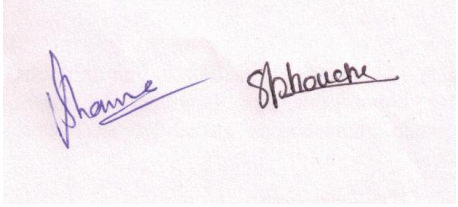
M. SC. BIOCHEMISTRY

PROGRAM OBJECTIVES

1. To educate and prepare post graduate students from rural and urban area who will get employment in academic institutes, R & D and clinical laboratories of Indian biochemical/pharmaceutical/medical industries as well as multinational and forensic laboratories.
2. To provide students with broad theoretical and applied background in all the fields of Biohemistry.
3. To provide broad common frame work of syllabus to expose our young graduates to the recent and applied knowledge of interdisciplinary branches of biochemistry involving medicinal, genetics, microbiology, biotechnology, pharmaceutical, clinical, nutrition and many more.
4. To encourage students to conduct various academic activities like midterm tests, online tests, open book tests, tutorials, surprise test, oral, seminar, assignments and seminar presentation.
5. To give practical training to the students for qualitative and quantitative analysis instrumental techniques.

PROGRAM OUTCOMESS:

1. A graduate with a Master's degree in Biohemistry will have in-depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods of biochemistry.
2. The graduate will have the knowledge of a well-defined area within biochemistry.
3. The graduate will have specific skills in planning and conducting advanced biochemical experiments.
4. The graduate will be able to contribute to the generation of new scientific insights or to the innovation of new applications of biochemical research.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
I Semester

Paper – I
Biophysical Chemistry of Biomolecules

Paper-I Biophysical Chemistry of Biomolecules (5 credits)

OBJECTIVES: To impart the knowledge of

- Organic reactions with reference to biological systems.
- Chemical bonding, strong and weak interactions, hydrogen bonding and to apply these principles in various biomolecules and biological reactions.
- Nature of various biomolecules present in living cells.
- Properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems.
- Amino acid and nucleotide sequences of proteins and DNA respectively.

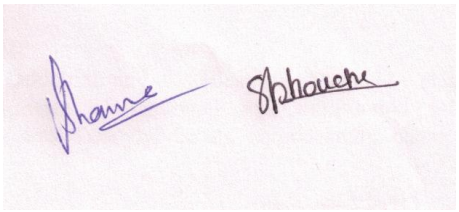
OUTCOMES: On completion of this course, the students will be able to understand

- H-bonding, acids and bases, reaction equilibrium, ionization behavior and its biological application.
- Maintenance of normal pH of the body fluids. Blood buffers
- Formation of biopolymers and their importance.
- Definition, classification and properties of carbohydrates, proteins, lipids and nucleic acids and their significance in biological reactions.

UNIT - I

Physical Properties and structure of H_2O, H-Bonding, Ionization of water, pH scale, Handerson – Hasselbalch Equation, Buffers, Buffer solution and their action, Ionization behavior of amino acids and proteins.

Colloidal Particles and their properties, Donnan membrane Equilibrium and its biological application.



UNIT - II

Carbohydrates – Structure of Monosaccharide, Isomerism of sugars, Reactions of aldehyde and ketone groups, Ring structure and anomeric forms, mutarotation, structure, occurrence and biological importance of monosaccharide, oligosaccharides and polysaccharides e.g., cellulose, chitin, agar, alginic acid, pectins, proteoglycans, sialic acids, glycogen and starch. Bacterial cell wall polysaccharides.

UNIT - III

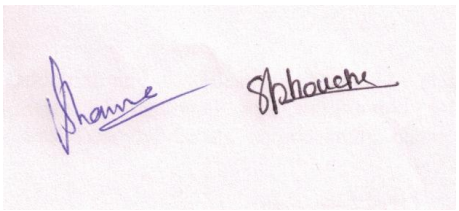
Lipids - Definition and classification. Fatty acid – classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acid, prostaglandins. Triacylglycerols- nomenclature, physical and chemical properties of fats-hydrolysis, saponification value, rancidity of fats, Reichert-Meissel number, reaction of glycerol. Glycerophospholipid, sphingomyelins, glycolipids. Properties and functions of phospholipids and sterols.

UNIT-IV

Amino Acids and Proteins – Amino Acids – common structural features, classification and structures of standard amino acids, physical and chemical properties of amino acids. Essential Amino acids. Level of organization of protein – primary, secondary, tertiary structure of protein. Forces stabilizing the tertiary and quaternary structure of protein. Denaturation and renaturation of proteins. Salting in and salting out of proteins. Structure and biological function of fibrous protein, globular proteins (hemoglobin and myoglobin), lipoprotein, metalloprotein, glycoprotein and nucleoproteins.

UNIT – V

Nucleic Acids Structure of constituents of nucleic acids, purines, pyrimidines, nucleosides and nucleotides. General structural plan of nucleic acids, features of DNA double helix. Denaturation and annealing of DNA, structure and roles of different types of RNA. Central dogma and molecular biology. Biological roles of nucleotides.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
I Semester

Paper – II
Physiology

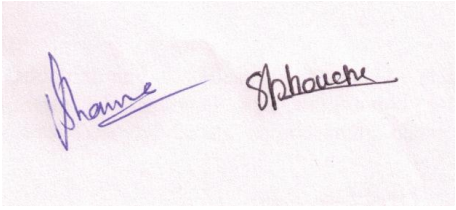
Paper-II Physiology **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Body fluids, formed elements
- Endocrine glands
- Mechanism of signal transduction and the role of second messengers in signal transduction.
- Structure and function of muscular, nervous, excretory and respiratory system.
- The process of gaseous exchange in tissues and lungs,
- Role of hormones in biochemical reactions,
- Role of kidney and hormones in homeostasis.

OUTCOMES: On completion of this course, the students will be able to understand

- Blood volume, composition and functions of RBC, WBC and platelets, Mechanism of blood coagulation. disorders of clotting.
- Endocrine glands, functions, mechanism, secretions.and regulation of hormones of pitutary, thyroid, parathyroid, pancreas, adrenal glands. Disorders and deficiency symptoms.
- Types and structure of muscles, contractile and regulatory proteins of muscle, sources of energy, mechanism and different theories of muscle contraction
- Structure and types of neurons, Resting membrane potential, Action potential, ion channel, refractive period, saltatory conduction, Synapses, transmission of nerve impulse and neurotransmitters.
- Structure and function of nephron, mechanism of urine formation, Homeostasis – regulation of water and electrolyte balance, role of kidney and hormones in the maintenance.
- Functional anatomy of respiratory tract, biochemical events in transport of CO_2 and O_2 in blood, pulmonary and alveolar ventilation, mechanism of ventilation and associated clinical conditions.



UNIT - I

Blood and Endocrine system-Blood – Composition, Homeostasis, plasma proteins and its functions. Formed elements : RBC, WBC and platelets – Development and functions. Hemoglobin structure and functions, Abnormal Hemoglobin. Coagulation of blood, Mechanism of clotting, clotting factors, clot retraction, fibrinolysis and disorders of clotting.

Endocrine glands – Secretions and function of – pitutary, thyroid, parathyroid, pancreas, adrenal glands. Disorders and deficiency symptoms.

UNIT – II

Muscle Biochemistry-Muscle tissue : Type – voluntary, involuntary, cardiac-structure, properties and functions. Molecular, organization of actin, myosin, tropomyosin, troponin, Z-disc and H-line components. Contraction and relaxation phenomenon sub cellular ion movements during contraction cycle. Sources of energy for muscle contraction.

