Devi Ahilya Vishwavidyalaya,Indore
Syllabus for M.Sc. (Biochemistry) for Colleges
Semester System 2012-14

Semester I

Paper 1. Chemistry of Biomolecules (85+15 marks)

Paper 2. Analytical Biochemistry (85+15 marks)

Paper 3. Cell Biology (85+15 marks)

Paper 4. Biostatistics (85+15 marks)

Practical (100 marks)

Semester II

Paper-1. Physiology (85+15 marks)

Paper-2. Microbial Biochemistry (85+15 marks)

Paper 3. Nutritional Biochemistry (85+15 marks)

Paper 4. Genetics (85+15 marks)

Practical (100 marks)

Semester III

Paper 1. Enzymology (85+15 marks)

Paper 2. Metabolism I (85+15 marks)

Paper 3. Plant Biochemistry (85+15 marks)

Paper 4. Biotechnology (85+15 marks)

Practical (100 marks)

Semester IV

Paper 1. Molecular Biology (85+15 marks)

Paper 2. Metabolism II (85+15 marks)

Paper 3. Immunology (85+15 marks)

Paper 4. Clinical Biochemistry (85+15 marks)

Practical (100 marks)

Project (50 Internal+ 50 Externa1=100 marks)

Passing marks 28/85 in Theory, for CCE 05/15 and for Practical 17/50

M.Sc. Semester I (Admission 2012-14)
Paper I Chemistry of Biomolecules

Unit I

Carbohydrates: Occurrence, stereochemistry, classification, structure, properties and biological importance of carbohydrates, mucopolysaccharides and amino sugars.

Unit II

Proteins: Classification, structure and properties of amino acids, essential amino acids, biologically active peptides.
Classification and properties of proteins, sequencing of proteins, conformation and structure of proteins-primary, secondary, tertiary and quaternary structure, coagulation and denaturation of proteins.

Unit III

Lipids: Structure, distribution and biological importance of fats and fatty acids, chemical properties and characterization of fats, waxes, cerebrosides, gangliosides, phospholipids and proteolipids. Steroids and bile salts. Prostaglandins.

Unit IV

Nucleic acids: Structure of purines, pyrimidines, nucleosides and nucleotides, structure, types and biological role of RNA and DNA.

Unit V

Vitamins: Structure and biochemical properties of water soluble and fat soluble vitamins and their coenzyme activity.
Hormones : Mechanism of hormone action and its regulation.

Paper 2. Analytical Biochemistry

Unit I

The concept of pH, dissociation and ionization of acids and bases, pKa, buffers and buffering mechanism, Henderson Hasselbalch equation, ionization of amino acids and proteins, measurement of pH.

General principle and different types of chromatography, adsorption and partition, Column, Paper and Thin layer.

Unit II

Principle, materials used and applications of Ion-exchange chromatography, gel filtration chromatography, affinity chromatography and high performance liquid chromatography.

Unit III

Electrophoresis: Moving boundary and zonal electrophoresis, paper and gel electrophoresis, PAGE and SDS-PAGE, isoelectric focussing technique.
Sedimentation: Sedimentation velocity, preparative and analytical ultracentrigugation techniques, differential and density gradient centrifugation, subcellular fractionation.

Unit IV

Radioactivity: Disintegration of radionuclides, half-life of radioactive compounds, measurement of radioactivity, scintillation counting, use of radioisotopes, *in vivo* and *in vitro* labeling, isotopic tracer techniques, autoradiography.

Unit V

Spectrophotometry: Beer-Lamberts law, extinction coefficient and its importance, design of colorimeter and spectrophotometer, applications of uv-vis spectrophotometry.
Atomic absorption spectrophotometry and its application in biology.
Principle of optical rotatory dispersion, circular dichroism and X-ray diffraction and their applications in structure determination.
Principle of NMR spectroscopy, application of NMR in Biology.

Paper 3. Cell Biology

Unit I

Structure of plant and animal cell, plant cell wall and its composition, plasmodesmata, models of the biomembrane, structure, constituents and fluidity of plasma membrane,. cytoskeleton

Unit II

Transport of metabolites across the plasma membrane, non-mediated and mediated, passive and active transport, primary and secondary active transport.

Unit III

Structure of mitochondria, different enzymes and their location, electron transport complexes, ATP synthase, mitochondrial DNA.
Structure of chloroplast, protein complexes and photosynthetic electron transport chain, DNA of the chloroplast.

Unit IV

Structure and functions of ribosomes and endoplasmic reticulum, protein sorting and signal hypothesis

Unit V

Structure and functions of golgi body and lysosomes, mechanisn of secretary processes, sStructure of nucleus, nuclear membrane and chromatin.

Paper 4. Biostatistics

Unit I

Types of data, collection of data, sampling and non sampling methods
Representation of Data: Frequency distribution, Line diagram, Bar diagram, Histogram and Relative Frequency Histogram. Frequency polygon and Frequency curve. Pie diagram, cumulative frequency distribution. Ogive and curve.

Unit II

Measures of Central Tendency: Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean.
Measures of Dispersion: Range, Semi-interquartile range, Mean deviation, Standard deviation, Coefficient of variation, Skewness and their applications in biochemistry.

Unit III

Correlation and Regression: Scatter diagram. Correlation coefficient, Method of Least Squares, Fitting of regression line, Coefficient of determination. Non - linear regression.

Unit IV

Probability and Probability distributions: Classical and Statistical definitions of probability. Conditional Probability. Binomial, Poisson and Normal Distributions and their applications in Biochemistry.

