITION

UNIT I: NUTRITION **(12 Lectures)**

Introduction and definition of food and nutrition, functions of food, factors altering nutritional requirements, Genetic and environmental determinants of food intake. Macronutrients (carbohydrates, fats, proteins and water) and their functions; Micronutrients (vitamins A, D, E, K. vit. B-complex group and vit. C; minerals: Calcium, phosphorus, iron, zinc, copper and iodine); arsenic, lead and fluoride toxicity.

Basic food groups; digestion and absorption of carbohydrates, lipids and proteins; role of bile salts in lipid digestion and absorption; mechanism of HCl formation; role of r-glutamyl cycle in amino acid absorption.

UNIT II: NUTRITIVE AND CALORIFIC VALUE OF FOODS (12 Lectures)

Basic concepts of energy expenditure, units of energy, measurement of energy expenditure by direct or indirect calorimetry, calculation of non-protein RQ and its conversion to weight of carbohydrates and fats (in gm) metabolized, determination of amount of protein metabolized and calculation of total heat production of the diet; basal metabolism and methods of measuring basal metabolic rate (BMR), energy requirements under conditions of pregnancy, lactation and various physical activities, calculation of energy expenditure of average reference men and women.

Specific dynamic action (SDA) of food; prevention of malnutrition specially protein - calorie malnutrition (kwashiorkor and marasmus) by improvement of diets; under nutrition (anorexia and bulimia) and starvation; over nutrition and obesity; nutritional support in special clinical situations.

CLINICAL BIOCHEMISTRY

UNIT III : BASIC CONCEPTS OF CLINICAL BIOCHEMISTRY (12 Lectures)

(a) Definition and scope of clinical biochemistry in diagnosis; setting up and solving problems related to operation of clinical biochemistry laboratory including its quality control; internal and external quality assurance producers; manual vs automation in clinical laboratory.

(b) Collection and preservation of biological fluids (blood, serum, plasma, urine and CSF); chemical parameters of blood, clearance tests, physical and chemical analysis of urine and CSF; controllable biological variables, physiological factors affecting the composition of body fluids; influence of food, drugs and stimulants; effect of underlying medical conditions on laboratory values.

UNIT IV: CLINICAL ENZYMOLOGY, HORMONAL AND OTHER DIORDERS (12 Lectures)

Principles of diagnostic enzymology; definition of functional and non-functional plasma enzymes, problems of enzyme assay in clinical biochemistry laboratory; factors affecting enzyme levels in plasma or serum; selection of enzyme tests; enzyme and enzymes pattern in health and diseases with special mention of plasma lipase, amylase, cholinesterase;, alkaline and acid phosphates, SGOT, SGPT, LDH & CPK.

Hypo- and hyperthyroidism and goiter, hypo- and hyper-adrenocorticism, hypo- & hyper-pituitarism, haemoglobinopathies; anemia, thalassemia, sickle cell anaemia, jaundice, rheumatoid arthritis; kidney and liver function tests.

UNIT V: DISEASES RELATED TO METABOLSIM **(12 Lectures)**

Hypo - and hyper-glycemia, diabetes mellitus, diabetes insipid us, juvenile diabetes, glucose-insulin tolerance tests, glycogen storage diseases; lipid malabsorption and steatorrheae, aminoacidurians; albinism, gout and hyper-uricemia; renal disorders in gout.

RECOMMENDED BOOKS

1. M.L. Bishop, J.L.D.V. Laufen and E.P. Fody, CLINICAL CHEMISTRY (1985), J.B. Lippincot Co., Philadelphia, USA.

2. D.L. Williams and V. Mark (editors), PRINCIPLES OF CLINICAL BIOCHEMISTRY , 2nd edn. (1988), Heipman Professional Publications Ltd., Oxford, UK.

3. T.M. Delvin (editor), TEXT BOOK OF BIOCHEMISTRY WITH CLINICAL CORRELATION, (1982), Jhon Wiley & Sons Inc. USA.

4. R.K. Murray, D. Granner, P. Mayes and V. Rodwell HARPER'S BIOCHEMISTRY (25th ed., International Edition) (2000) Appleton and Lange, USA.

5. G.P. Talwar, L.M. Srivastava and K.D. Moudgil (Editors), TEXT BOOK OF BIOCHEMISTRY AND HUMAN BIOLOGY, Chapters 36-42 (SectionA), Chapters 100 & 101 (Section B).

6. I.M. Weisbrot STATISTICS FOR CLINICAL LABORATORY.

7. A.L. Lehninger, PRINCIPLES OF BIOCHEMISTRY, (1982), Worth Publishers, Inc. New York, USA/Kalyani Publishers, Ludhiana, NewDelhi.