Theories of muscle contraction – Sliding filament theory, Davis theory, Ratchat theory and solenoid theory. Role of cyclic AMP, clamodulin, Ca^{++} ions.

UNIT – III

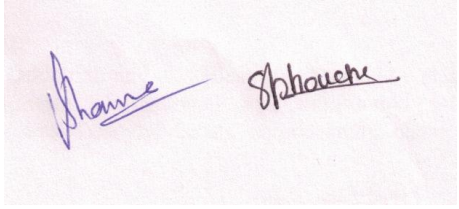
Nervous System-Nervous tissue – structure of neuron, modulated and non modulated, Classification, functions and properties of nerve fiber. Neurotransmitters – chemistry, synthesis, storage and release. Mechanism of conduction of nerve impulse – Resting membrane potential, ion channel actions potential, refractive period, saltatory conduction. Synapse - types, properties and function. Transmission at cholinergic and non cholinergic synapse.

UNIT – IV

Excretory System-Structure and function of Nephron, Mechanism of urine formation, glomerular filtration, factors affecting GFR, tubular reabsorption of glucose, water and electrolytes, tubular secretions. Evaluation of kidney functions – dilute and concentrated urine formation. Homeostasis – regulation of water and electrolyte balance, role of kidney and hormones in the maintenance.

UNIT – V

Respiratory System- Functional anatomy of respiratory tract, Pulmonary ventilation, Mechanism of Ventilation. Alveolar ventilation and its importance. Transport of gases (O_2, CO_2). Regulation of breathing. Role of 2,3 DPG, Bohr effect and chloride shift. Clinical conditions.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
I Semester

Paper – III
Metabolism-I

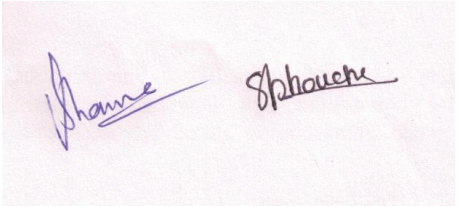
Paper-III Metabolism-I **(5 credits)**

OBJECTIVES: Students will acquire the concept of

- Bioenergetics, high energy compounds, electron transport chain, synthesis of ATP under aerobic and anaerobic conditions
- Redox balance occurring in the cells.
- How various biomolecules are metabolized inside the body in order to produce energy for various functions.
- anabolism, catabolism and compartmentalization of metabolic pathways.
- Transport mechanisms across biological membranes.
- Regulation of various metabolic pathways.
- Biological role of mineral and trace elements.
- TCA cycle in central carbon metabolism,
- Finally, the student will gain insights into metabolic engineering for the production of useful biomolecules.

OUTCOMES: On completion of this course, the students will be able to understand

- Laws of Thermodynamics, Concept of free energy, standard free energy, equilibrium constant, endergonic and exergonic reactions, high energy compounds, transfer potential of Phosphate groups.
- Biological oxidation-reduction reactions, redox potentials, related enzymes, structure of mitochondrion, electron transport chain and inhibitors, Substrate level phosphorylation with examples.
- Catabolism of carbohydrate, Stages, energetics, enzymes and regulation of various catabolic pathways of carbohydrate, entry of other carbohydrates in to the glycolytic sequence.
- Anabolism of various carbohydrates including mucopolysaccharides and bacterial cell wall polysaccharides and their significance. Glycogen storage diseases.
- Minerals and Porphyrin Metabolism, trace elements, bile Pigments.



UNIT- I

Thermodynamics – open, closed and isolated system,
Ist law of thermodynamics, heat of formation, and heat of reaction
IInd law of thermodynamics, molecular basis of entropy.
Helmbolts and Gibb's Free Energy.
IIIrd law of thermodynamics, calculation of entropy, application of Ist and IInd law of thermodynamics in understanding energies in living cells, chemical potentials, equilibrium constant. High energy compounds, standard free energy of hydrolysis of ATP. Transfer potential of Phosphate groups.

UNIT –II

Biological oxidation – Oxidation, Reduction potential, standard redox potential. Oxidoreductase enzymes, mitochondrial electron transport chain, inhibitors of electron transport, microsomal electron transport, coupling of electron transport to oxidative phosphorylation, theories of electron transport and metabolic transport system (shuttle system).

UNIT – III

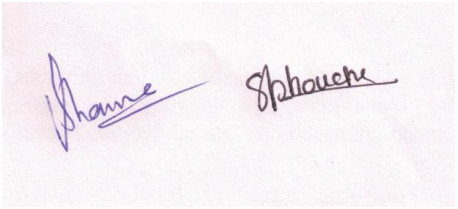
Catabolism of carbohydrates – Digestion and absorption of carbohydrates. Stages, energetics and enzymes of Glycolysis, TCA. Entry of other carbohydrates in to the glycolytic sequence. Alcoholic fermentation, Glycogenolysis, Glyoxalate cycle, Phosphogluconate pathway. Pasteur's effect and regulation of carbohydrate catabolism.

UNIT – IV

Anabolism of Carbohydrates –
Glycogenesis, Gluconeogenesis, synthesis of mucopolysaccharides and synthesis of bacterial cell wall polysaccharides. Glycogen storage diseases.

UNIT – V

Minerals and Porphyrin Metabolism.
Biological role of mineral and trace elements – Ca, P, Fe, Cl, Zn, Mn, I, Mg and Cu.
Biosynthesis and degradation of Porphyrins. Production, chemical nature and physiological importance of Bile Pigments.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
I Semester

Paper - IV
Biochemical Techniques

Paper-IV Biochemical Techniques **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Various chromatographic techniques and how to apply them in isolation and characterization of different biological molecules.
- Applications of centrifugation in biological investigations.
- principle of Electrophoresis, Spectrophotometry and their applications in biological separation, investigations and experiments
- Radioisotopic techniques, biological hazards of radiation and safety measures

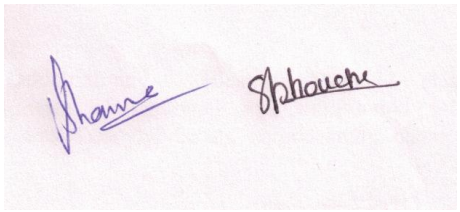
OUTCOMES: On completion of this course, the students will be able to understand

- General principles, procedure and applications of :- partition, adsorption, thin layer, ion – exchange, molecular – sieve, gas – liquid, affinity chromatography and HPLC.
- Basic principles, factors affecting electrophoretic migration, Basic Principles of agarose electrophoresis, PAGE, SDS-PAGE, and other electrophoretic techniques, and their applications in analyzing proteins and nucleic acids.
- Concepts of spectroscopy, Visible and UV spectroscopy, BeerLambert's law, Principles and applications of NMR, ESR, Fluorescent and emission spectroscopy.
- Principles of centrifugation, concepts of RCF, preparative, differential and density gradient centrifugation, ultra-centrifugation, subcellular fractionation.
- Types of radioisotopes used in Biochemistry, units of radioactivity measurements, techniques used to measure radioactivity, Principle and application of tracer technique, Auto radiography, Biological hazards of radiation and safety measures.

UNIT – I

Chromatography –

General principles, procedure and applications of :- partition, adsorption, thin layer, ion – exchange, molecular – sieve, gas – liquid, affinity chromatography and HPLC.



UNIT – II

Electrophoresis –

Basic principles, factors affecting electrophoretic migration, Basic Principles of agarose electrophoresis, PAGE, SDS-PAGE, Two – dimensional electrophoresis, isotachophoresis, moving boundary and zonal electrophoresis, isoelectrofocussing techniques.

UNIT – III

Spectroscopic techniques-

Beer Lambert law, light absorption and its transmittance, determination and application of extinction coefficient, application of visible and UV spectroscopic techniques (Structure elucidation and numerical excluded) Principle and application of NMR, ESR, Fluorescent and emission spectroscopy.