Unit V

Tests of Significance Tests based on t, z, F and Chi-square distributions. Analysis of Variance: One way and Two way classification and their applications in biochemistry. P-value and its significance.

List of Practicals Semester I:

1. Qualitative identification of carbohydrates and proteins.
2. Normal and abnormal constituents of urine.
3. Free & total acidity in gastric juice
4. Quantitative estimation of proteins by different methods.
5. Quantitative estimation of carbohydrates.
6. Estimation of Amino Acids by Sorenson formol titration.
7. Separation of amino acids, sugars and phospholipids by chromatography.
8. Isolation of casein from milk, lecithin from egg yolk and glycogen from liver.
9. Isolation of cell organelles.

M.Sc. Semester II (Admission 2012-14)

Paper-1. Physiology

Unit I

Composition and function of blood, plasma and blood corpuscles, functions of plasma proteins, structure and function of haemoglobin, abnormal haemoglobins,
Blood coagulation - mechanism and regulation. Blood groups.

Unit II

Structure of nephron, composition and mechanism of urine formation, glomerular filtration, tubular reabsorption of glucose, water and electrolytes, tubular secretion.
Regulation of water and electrolyte balance, role of kidneys and hormones in their maintenance.

Unit III

Hydrogen ion homeostasis, acid-base balance, metabolic and respiratory acidosis and alkalosis.
Respiratory unit, exchange and transport of respiratory gases in the body, role of 2,3 DPG, Bohr effect and chloride shift.

Unit IV

Classification of muscles, Structure of skeletal, smooth and cardiac muscles. Actin, myosin, tropomyosin, troponin, Z disc and H line components. The sliding filament mechanism and subcellular ion movements during the contraction cycle in skeletal muscles.

Unit V

Structure of neuron, nerve impulse, origin and transmission, neuromuscular junction, mechanism of nerve conduction. Reflex action and reflex arc.

Paper-2. Microbial Biochemistry

Unit I

Cellular organisation of bacteria with special reference to molecular organisation of cell wall, flagella and pilli.
Identification and classification of bacteria.

Unit II

Handling and sterility maintenance in microbiological work, Methods of isolation and pure culture techniques, culture media.
Microbial nutrition, bacterial growth and its kinetics.

Unit III

Energy metabolism in bacteria- fermentation, aerobic and anaerobic respiration and bacterial photosynthesis, application of microbes in food industry, dairy products and food preservation.

Unit IV

Fermentation technology- Primary and secondary metabolites, continuous and batch type culture techniques, Types and design of fermentors, fermentation processes - brewing, manufacture of penicillin, production of other antibiotics and organic compounds, single cell proteins.
Microbial assay of vitamins and amino acids.

Unit V

Viruses- Structure, proteins, classification and methods of assay. Replication of RNA and DNA viruses. Virus-host interaction, Vaccines and prevention.

Paper 3. Nutritional Biochemistry

Unit I

Direct and indirect calorimetry, energy value of the foods, thermal equivalent of oxygen, respiratory quotient, calorigenic action of the foods, basal metabolic rate- definition and its measurement, factors affecting BMR, energy requirements of the human beings.

Unit II

Nutritional aspects of the carbohydrates- Different dietary types, available and unavailable carbohydrates, requirements, utilization and functions. Special role of the non-starch polysaccharides.
Nutritional aspects of the lipids- Different dietary types, requirements, utilization and functions. Essential fatty acids.

Unit III

Nutritional aspects of the proteins- Quality of proteins, digestibility coefficient, net protein utilization, biological value and amino acid score, protein requirements and functions.

Unit IV

Nutritional aspects of the vitamins and minerals.

Unit V

Balanced diet- Recommended dietary allowances for different categories of human beings.

Food processing and loss of nutrients during processing and cooking. Naturally occurring anti-nutrients.
Disorders related to the nutrition - Protein energy malnutrition, Starvation, Obesity.

Paper 4. Genetics

Unit I

Mendelian Inheritance: Segregation and Independent Assortment, Extension of Mendelism: Incomplete dominance, Codominance, Multiple Allelism, Testing for Allelism, Gene Interaction, Epistasis, Pleiotropy
Linkage, recombination and crossing over

Unit II

Genetic mapping by recombination frequency in diploids: Two factor and three factor genetic crosses, Interference, Mapping functions,
Linkage detection in fungi by tetrad analysis,

Unit III

Linkage in humans: Somatic cell hybridisation,
Definitions of the gene, complementation test and its limitations, complementation mapping,
Viral genetics Recombination in bacteriophages, Genetic fine structure.

Unit IV

Genetic analysis in microbes: DNA transfer, transformation, transduction and conjugation and their mechanisms, mapping by recombination, genetic map of E. coli.

Unit V

Gene mutation: Molecular basis of mutation, Types of mutation, e.g. transition, transversion, frame shift, insertion, deletion, suppressor sensitive, true reversion and suppression, dominant and recessive, spontaneous and induced mutations, Mutagenecity testing. Chemical and physical mutagens and their actions DNA repair mechanisms, Transposable elements.

List of Practicals Semester II:

1. Estimation of reducing sugars by Nelson Somogyi Method.
2. Estimation of maltose by DNS Method.
3. Estimation of creatinine, chloride and inorganic phosphate in urine sample.
4. Estimation of ascorbic acid and riboflavin.
5. Estimation of methionine, tyrosine and tryptophan.
6. RBC and WBC Count, Hb estimation and blood group determination.
7. Cultivation, isolation and staining of microorganisms.
8. Determination of iodine value and saponification number of fats.