8. R. Montgomery, R.L. Dryer, T.W.onway and A.A.pector, BIOCHEMISTRY, A CASE ORIENTED APPROACH, 2ND EDN. (1977), The C.V. Mosby Co. St. Louis, USA.

9. C.H. Gray, P.J.N. Howorth and M.G. Rinsler, CLINICAL CHEMICAL PATHOLOGY (1985) , ELBS.

10. I.M. Riott, J. Brostoff, D. Male "Immunology" 3rd edn. W.H. Freeman and Pub. Company, USA

11. J. Kuby "Immunology" 3rd edn., Mosby Year Book Co., England

B.Sc.(Hons) Syllabus (BSYL9) Department of Biochemistry

BOS/ 26.08.2002 Faculty of Life Sciences

(to be introduced w.e.f. 2005-2006) Aligarh Muslim University

Aligarh.

BIOCHEMISTRY

B.Sc. (Hons) III Year

Paper IX

INTRODUCTORY MOLECULAR BIOLOGY AND GENETICS

Total Lectures : 60
Exam Marks : 40
Sess. Marks : 10

NOTE: All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 Questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five units. Three more questions shall be set from any of the units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT I: BASIC CONCEPTS OF GENETIC INFORMATION AND TRANSMISSION (9 Lectures.)

(i) Mendelian Genetics – Principles of Mendelian inheritance, gene interaction, sex-linked traits, linkage and cross-over mapping (4 Lectures)

(ii) Extranuclear Inheritance – Mitochondrial and Chloroplast mediated inheritance (1 Lecture).

(iii) Genetic Material: historical perspective and salient features – Earlier theories and controversies; salient features of viral, bacterial and eukaryotic genomes and extrachromosal DNAs (3 Lectures).

(iv) Central Dogma of Molecular Genetics – Old and current version, Temimism (1 Lecture).

UNIT II: STRUCTURAL DETAILS OF NUCLEIC ACIDS AND RELATED PROPERTIES (16 Lectures)

(i) Primary, Secondary and Tertiary Structures of DNA – Generalized structures of nucleotides and nucleic acids, Watson – Crick model, A,B, and Z types of DNA, deep and narrow grooves, chinality, tertiary structure and linking number (7 Lectures).

(ii) Structure and properties of RNA-Classes of RNA and their primary, secondary and tertiary structure (2 Lectures).

(iii) Nucleic Acid Hybridization – Denaturation and renaturation of DNA, Tm and buoyant density of DNA; cot value and satellite DNA; Unique, moderate and highly repetitive DNA sequences, DNA palindromes (5 Lectures).

(iv) DNA sequencing – Sangers and Maxam-Gilbert methods (2 Lectures).

UNIT – III DNA REPLICATION AND TRANSCRIPTION (14 Lectures)

(i) **Replication**: Possible modes of replication, Meselson Stahl experiment, origin of replication in E. coli, major proteins and enzymes involved in replication process: DNA replication in nut shell, rolling circle model of replication.(5 Lectures)

(ii) **Transcription** : Mechanism of transcription, DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/Pribnow box, chain termination and the role of the protein, split genes and post-transcriptional processing of RNA in eukaryotes, inhibitors of transcription.(6 Lectures)

UNIT - IV: TRANSLATION AND REGULATION OF GENE EXPRESSION (14 Lectures)

(i) **Genetic Code**:Basic features of genetic code, biological significance of degeneracy, Wobble hypothesis, gene within genes and overlapping genes, universality of genetic code and its exeption, single coding system between the nucleic acids and amino acids, pseudo genes. (5 Lectures).

(ii) **Mechanism of Translation:** Ribosome structures, A and P sites, Charged tRNA, f-met tRNA, initiator codon, Shine-Dalgarno consensus sequence, formation of 70S initiation complex,

role of EF-Tu, EF-Ts, EE-G and GTP, Non-sense codons and release factors, RFI and RF2. Post translational modifications (general treatment), inhibitors of protein synthesis. (5 Lectures).

(iii) **Regulation of Gene Expression**: Enzyme induction and repression, operon concept, Lac operon, attenuation and trp operon.(4 Lectures).

UNIT - V: MUTATION AND REPAIR **(10 Lectures)**

(i) **Mutation**: Molecular basis of mutation, tyupes of mutation, e.g., transition, transversion, frame shift, suppresser sensitive, germinal and somatic, backward and forward mutations. True reversion and suppression, dominant and recessive mutations, spontaneous and induced mutations - Lederberg's replica plating experiment. (3 Lectures).