UNIT – IV

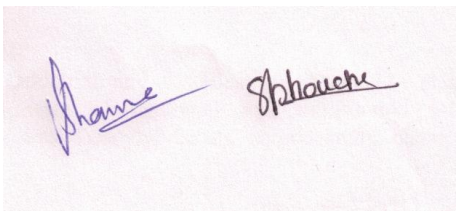
Centrifugation –

Basic principle of sedimentation – sedimentation velocity, Preparative centrifugation – Differential and density gradient centrifugation. Analytical centrifugation – Application of analytical ultracentrifugation in Biochemistry. Sub – cellular fractionation and relative molecular weight determination by hydro dynamic method (derivation and numerical excluded.)

UNIT – V

Radioisotopic techniques –

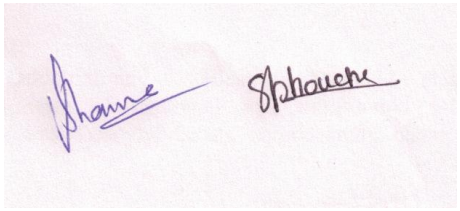
Types of radioisotopes used in Biochemistry, units of radioactivity measurements, techniques used to measure radioactivity (gas ionization and liquid scintillation counting), Principle and application of tracer technique, Auto radiography, Biological hazards of radiation and safety measures in handling radioisotopes and biological applications.



List of Practicals

M.Sc. I Semester

1. Qualitative identification of carbohydrates.
2. Qualitative identification of Proteins.
3. Qualitative identification of Lipids.
4. Total count of WBC and RBC by hemocytometer.
5. Identification of blood groups,clotting time and bleeding time.
6 . Estimation of hemoglobin content in blood by Sahli's hemoglobinometer.
7. Estimation of casein from milk.
8 . Estimation of lecithin from egg yolk.
9. Normal constituents of urine.
10. Abnormal constituents of urine.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
II Semester

Paper - I
Immunology

Paper-I Immunology **(5 credits)**

OBJECTIVES: Students will gain an overview of

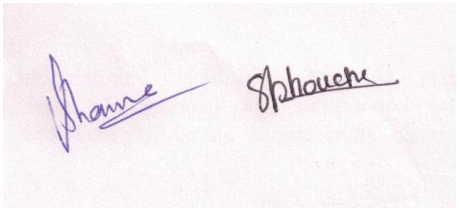
- The immune system including cells, organs and receptors.
- Structure and functions of different classes of immunoglobulins,
- Importance of humoral, cell-mediated and innate immune responses in combating pathogens.
- mechanisms involved in different types of hypersensitivity,
- Importance of antigen-antibody interaction in disease diagnosis.
- Immunological techniques, immunodeficiency diseases, auto immunity and immunosuppression.

OUTCOMES: On completion of this course, students will gain an overview of

- Innate, acquired, active and passive.immunity. Cells involved in immune response and their killing mechanism. Lymphoid system, primary and secondary lymphoid organs.
- Formation and functions of T and B Lymphocytes, cell mediated and humoral immune response, Macrophages, Role of MHC antigens.
- Antigen recognition, processing and presentation, Hypersensitivity (I, II, III, IV), complement activation.
- Functions of Immunoglobulins, Isotypic, allotypic, idiotypic variation, Ag-Ab Interaction.
- Immunological techniques – RIA, ELISA etc., Monoclonal Antibodies and its biological applications, immunodeficiency diseases, auto immunity and immunosuppression.

UNIT – I

Concept of Immunity and Immune system. Types – Innate, acquired, active and passive. Cells involved in immune response – Phagocytic cells and their killing mechanism. Lymphoid system. Structure and functions of primary and secondary lymphoid organs.



UNIT – II

T and B Lymphocytes, cell mediated and humoral immune response, macrophage activation, cell mediated cytotoxicity, cytokins, and constimulatory molecules. Role of MHC antigens in immune response.

UNIT – III

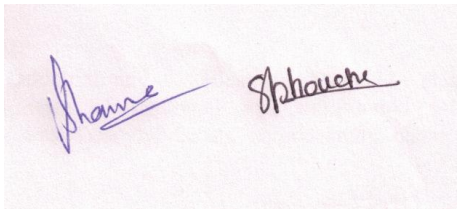
Antigen recognition, processing and presentation, Interferons, Hypersensitivity (I, II, III, IV), complement activation and its biological consequences.

UNIT – IV

Antibody– types and specificity, structure and functions of Immunoglobulins. Isotypic, allotypic, idiotypic variation. Ag Binding sites – Formation and function. Ag-Ab Interaction.

UNIT – V

Immunological techniques – Gel precipitation, radio immunodiffusion, RIA and ELISA. Monoclonal Antibodies and its biological Applications. Primary and Secondary immunodeficiency diseases in human. AIDS, auto immunity and immunosuppression.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
II Semester

Paper II
Nutritional Biochemistry

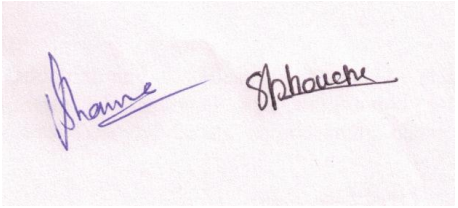
Paper-II Nutritional Biochemistry **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Basic concept of nutrition for maintaining normal health.
- Role of nutrients for the body.
- Dietary requirements of carbohydrates, proteins, fats, vitamins, minerals, etc.
- Balanced diet, glycemic index, micronutrient deficiencies and remedies, and their importance.
- Need for specialized food, inherited metabolic disorders.
- Energy metabolism, food additives, adulteration.

OUTCOMES: On completion of this course, students will acquire the understanding of

- Nutritional aspect of Carbohydrates and protien, Dietary requirement and sources, Nitrogen balance studies, factors influencing nitrogen balance, essential amino acid, Protein energy malnutrition. Major classes of dietary lipids, essential fatty acids and their physiological functions,
- Minerals and vitamins – Nutritional significance, biochemical function, sources, daily requirements and deficiency disorders.
- Energy Metabolism - Energy content of blood, Measurement of energy expenditure, Direct and indirect colorimetry, BMR, SDA and factors affecting them, Inherited metabolic disorders.
- Food additives and leavening agents, Flavor components in food adulteration. Food preservation and adulteration, nutritive value and digestibility of food, microbiology and hygiene.
- Role of diet and nutrition in prevention and treatment of various diseases. Starvation and obesity.



UNIT – I

Nutritional aspect of Carbohydrates – Dietary requirement and sources of available and unavailable carbohydrates. Physiochemical properties and physiological role of unavailable carbohydrates (Dietary fiber). Proteins – Nitrogen balance studies, factors influencing nitrogen balance, Essential amino acid, Biological value of proteins, Protein energy malnutrition. Lipids - Major classes of dietary lipids, essential fatty acids and their physiological functions, dietary needs of lipids.

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UNIT – II

Minerals – Nutritional significance, source, daily requirements and deficiency disorders of dietary Ca, P, Mg, Fe, I, Zn and Cu.

Vitamins – Dietary sources, biochemical function, specific deficiency disease and hyper vitaminosis.

UNIT- III

Energy Metabolism- Energy content of blood, Measurement of energy expenditure : Direct and indirect colorimetry, BMR, SDA and factors affecting them, Energy requirements of men and women and factors affecting energy requirements.

