B.Sc. Biochemistry First Semester

Biochemistry – I **52 hrs**

Unit-I **13 hrs**

1. Measurement

SI Units – International System of Units – Basic Units, Derived Units. Simple problems relating to derived units (conversions) – Prefixes, subsidiary units – Non SI units and their SI equivalents. Significant figures – and computarion Dimensional analysis for volume, density pressure, surface tension and viscosity.

Exponential notation – expression of a large number in an exponential form; purposes, positive and negative powers of 10. Graphical representation of data – Types of graphs, Advantages of showing data in graphical forum.

Errors in quantitative analysis – types ,sources minimization of errors.

Precision and accuracy.

Relationship between significant figures and precision 6 hrs

2. Atomic structure

Electromagnetic radiation – (wave length, frequency, velocity, wave number) electromagnetic spectrum, Nature of wave particle.

Quantum numbers & their significance (Principal quantum number, Azimuthal quantum number(1) , Magnetic quantum number (m) and Spin quantum number [s])

Shapes of Atomic orbitals – s, p and d orbitals.

Pauli Exclusion Principle, Aufbau Principle, Hund's rule of maximum multiplicity-cause of stability of half filled and completely filled energy levels.

Electronic configuration of elements up to At No.54, (n+l rule , $2n^2$,order of energy levels to be followed)

Oxidation numbers – concept, difference between valency and oxidation number, and computation. calculation of equivalent weights of oxidising and reducing agents.

7 hrs

Unit-II 13 hrs

3. Chemical bonding

Ionic bond - factors favouring formation – lattice energy – energetics of Ionic bond formation (NaCl as example) Born – Haber cycle – for Nacl. Calculation of Lattice energy Characteristics of ionic compounds. Covalent bond- definition, pictorial representation of covalent bond formation in H_2, HCl, NH_3, CO_2 and N_2. Valence bond theory – postulates, Sigma and pi bonds Hybridization of orbitals and directoral characteristics –sp,sp^2 , sp^3(egs- methane, ethene and acetylene) Resonance forms of H_2 and Benzene. VSPER theory-Shapes of H_2O, NH_3, H_3O^+, SF_4 , ClF_3 and ICl_2^-. Molecular Orbital Theory – postulates, Atomic orbitals and molecular orbitals; conditions for the formation of molecular orbitals. LCAO – Bonding and antibonding molecular orbitals; comparison between bonding and antibonding molecular orbitals. Shapes of molecular orbitals (by s-s, s-p, p-p overlap) – pictures to be given. Molecular orbital diagrams for the formation of H_2, He and O_2. Polarisation concept, Fajan's rule, bond length, bond angle and bond energy, dipole moment. Coordinate bond – Donor, acceptor, representation of the formation of co-ordinate bond in H_3O^+, NH_4^+. Chelates – ligands, chelates in biological systems (mention chlorophyll, vitamin B_{12}, haeme, catalase as examples) Hydrogen bond – inter and

intramolecular hydrogen bond- anomalous properties of HF, H_2O,NH_3 and nitro phenols Vander Waals forces – definition. 8 hrs

4. Nuclear chemistry and Radioactivity

Characteristics of radioelements -Nucleus- – structure , nuclear forces - N/P ratio, mass defect, binding energy; packing fraction, instability of nuclei. Radioactivity –Types of radioactive decay, Properties of M, N, O radiations. Group displacement law. Decay law - decay constant, Half life period and average life of a radioactive element. Detection of radioactivity – GM counter and scintillation counters. Tracer technique – pplications of P_{32} , C_{14} , I_{131} & Co_{60}. Safety measures 7 hrs

Unit-III **13 hrs**

5. Solutions and Colligative properties

Concentration units – molarity, molality, normality, mole fraction – simple problems.
Types of solutions – homogenous and heterogeneous, factors influencing solubility– nature of solvent, solute, temperature, pressure and practice size. Solubility curves– plots showing solubility of sodium chloride, potassium nitrate, lead nitrate and sodium sulphate against temperature. Henry's law – statement, Applications. Colligative properties– Definition, Relative lowering of vapour pressure. Raoults' law of relative lowering of vapour pressure, Osmosispreparation
of copper ferrocyanide semi permeable membrane,
Osmotic pressure – measurement by Berkely – Hartley method. Theory of dilute solutions – Laws of osmotic pressure - Van't Hoff Boyle's law, Van't Hoff Charles' law and Avogardro's law. Hypo-, hyper- and isotonic solutions. Donnan membrane equilibrium and its applications. Elevation in boiling point, ebullioscopic constant. Depression in freezing point, cryoscopic constant. Limitations of colligative properties. Abnormal molecular weights and the van't Hoff factor **–** degree of association, Degree of dissociation
6 hrs