(ii) **Mutagenecity Testing**: Correlation of mutagenecity and carcinogenecity; Ames testing, Random and site-directed mutagenesis. (3 Lectures).

(iii) **Mechanism that safeguartd DNA**: Restriction-modification system in bacteria; UV repair systems in E.coli; Role of uracil-DNA glycosylase; significance of thymine in DNA. Significance of thymine in DNA (4 Lectures).

RECOMMENDED BOOKS

1. Nelson and Cox, Lehninger's Principles of Biochemistry (2000), Worth Publish., Inc. New York.
2. L. Stryer. BIOCHEMISTRY, 4th Edn., (1995), W.H. Freeman Press, San Fransisco, USA.
3. E.J. Gardner and D.P. Snustad. PRINCIPAL OF GENETICS (1984), John Wiley & Sons, Ney york
4. A.C. Pai, FOUNDATION OF GENETICS (1984), mCgRAW-Hill Book Company, new york, New Delhi, london.

B.Sc. (Hons) Syllabus (SYLI) | Department of Biochemistry

Special BOS 15.10.2005 | Faculty of Life Sciences

(to be introduced w.e.f. July 2005) | Aligarh Muslim University,Aligarh.

BIOCHEMISTRY

B.Sc.(Hons) III year

Paper – X

Bio-Mathematics and Computer Science

Total Lecture: 60
Exam marks : 40
Sess. Marks: 10

NOTE:- All the topics listed below shall be treated to create basic understanding. The students are required to answer 5 questions. EIGHT QUESTIONS shall be set in the examination paper, one from each of the five Units. Three more questions shall be set from any of the Units. However, there will be intra-unit choice. Each question shall carry 8 marks.

UNIT I: Basic Aspects of Applied Mathematics **(12 Lectures)**

(a) Logarithms – logarithms vs exponents, characteristics and mantissa, multiplication and division, powers and roots, semi logarithmic coordinates, log-log coordinates.
(6 Lectures)

(b) Graphical representation of equations – rectangular coordinates, equation of straight line, change of origin; Graphs of equation of second degree the circle, the ellipse, the parabola, the hyperbola, reciprocals. (6 lectures)

UNIT II: Differential Calculus **(12 Lectures)**

(a) Differential calculus – theory, rules for differentiation, powers, constants, products, quotients, Differentiation – function of a function,successive differentiation maxima, the Mechanical interpretation of a differential, the Geometrical interpretation of differential and minima, application of maxima and minima (6 lectures)

(b) Differential equations , simple and exact and linear. (6 lectures)

UNIT III: Integral Calculus and Statistical Analysis (12 Lectures)

(a) Theory rule, integration between limits, integration of trigonometric functions, integration by parts, area, volumes, length of curves.

(6 Lectures)

(b) Sampling techniques, restricted, random and non random sampling, presentation of data, frequency distribution. Graphical methods including least square methods for best fit for a straight line, linear regression mean, median, mode, mean deviation, standard deviation, errors and types of errors. (6 Lectures)

UNIT IV: Probabilities and Distribution Theory (12 Lectures)

Probability perpetuation combination, continuous and random variables. Experimental variability coefficient of variation, correlation and analysis of variance, positive and negative correlations, variance between the sample(F) correlation coefficient (r), student 't' test, chi square test. Accuracy and precision distribution function, normal distribution.

UNIT V: Basic Aspects of Computer Programming (12 Lectures)

(a) Evolution of computer, basic components of a computer, algorithms, Flow chart, **C-Programming** : constants, variables, arithmatic & logical expression, input – output, format specification, control, do & go to statements. (6 Lectures)

(b) **Simple exercise**: Roots of equations, numerical solutions of integral & ordinary 1^{st} & 2^{nd} degree differential equations, statistical analysis of data. (6 Lectures)

RECOMMENDED BOOKS**:**

1. Mathematical preparation for physical Chemistry by F. Daniels, McGraw-Hill Pub;
2. Mathematical Hand book, Higher Mathematics by M. Vygodsky, Mir Publisher, Moscow;
3. Applied Mathemaics by V.K. Parasher, Galgotia;
4. Fundemental of Mathematical Statistics by S.C. Gupta and V.K. Kapoor, Sultan Chand and Sons;
5. Fundamental of Applied Statistics by S.C. Gupta and V.K. Kapoor, Sultan chand and Sons;
6. Computer Programming in C by V. Rajaraman, Prentice Hall of India, N. Delhi;
7. Numerical Methods by E. Balagurusamy, Tata McGraw-Hill, N. Delhi.