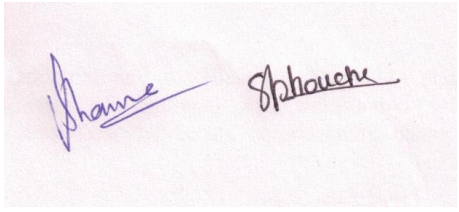
Inherited metabolic disorders : Phenyl Ketonuria, Maple syrup disease. Hemocystinuria, Galactosemia, Gout, Diabetes insipidus and Diabetes Mellitus.

UNIT- IV

Food additives and leavening agents, Browning reaction in foods. Flavor components in food adulteration. Food preservation and food adulteration. Effect of cooking and heat processing on the nutritive value and digestibility of foods, microbiology and hygiene.

UNIT-V

Role of diet and nutrition in the prevention and treatment of diseases – Dental caries, Renal failure, Hyperlipidemia, Atherosclerosis and Rheumatic disorders. Starvation and obesity.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
II Semester

Paper – III
Metabolism-II

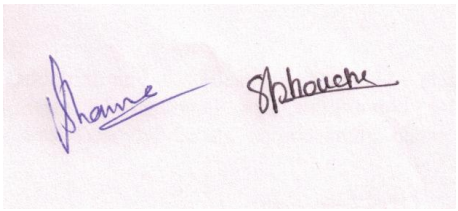
Paper-III Metabolism-II **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Importance of lipids as storage molecules and as structural component of biomembranes.
- Metabolic engineering for the production of useful biomolecules.
- How various biomolecules like lipids, proteins, amino acids and nucleic acids are metabolized inside the body in order to produce energy for various functions and how various metabolic pathways regulate growth and development of living beings.

OUTCOMES: On completion of this course, the students will be able to understand

- Catabolism of lipids, digestion, mobilization and transport of fatty acids. , α-, β-, ω-Oxidation of fatty acids and its regulation, oxidation of odd-chain fatty acids, Ketone bodies, Degradation of cholesterol.
- Anabolism of lipids, Biosynthesis and elongation of saturated fatty acids, in mitochondria and microsomes, Biosynthesis of triglycerides, phospholipids, glycolipids, sphingolipids and cholesterol, lipoprotein metabolism and its regulation.
- Catabolism of proteins,.digestion, absorption and degradation of glycogenic and ketogenic amino acids, Proteolysis, deamination, transamination and decarboxylation reactions, metabolic fate of amino group, Nitrogen excretion and Krebs- Henseleit urea cycle.
- Biosynthesis and regulation of individual amino acids, precursor function of amino acids for polyamines, porphyrins.
- Metabolism of Nucleic acids, Biosynthesis and degradation of purines and pyrimidines, Regulation and inhibitors of purine and pyrimidine biosynthesis, Biosynthesis of ribonucleotides, deoxyribonucleotides and polynucleotides.



UNIT –I

Catabolism of lipids

Review of digestion, mobilization and transport of fatty acids. β Oxidation of saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd-chain fatty acids, Ketone bodies and their oxidation. Regulation of fatty acid oxidation, Degradation of cholesterol.

UNIT – II

Anabolism of lipids

Biosynthesis of saturated fatty acids, elongation of saturated fatty acids in mitochondria and microsomes. Biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol. Lipoprotein metabolism and its regulation.

UNIT – III

Degradation of proteins.

Digestion and absorption of amino acids. Common enzymatic reactions of amino acid degradation. Proteolysis, Deamination, Transamination and decarboxylation reactions. Metabolic fate of amino group. Nitrogen excretion and Krebs- Henseleit urea cycle. Degradation of individual amino acids (glycogenic and Ketogenic A.A.)

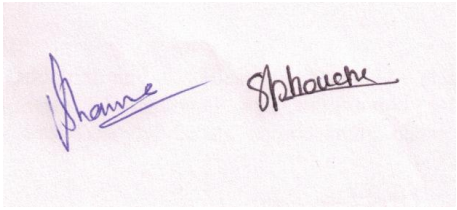
UNIT –IV

Biosynthesis of individual amino acids, Regulation of amino acid biosynthesis and degradation (metabolism). Precursor function of amino acids for polyamines, porphyrins.

UNIT – V

Metabolism of Nucleic acids

Degradation of purines and pyrimidines, Biosynthesis of purines and pyrimidines, Regulation of purine and pyrimidine biosynthesis. Biosynthesis of ribonucleotides, deoxyribonucleotides and polynucleotides. Inhibitors of nucleic acid biosynthesis.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
II Semester

Paper – IV
Toxicology and Computer Science

Paper-IV Toxicology and Computer Science (5 credits)

OBJECTIVES: To impart the knowledge of

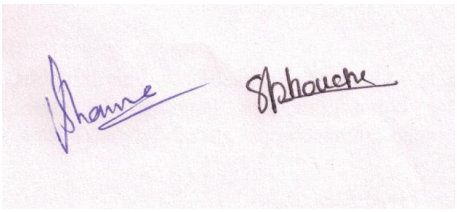
- Toxins and other harmful chemical substances which have an adverse effect on human and other living organisms.
- The relationship between doses and their effect on the exposed organisms. It is a subfield of bioscience.
- Observing and reporting symptoms, mechanisms, detection, and treatments of toxic substances, in particular relation to the poisoning in humans.
- Environmental agents and chemical compounds found in nature, as well as pharmaceutical compounds that are synthesized for medical use by humans.
- Working of computer.
- Computers to solve problems related to Biochemistry.
- Applications of computer science in biochemistry via programming.
- Applications of internet useful for biochemistry.

OUTCOMES: On completion of this course, the students will be able to understand

- Definition and scope of toxicology - Toxic effects general classification, nature and types of toxic substances. Dose – Response relationship. Synergism and Antagonism, ED_{50} and LD_{50}.
- Environmental Toxicology - Air pollution and water pollution, toxicity by natural products, toxicity caused by Carbon monoxide, Antifreeze, ethylene glycol and Alcohol.
- To understand the basic concepts of computer and programming language. Operating systems with DOS as an example, Introduction to UNIX and WINDOWS. Principles of programming.
- Operation of PC, Data Processing, standard programs and packages such as MS WORD, MS EXCEL, Simpson's Numerical Integration method.
- basics of internet and its applications for biochemistry.

UNIT – I

Definition and scope of toxicology - Toxic effects general classification and nature. Types of toxic substances. Dose – Response relationship. Synergism and Antagonism. Determination of ED_{50} and LD_{50}. Types of exposure. Factors influencing toxicity.



UNIT – II

Environmental Toxicology - Air pollution and water pollution. Toxicity by natural products : Plant toxins, Animal toxins and Fungal toxins.

Toxicity by : Carbon monoxide, Antifreeze, ethylene glycol and Alcohol.

UNIT – III

Introduction to computers and Computing -

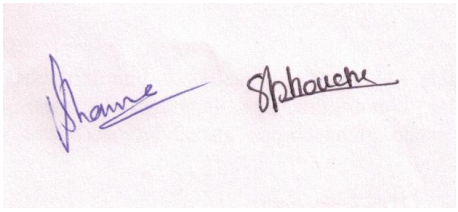
Basic structure and functioning of computer with a PC as illustrative example. Memory I/O devices. Secondary storage Computer languages. Operating systems with DOS as an example Introduction to UNIX and WINDOWS. Principles of programming Alogrithms and flow-charts.

UNIT-IV

Use of Computer programs Operation of PC. Data Processing. Running of standard Programs and Packages such as MS WORD, MS EXCEL -special emphasis on calculations and chart formations. X-Y plot. Simpson's Numerical Integration method. Programs with data preferably from physical chemistry laboratory.