5. Electrochemistry

Strong and weak electrolytes – definition and examples. Activity and activity coefficient – concepts. Activity and mean activity of the electrolyte. Mean ionic activity. Ionic strengthclassification
of electrolytes as 1:1, 2:2, 2:1 electrolytes with examples. Electrochemical cells: conventions of representing galvanic cells , half cell reactions and cell reaction Reversible electrodes and cells – definition. Types-Cation reversible electrode, anion reversible electrode, redox electrode. (Examples and electrode reactions to be given) Single electrode potential – Nernst equation,Factors affecting single electrode potential. Standard Electrode Potential (definition). Reference electrodes – primary reference (Standard hydrogen electrode), secondary reference electrodes (Calomel, quinhydrone and glass electrodes). Electrochemical series- to predict the ease of oxidation, displacement reaction to calculate standard emf of cell Ion selective electrodes- concept, types and applications.
7 hrs

Unit – IV **13 hrs**

6. Acids,Bases and Buffers

Modern concepts of acids and bases-Arrhenius, Lowry- Bronsted and Lewis concepts. Limitations of each concept. Strong and weak acids -ionisation constant K_a and pK_a of weak acids, comparison of acid strength on this basis, Ionic product of water ,common ion effect, solubility product and ionic product of sparingly soluble salts and conditions for precipitation.

and in qualitative analysis –in prediction of selective precipitation of second and forth group basic radicals, precipitation of third group basic radicals. Hydrolysis of salts– pH of salt
9
solutions. Hydrogen ion concentration- pH, pH of some biological fluids and its importance. Buffers-definition, types, buffer action and buffer capacity. pH of buffers-Henderson–Hasselbalch equation-derivation, preparation of buffers, problems.
7 hrs

7. Liquids

Properties of liquids –vapour pressure, viscosity and surface tension. Relationship between vapour pressure and boiling point, freezing point-heat of fusion. Viscosity-Definition, units, experimental determination using Ostwalds viscometer. Viscosity and shape/size of molecules. Surface tension:- Definition, units, experimental determination using stalagmometer. Surfacants – effect of sufactants on surface tension. Viscosity and Surface tension in everyday life.
4 hrs

Biochemistry Practical - I

3 hrs / wk

1. Calibration of glass wares - pipettes, burettes and volumetric flasks (demonstration)
2. Preparation of standard sodium oxalate and estimation of potassium permanganate.
3. Preparation of standard potassium bipthalate and estimation of alkali
4. Preparation of standard potassium dichromate solution and estimation of $Na_2S_2O_3$.
5. Estimation of hardness of water using EDTA (Standard EDTA to be provided)
6. Estimation of nitrogen in ammonium salts using sodium hydroxide and standard oxalic acid
7. Estimation of chloride by Mohr's method
8. Estimation of Fe^{2+} using standard potassium dichromate and diphenyl amine indicator
9. Estimation of borax using standard sodium carbonate.
10. Estimation of carbonate and bicarbonate in a given mixture.

B.Sc. Biochemistry Second Semester

Biochemistry – II **52 hrs**

Unit –I **13 hrs**

1. Solids

Types-Crystalline and Amorphous. Size and Shapes. Definition of Space Lattice and Unit cell. Symmetry elements in crystals. Laws of Crystallography ,Weiss and Miller Indices with simple numericals. Crystal systems with examples. Defects in crystalline solids – Schotky & Frenkel defects. X – ray diffraction of crystals-Braag's equation. 5 hrs

2. Phase Rule

Definitions of Phase & Components,Criterion of phase equilibrium,Gibb's phase rule (no derivation) . Application of phase rule to one component system –water system, Two component system-water-potassium iodide (freezing mixtures). Solutions of liquids in liquids– ideal solutions and Raoult's and Henry's law .Non-ideal solutions-vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions- azeotropes –HCl - H_2O and water-ethanol system.. Distillation of solutions-Lever rule. Partial miscibility of liquids (Water – Phenol). Critical Solution Temperature (lower and upper).Effect of impurity on CST. Immiscibility of liquids. Principle of steam distillation. Nernst distribution law- statement,

deviations from distribution law due to association and dissociation of the solute in one of the solvents. Applications of distribution law– solvent extraction. 6 hrs

3. Chemical Equilibrium

Reversible reactions with examples.Law of mass action, Chemical equilibrium – definition and characterstics.Relationship between K_c , K_p Homogenous and heterogeneous systems with examples. Le Chatlier principle . Equilibrium constant and free energy change. Biological applications-ATP and its role in bio-energetics and binding of oxygen by myoglobin and haemoglobin. Redox equilibria with example Fe^{2+} Fe^{3+} System. 3 hrs

Unit-II **13 hrs**

4. Reaction Kinetics

Experimental methods of studying kinetics of reactions, rate of reactions, Factors influencing rate of reaction – temperature, pressure, concentration and catalyst, rate law or Rate equation, Molecularity and order of a reaction, velocity constant or rate constant and half life period expressions for zero, first and second order reactions (a=b and aRb).Theories of reaction rates – Effect of temperature on rate of reaction, Arrhenius equation, elementary treatment of transition state theory. 5 hrs

5. Catalysis

Characteristics of catalysts, Types of catalysis – Homogeneous and heterogeneous with both biological and non-biological examples. Theories of catalysis – intermediate compound formation theory and adsorption theory (No mechanism required). 2 hrs