UNIT-V

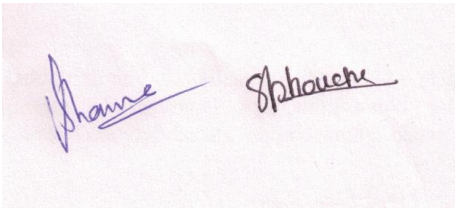
Internet Applications of Internet for Biochemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap. Scanning OMR, Web camera.



List of Practical

M.Sc. II Semester

1. Estimation of protein by Lowry's method.
2. Estimation of protein from serum by Biuret method. Determination of albumin and A/G ratio.
3. Determination of saponification value of fats or oil.
4. Estimation of cholesterol in blood serum by Zak's method.
5. Estimation of urea in blood.
6. Estimation of blood glucose by Folin-Wu method.
7. Estimation of creatinine in serum and urine sample.
8. Estimation of serum calcium.
9. Separation of amino acids and sugars by TLC.
10. Estimation of serum total and direct bilirubin.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
III Semester

Paper – I
Cell Biology & Genetics

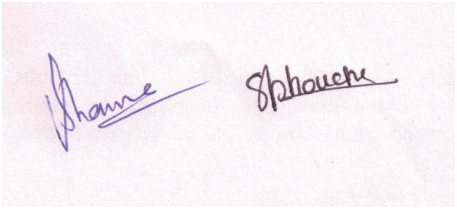
Paper-I Cell Biology & Genetics **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Structure of cell, various subcellular organelles and various cellular events.
- Cell theory
- Composition of cytoskeleton and extracellular matrix.
- Cell cycle, cell division and cell death mechanisms.
- Classical and modern concepts in genetics, molecular and developmental genetics, mapping techniques, Mendelian genetics, genetic fine structure.

OUTCOMES: On completion of this course, the students will be able to understand

- Cell structure, Cell theory, eukaryotic cell organelles, electron transport chain, DNA of chloroplast, plasma membrane and different models, passive and active transport across cell membrane. Endocytosis, exocytosis, pinocytosis and phagocytosis.
- Cell growth, cell division by mitosis or meiosis, cell cycle and its regulation, cytokinesis and growth factors, cytoskeleton and its organization, protein and lipid sorting and organelle biogenesis, apoptosis.
- Introduction to genetics - Birth, growth and history of genetics, structure of chromosome, Mendel's experiments, principle of segregation, genetic terminology, types of crosses, principles of independent assortment, gene interaction.
- Modern Genetics - Linkage, crossing over & its cytological basis. Chromosome mapping, molecular mechanism of crossing over, Recombination within gene or gene conversion. Complementation, sex determination and sex linkage.
- Genetic fine structure, classical versus molecular concept of gene, Cis-Trans complementation test, variation in chromosome number and structure.



UNIT I

Cell - structure, Cell theory. Organelles of Eukaryotic cell Nucleus, nucleolus, Nuclear matrix, Nucleosome, Endoplasmic reticulum, Golgi Vesicles, mitochondria, chloroplast, structure of chloroplast, protein complexes, electron transport chain, DNA of chloroplast, lysosomes, peroxisomes, ultra structure, composition of plasma membrane and different models. Transport across cell membrane- passive transport, active transport. Endocytosis, Exocytosis, Pinocytosis and Phagocytosis.

UNIT II

Cell Mechanics - Cell growth, types of cell division – mitosis, meiosis, cell cycle and its regulation, cytokinesis and growth factors, cytoskeleton and its organization – Microtubules and action filaments. Protein and lipid sorting and organelle biogenesis, apoptosis.

UNIT III

Introduction to genetics - Birth, growth and history of genetics. Mendel's principle. Structure of chromosome.

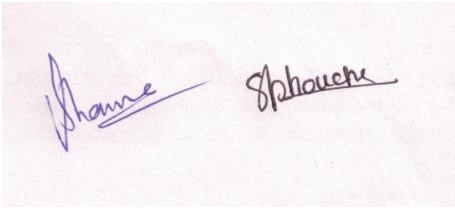
Mendelian genetics - Mendel's experiments, principle of segregation, genetic terminology, types of crosses, principles of independent assortment, gene interaction.

UNIT IV

Modern Genetics - Linkage, crossing over & its cytological basis. Chromosome mapping- two factor crosses and three factor crosses. Molecular mechanism of crossing over, Recombination within gene or gene conversion. Complementation. Sex determination and sex linkage.

UNIT V

Genetic fine structure / Classical Genetics - Classical versus molecular concept of gene. Evidence that gene is sub divisible. Cis-Trans or complementation test for functional allelism. Variation in chromosome number and structure.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
III Semester

Paper – II
Biotechnology and Genetic Engineering

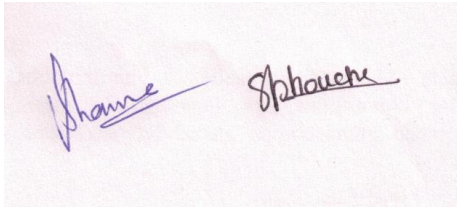
Paper-II Biotechnology and Genetic Engineering (5 credits)

OBJECTIVES: To impart the knowledge of

- Recombinant DNA technology, DNA manipulation in prokaryotes and eukaryotes, engineering of DNA molecules using restriction and modification enzymes.
- Cloning and expression vectors, creation of genomic and cDNA libraries and their applications.
- Integration of DNA insert into the vector, sequencing of DNA, restriction mapping, Hybridoma technology, enzyme technology.

OUTCOMES: On completion of this course, the students will be able to understand

- Recombinant DNA technology, properties of restriction endonucleases construction and screening of c- DNA library and genomic library, chemical synthesis of gene, PCR technique and its applications, Vectors for molecular cloning.
- Integration of DNA insert into the vector, sequencing of DNA- chemical and enzymatic methods. Preparation of southern, northern and western blots, colony hybridization, Probes, ELISA, Nick translation.
- Restriction mapping. RFLPs, molecular markers and phenotypic markers – RAPDs, Chromosomal walking and jumping, application of recombinant technology- DNA fingerprinting and site directed mutagenesis, antisense RNA technology, drug delivery and targeting, interferons.
- Hybridoma technology - Monoclonal and polyclonal antibodies, production, screening, purification and applications of monoclonal antibodies in diagnosis and therapy.
- Enzyme technology, methods of enzyme immobilization, advantage and disadvantage, applications of immobilized enzymes, biosensors-definition, function and types, gene therapy.



UNIT- I

Recombinant DNA technology- Properties of restriction endonucleases and their mode of action, modification of cut ends, Isolation of desired gene by construction and screening of c- DNA library and genomic library, chemical synthesis of gene, gene amplification by PCR technique and its applications, Vectors for molecular cloning- lambda phage, plasmid, M-13 phage and cosmid vectors.

UNIT-II

Integration of DNA insert into the vector, Integration of the vector into a suitable host, selection of recombinant clones, Sequencing of DNA- chemical and enzymatic methods. Preparation of southern, northern and western blots, colony hybridization, Probes, ELISA, Nick translation,

UNIT-III

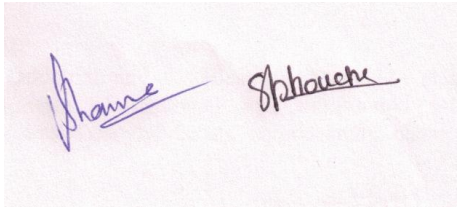
Restriction mapping. Restriction fragment length polymorphism (RFLPs), linkage and recombination between molecular markers and phenotypic markers- Random amplified polymorphic DNA (RAPDs). Chromosomal walking and chromosomal jumping, application of recombinant technology- DNA fingerprinting and site directed mutagenesis. Antisense RNA technology. Drug delivery and targeting and interferons.

UNIT-IV

Hybridoma technology - Monoclonal and polyclonal antibodies ,production of Monoclonal antibodies, mycelium cell fusion, selection of hybridomas, HAT medium, screening, purification and applications of monoclonal antibodies in diagnosis and therapy.

UNIT-V

Enzyme technology - methods of enzyme immobilization, advantage and disadvantage, applications of immobilized enzymes. Biosensors-definition, function and types. Gene therapy - definition and types.



Vikram University

Syllabus –2021-22
M.Sc. Biochemistry
III Semester

Paper – III
Plant Biochemistry

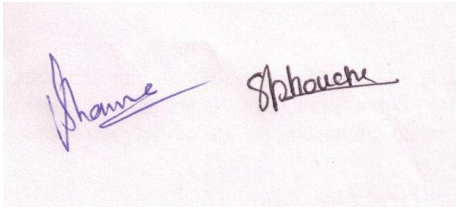
Paper-III Plant Biochemistry **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Metabolic processes specific for plants such as photosynthesis, respiration, nitrate assimilation, nitrogen fixation.
- Role of different metabolic pathways in plant growth and development.
- various stressful conditions of the environment that affect plant growth and productivity as well as the defense mechanisms in plants due to which plants survive under stresses.

OUTCOMES: On completion of this course, the students will be able to understand

- Photosynthesis, structure of chlorophyll a and b, Photosystem I(P_{700}) and photosystem II(P_{690}). Cyclic and non cyclic photophosphorylation, Calvin cycle, photorespiration, C_4 pathway of CO_2 fixation.
- Nitrogen cycle, bological nitrogen fixation, Mechanism of action of nitrogenase, nif genes and its regulations, Nitrate and sulphate reduction and their incorporation into amino acids.
- Special features of secondary plant metabolism, defense system in plants, tissue culture.
- Plant hormones, growth regulating substances and their mode of action. Molecular effect of hormones in regulation of cell extension, seed dormancy, germination, growth, development and embryogenesis. Biochemistry of seed development and fruit ripening.
- Plant Tissue Culture, general techniques, callus and suspension cultures, cloning, regeneration, somatic embryogenesis, anther culture and meristem culture, translocation.



UNIT – I

Photosynthesis – structure of chlorophyll molecules (a and b). Light absorption of Photosystem I(P_{700}) and photosystem II(P_{690}). Cyclic and non cyclic photophosphorylation, Calvin cycle, photorespiration, C_4 pathway of CO_2 fixation, photosynthetic pigments.

UNIT- II

Nitrogen cycle – Biological nitrogen fixation, Mechanism of action of nitrogenase, structure of nif genes and its regulations.

Ammonia assimilation, Nitrification, Denitrification, Nitrate and sulphate reduction and their incorporation into amino acids.

UNIT- III

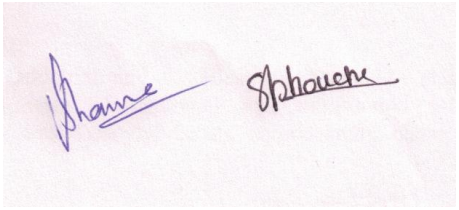
Special features of secondary plant metabolism – phenolic acids, tannins, lignins, lignans, pigments, terpenes, terpenoids, plant phenolics, alkaloids and surface waxes. Defense system in plants, tissue culture.

UNIT – IV

Plant hormones – growth regulating substances and their mode of action. Molecular effect of auxin in regulation of cell extension and gibberlin, abscissic acids and cylokins, ethylene in the regulation of seed dormancy, germination, growth, development and embryogenesis. Biochemistry of seed development and fruit ripening.

UNIT- V

Plant Tissue Culture - General techniques, Callus and suspension cultures, cloning, Regeneration, somatic embryogenesis, Anther culture and Meristem culture. Translocation of inorganic and organic substances.



Vikram University
Syllabus –2021-22
M.Sc. Biochemistry
III Semester

Paper – IV
Microbial Biochemistry

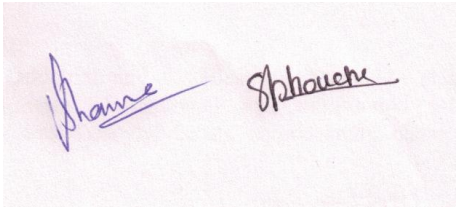
Paper - IV Microbial Biochemistry **(5 credits)**

OBJECTIVES: To impart the knowledge of

- General characteristics and classification of microorganism, general organization of bacterial cells, nutritional types of bacteria, staining of bacteria
- Isolation and pure culture techniques, microbial genetics and differentiation, microbiology of dairy products.
- Cultivation and growth of bacteria, bacterial growth curve, sterilization – physical and chemicals ways, bacterial photosynthesis, nitrogen fixation.
- Viruses, viral proteins, replication of retroviruses and adenovirus, acute viral infections.
- Fermentation, food spoilage and food borne infections, microbial assay.

OUTCOMES: On completion of this course, the students will be able to understand

- General characteristics of bacteria, fungi, virus and mycoplasm, gram positive and gram negative bacteria, peptidoglycan, nutritional types of bacteria, staining of bacteria-simple staining, negative staining, differential staining and spore staining.
- Methods of isolation and pure culture techniques, bacterial metabolism, glyoxalate cycle, microbial genetics and differentiation, types of mutation, induction of mutation, transformation, conjugation, sex types, transfection, transduction, genetic recombination, transposons, microbiology of dairy products.
- Cultivation and growth of bacteria, physical conditions required for growth, bacterial growth curve, sterilization – physical and chemicals ways, disinfection, bacterial photosynthesis, symbiotic and non symbiotic nitrogen fixation.
- Viruses- discovery, structure, properties, classification, morphology and replication, viral proteins, bacteriophage, replication of retroviruses, infection cycle and adenovirus or SV40, acute viral infections – AIDS and Cancer, RNA tumor virus.
- Microbiology of fermentation, food spoilage and food borne infections. Application of microbes in industrial and domestic sewage, in production of antibiotics, microbial insecticides, microbial assay of vitamins and amino acids.



UNIT - I

General characteristics and classification of main group of microorganism- bacteria, fungi, virus and mycoplasm. General organization of bacterial cells- gram positive and gram negative bacteria. Function of peptidoglycan, nutritional types of bacteria. Staining of bacteria-simple staining, negative staining, differential staining and spore staining. Bacterial identification.

UNIT- II

Methods of isolation and pure culture techniques. Metabolism of bacteria- special features of bacterial metabolism, glyoxalate cycle and its role in conversion of fats into carbohydrates. Microbial Genetics and differentiation- types of mutation, induction of mutation, transformation, conjugation, sex types, transfection, transduction, genetic recombination, transposons. Microbiology of dairy products.

UNIT-III

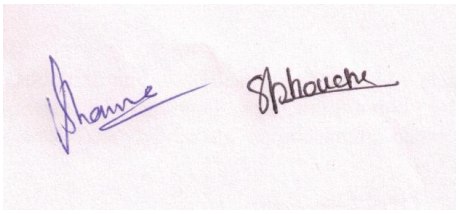
Cultivation and growth of bacteria. Bacterial media, physical conditions required for growth. Bacterial growth curve and measurement of growth control of growth. Sterilization – physical and chemicals ways, disinfection. Bacterial Photosynthesis, symbiotic and non symbiotic nitrogen fixation.

UNIT-IV

Viruses- discovery, structure, properties and classification. Morphology and replication of virus, viral proteins. Morphology of bacteriophage. Replication of retroviruses (infection cycle) and adenovirus or SV40). Acute viral infections – AIDS and Cancer-RNA tumor virus: characterization of retroviruses, genome and mechanism of transformation of retroviruses.

UNIT-V

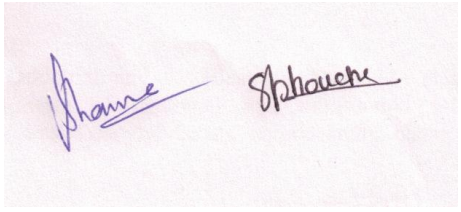
Microbiology of fermentation. Food spoilage and food borne infections. Application of microbes in industrial and domestic sewage. Application of microbes in production of antibiotics, microbial insecticides. Microbial assay of vitamins and amino acids.



List of Practical

M.Sc. III Semester

1. Preparation and sterilization of Culture media.
2. Isolation of pure culture by Streak plating and Pour plating methods.
3. Isolation of RNA from yeast.
4. Isolation of DNA from goat liver.
5. Quantitative determination of individual bases in DNA.
6. Extraction of Total Lipid from dry seeds by Bligh and Dyer method or Bloor's mixture.
7. Determination of change in the Lipid content during seed germination.
8. Determination of Phosphorus content in plant material.
9. Estimation of plant pigments from leaves.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
IV Semester

Paper – I
Enzymology

Paper - I Enzymology **(5 credits)**

OBJECTIVES: To impart the knowledge of

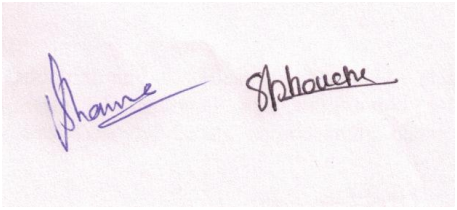
- Enzymes and their importance in biological reactions.
- Difference between a chemical catalyst and biocatalyst.
- The concept of activation energy and its importance in biological reactions.
- Nature of non-protein enzymes such as ribozymes.
- Enzymes in clinical diagnosis and industries.
- Enzymes and their importance in biological reactions.
- Industrial and biomedical applications of enzymes.

OUTCOMES: On completion of this course, the student will know about

- Holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metalloenzymes, units of enzymes activity, isoenzymes, multienzyme complexes, enzyme specificity, acid-base catalysis, proximity and orientation effect.
- Isolation and purification of enzymes, classification and nomenclature of enzymes, enzymes substrate relationship, expression of enzyme activity.
- Role of cofactors in enzyme catalysis, mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme.
- Enzyme kinetics - Order of reaction, factors affecting enzyme activity, Michaelis Menten equation, K_m and V_{max}, Line Weaver Burk's plot, importance of K_{cat} and $K_{m.}$, bisubstrate reactions, multisubstrate reactions, sequential and ping pong mechanism.
- Enzyme regulation, enzymes inhibition – competitive, non- competitive and uncompetitive, feed back inhibition and feed forward stimulation, reversible and irreversible inhibition.

UNIT – I

Definition with example of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metalloenzymes,units of enzymes activity, specific enzymes, isoenzymes, multienzyme complexes, enzyme specificity, acid-base catalysis, proximity and orientation effect.



UNIT – II

Isolation and purification of enzymes. Classification and nomenclature of enzymes, Enzymes substrate relationship, expression of enzyme activity.

UNIT – III

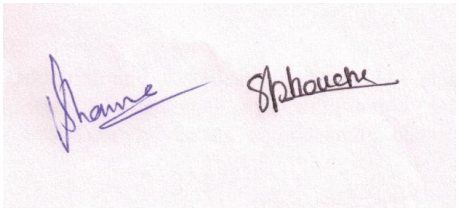
Role of cofactors in enzyme catalysis – NAD/$NADP^{+,}$ FMN/FAD, Coenzyme A, TPP, Pyridoxal phosphate, tetrahydrofolate. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme.

UNIT – IV

Enzyme kinetics - Order of reaction, factors affecting enzyme activity – enzyme concentration, substrate concentration, pH and temperature, derivation of Michaelis Menten equation for one – substrate reaction. K_m and V_{max} and its significance. Line Weaver Burk's plot and its limitations. Importance of K_{cat} and $K_{m..}$ Bisubstrate reactions, multisubstrate reactions with examples – sequential and ping pong mechanism.

UNIT- V

Enzyme regulation – allosteric and covalent modulated regulation, enzymes inhibition – competitive, non- competitive and uncompetitive. Feed back inhibition and feed forward stimulation, reversible and irreversible inhibition.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
IV Semester

Paper – II
Clinical Biochemistry

Paper-II Clinical Biochemistry **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Normal constituents of various biological fluids and their significance in maintaining good health, disorders of carbohydrate metabolism.
- Organ function test.
- Role of enzymes in diagnosis of various diseases, inborn error of metabolism.
- Detoxification, chemotherapy mechanism of drug action, antibiotics
- Cellular differentiation, ageing.

OUTCOMES: on completion of this course, the students will have the knowledge of

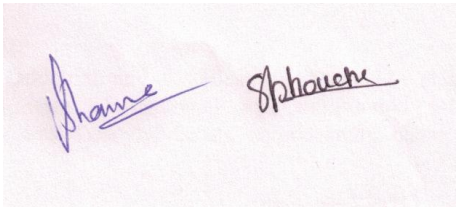
- Collection and preservation of biological fluids, CSF, diabetes mellitus, glycohemoglobin, hypoglycemia, disorders of carbohydrate metabolism, glucose tolerance test.
- Lipids, lipoprotein and their role in diseases, organ function test of gastric, kidney and liver, bilirubin, Vanden bergh's test, fatty liver, jaundice.
- Enzymes in differential diagnosis of diseases, inborn error of metabolism of carbohydrates, amino acid, lipid, Lipid storage diseases.
- Detoxification – Phase I and II reactions, chemotherapy mechanism of drug action, antibiotics like Penicillin, tetracycline, streptomycin, etc.
- Cellular differentiation, cancer and therapeutics, Biochemistry of aging.

UNIT – I

Collection and preservation of Biological fluids, chemical analysis of CSF. Diabetes mellitus, Glycohemoglobin, Hypoglycemia, disorders of carbohydrate metabolism, ketone bodies, glucose tolerance test.

UNIT – II

Lipids, lipoprotein and their role in diseases. Organ function test of gastric, Kidney and liver. Bilirubin – direct and Indirect. Vanden bergh's test and its clinical significance. Fatty liver, jaundice.



UNIT – III

Enzymes in differential diagnosis of diseases and their clinical significance.

Inborn error of metabolism :-

(i) Carbohydrates – Glycogen storage disease, galactosemia, essential pentosuria

(ii) Amino Acid – Phenylketonuria, Alcaptonuria, cystinuria, Albinism, Maple syrup urine disease, tyrosenimia.

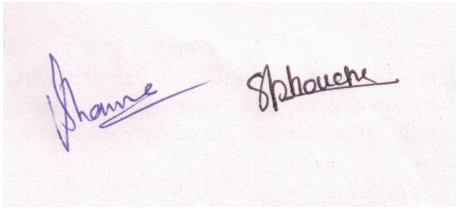
(iii) Lipid – Lipid storage diseases.

UNIT – IV

Detoxification – Phase I and II reactions. Chemotherapy mechanism of drug action. Antibiotics – Penicillin, tetracycline, streptomycin, chloramphenicol and sulphonamides.

UNIT – V

Cellular differentiation, cancerous growth, carcinogenic agents and therapeutics. Biochemistry of aging.



Vikram University
Syllabus – 2021-22
M.Sc. Biochemistry
IV Semester

Paper – III
Molecular Biology

Paper-III Molecular Biology **(5 credits)**

OBJECTIVES: To impart the knowledge of

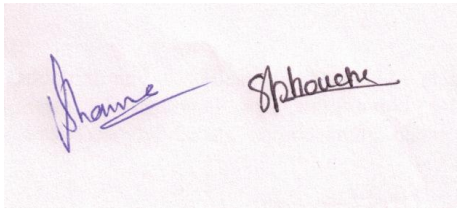
- DNA as genetic material, DNA replication, transcription, DNA repair and translation.
- Coding and non-coding regions and their importance.
- Gene expression, Operon concept, protein as signal.
- Mutations, Lederberg's replica planting experiment, Correlation of mutagenicity and carcinogenicity, DNA repair mechanism

OUTCOMES: On completion of this course, the students will have the knowledge of

- Nucleic acids as genetic information carriers experimental evidences, Watson and crick model of DNA and chirality of DNA, structure and properties of RNA, basic concepts about the secondary structures of nucleic acids, structure of chromosomes, histones and chromatin.
- DNA replication in prokaryotes, enzymes and protein factors involved in replication, mechanism of replication, inhibitors of DNA replication, cytoplasmic inheritance.
- Transcription - promoters, initiation, elongation, termination and inhibitors, genetic code.
- Translation - mechanism, structure of ribosome, initiation, elongation, termination and inhibitors.
- Regulation of gene expression in prokaryotes, Operon concept, post transcriptional and post translational modifications, protein as signal.
- Mutations – Molecular basis of mutations, various types of mutation - Transition, transversion, frame shift, insertion, etc., Lederberg's replica planting experiment, correlation of mutagenicity and carcinogenicity, DNA repair mechanism.

UNIT – I

Nucleic acids as genetic information carriers experimental evidences. Watson and crick model of DNA- A,B and Z types of DNA and chirality of DNA, structure and properties of RNA. Basic concepts about the secondary structures of nucleic acids, nucleosomes and solenoid structure, structure of chromosomes, histones and chromatin.



UNIT – II

DNA replication in prokaryotes – conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication. Inhibitors of DNA replication. Cytoplasmic inheritance.

UNIT – III

Transcription – RNA polymerase, promoters, initiation elongation and termination of RNA synthesis, inhibitors of transcription, Reverse transcriptase. Genetic code – basic features, biological significance, degeneracy, wobble hypothesis.

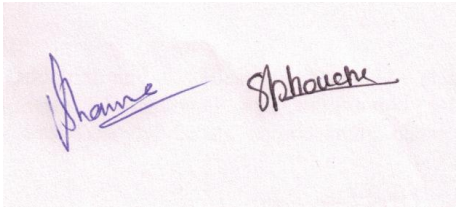
Translation – Mechanism, structure of ribosome, various steps involved in translation – initiation, elongation and termination, inhibitors of translation.

UNIT – IV

Regulation of gene expression in prokaryotes. Induction and repression, positive and negative control. Operon concept, lac operon, Trp operon, Ara operon. Post transcriptional and post translational modifications. Protein as signal.

UNIT – V

Mutations – Molecular basis of mutations example-Transition, transversion, frame shift, insertion, deletion, suppresser sensitive, germinal and somatic, backward and forward mutation, true reversion and suppression, dominant and recessive mutation, spontaneous and induced mutations – Lederberg's replica planting experiment. Correlation of mutagenicity and carcinogenicity, DNA repair mechanism.



Vikram University
Syllabus –2021-22
M.Sc. Biochemistry
M.Sc. - IV Semester

Paper – IV
Advanced Biotechnology

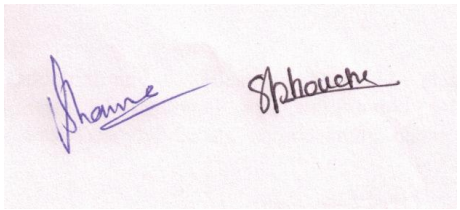
PAPER – IV Advanced Biotechnology **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Animal biotechnology, transgenic animals, transfection methods.
- Plants Biotechnology, transgenic plants, gene transfer methods, production of secondary metabolites and molecular farming.
- Environmental Biotechnology, waste treatment, waste water treatment, biodegradation of xenobiotic compound, hazards from xenobiotics.
- Medical Biotechnology, vaccines, gene therapy.
- Industrial Biotechnology, biotransformation, Biogas.
- Fermentation technology, single cell proteins, antibiotics and other organic compounds.

OUTCOMES: On completion of this course, the students will have the knowledge of

- Animal Biotechnology, monoclonal antibodies, in vitro fertilization and embryo transfer, transgenic animals, vectors, gene construct, transfection methods, targeted gene transfer, transgene integration, transgenic animals produced.
- Plants Biotechnology, micropropagation, somatic cell culture, somaclonal variations, somatic cell hybridization, protoplast culture, transgenic plants, agrobacterium mediated gene transfer and direct gene transfer, production of secondary metabolites and molecular farming.
- Environmental Biotechnology, sources of wastes and pollutants, hazards from wastes and pollutants, waste treatment, aerobic and anaerobic waste water treatment using microorganism and sludge treatment, biodegradation of xenobiotic compound, hazards from xenobiotics.
- Medical Biotechnology, vaccines, gene therapy, Industrial Biotechnology Biotransformation, Biogas.
- Fermentation technology, Continuous and batch type culture techniques, fermentors or bioreactors, production of single cell proteins, production strategies of the antibiotics and other organic compounds.



UNIT-I

Animal Biotechnology - monoclonal antibodies , in vitro fertilization and embryo transfer and their applications.

Transgenic animals - objective of gene transfer, vectors, gene construct, transfection methods, targeted gene transfer, transgene integration ,detection of transgenic and of transgene function, transgenic animals produced.

UNIT-II

Plants Biotechnology - Micropropagation, Somatic cell culture, somaclonal variations, somatic cell hybridization, protoplast isolation, protoplast fusion and protoplast culture.

Transgenic plants - objective and its application, Genetic transfer methods- agrobacterium mediated gene transfer and direct gene transfer. Production of secondary metabolites and molecular farming.

UNIT-III

Environmental Biotechnology-sources of wastes and pollutants, hazards from wastes and pollutants, waste treatment, aerobic waste water treatment - BOD, COD etc., anaerobic treatment of waste water using microorganism and sludge treatment Biodegradation of xenobiotic compound, hazards from xenobiotics.

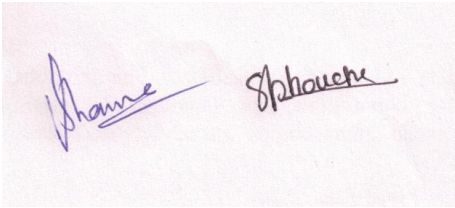
UNIT-IV

Medical Biotechnology disease prevention using vaccines, disease treatment, gene therapy.

Industrial Biotechnology Biotransformation. Biogas–substrate, dogester, microorganism, process, factors affecting, precautions, advantages, disadvantages.

UNIT-V

Fermentation technology -Continuous and batch type culture techniques, principal types of fermentors or bioreactors, general design of fermentor, fermentation process- brewing, manufacture of penicillin, production of single cell proteins, production strategies of the antibiotics and other organic compounds.



List of Practical

M.Sc. IV Semester

1. Determination of Na and K content in blood serum by flame photometer.
2. Estimation of ascorbic acid in lemon juice.
3. To examine the effect of enzyme concentration on the rate of an enzyme catalysed reaction.
4. Estimation of alkaline phosphatase activity in serum.
5. Estimation of acid phosphatase activity in serum.
6. Estimation of SGPT activity in serum.
7. Estimation of SGOT activity in serum.
8. Estimation of DNA by diphenylamine reaction.
9. Estimation of RNA by orcinol method.