6. Introduction to organic chemistry

IUPAC nomenclature bi and poly functional compounds. Inductive effect, resonance and hyper conjugation. Reactive intermediates – free radicals, carbocations and carbanions.
5 hrs
11

Unit-III **13 hrs**

7. Hydrocarbons

Mechanism of adition of HCl to propene, Morkownikoff's rule. Peroxide effect, Alkenes – ozonolysis, oxidation. Alkynes – formation of acetylides and their importance. Dienes– types with examples. Conjugate dienes, 1,3-butadiene – stability, mechanism of addition of HBr . Conformational analysis of ethane and n – butane. 4 hrs

8. Cycloalkanes

Reactivity and relative stabilities. Baeyer strain theory, Sachse – Mohr theory, boat and chair forms of cyclohexane, axial and equatorial bonds. 2 hrs

9. Arenes

Modern concept of structure of benzene, mechanism of electrophylic substitution in benzene (nitration, Friedal– Craft's alkylation and acylation). Electronic interpretation of the orienting influence of substituents in the electrophylic substitution of toluene, chlorobenzene and nitrobenzene. Aromaticity– Huckel rule (4n+2 rule), structure of naphthalene, anthracene, phenanthrene and diphenyl. Oxidation reactions of naphthalene. 6 hrs

Unit – IV **13 hrs**

10. Alkylhalides and organometallic reactions

SN_1 and SN_2 reaction mechanisms taking 1^o, 2^o & 3^o alkylhalides s examples. Mechanistic concepts of elimination reactions involving tertiarybutylchloride and *n*– butylchloride. Organometallic compounds – examples, preparation and synthetic applications of Gignard reagents. 4 hrs

11. Alcohols

Classification, monohydric alcohols: examples, general and distinguishing reactions. Dihydric alcohols: glycols, Trihydric alcohols: glycerol – synthesis from propene, properties and uses. 3 hrs

12. Phenols

Classification, electronic interpretation of acidity of phenols, mechanism of Kolbe, Reimer–Tiemann and bromination reactions. 2 hrs

13. Carbonyl compounds

General properties, addition of alcohols to aldehydes and ketones. Keto-enol tautomerism. Mechanisms: adition of HCN toacetaldehyde, Claisen and aldol condensations. Quinones: *o*and *p*-benzoquinones- structure and properties. 5 hrs

Biochemistry Practical- II

3 hrs / wk

List of experiments:

1. Determination of density and viscosity of the given organic liquid using Ostwald's viscometer
2. Determination of composition of a binary liquid mixture by viscosity method.
3. Determination of density and surface tension of the given liquid using Stalagmometer
4. Partition Coefficient of iodine between carbon tetrachloride and water
5. Partition Coefficient of benzoic acid between toluene and water.
6. Kinetics of iodination of acetone by colorimetric method
7. Reaction kinetics of acid catalysed hydrolysis of ethyl acetate
8. Determination of molar mass of a non-electrolyte by ebullioscopic method
9. Effect of surfactants on surface tension of water.
10. Adsorption of oxalic acid on activated charcoal.

B.Sc. Biochemistry – Third Semester

Biochemistry –III — 52 hrs

Unit – I — **13 hrs**

1. Bio-inorganic and Environmental Chemistry:

Metal ions in biological systems; Transition metal ions and oxidation states; Types of ligands; Role of iron in Myoglobin, Haemoglobin and cytochromes; Copper in Hemocyanin, Magnesium in chlorophyll, Cobalt in vitamin B-12 and Molybdenum in nitrogenase; Metaloenzymes; Geometrical and optical isomerism in coordination complexes. 7 hrs

2. Environmental Toxicology:

Biochemical toxicology- toxicity and detoxification of Pb, Hg, Cd. LD and ED values of major toxicants. Water pollution: Treatment of sewage and industrial effluents (tanning and electroplating); Pesticides hazards – DDT, Malathion, lindane and 2,4-D. Brief Introduction to Bioremediation and Phytoremediation with applications. 6 hrs

Unit -II — **13 hrs**

3. Carboxylic Acids :

Classification; hydroxy acids: preparation and properties of lactic acid; structures of tartaric, malic, citric and iso citric acids; dicarboxylic acids: saturated dicarboxylic acids- effect of heat on the first five members; ketoacids: structures , properties and reactions of pyruvic acid, M-ketoglutaric acid and oxaloacetic acid. 3 hrs

4. Amines:
Classification; isomerism; distinguishing reactions of 1°, 2° and 3° amines; some biologically important amines (DOPA, Histamine). 2 hrs
5. Alkaloids:
Introduction and general characteristics; general method of extraction; structure and medicinal uses of nicotine, atropine and LSD. 2 hrs
6. Terpenes: Structure and Biological roles of the following: menthol, santonin, juvenile hormone I, abscisin II, gibberilic acid and lanosterol. Steroids: basic ring system; structures of cholesterol, steroid hormones(testosterone and oestrogen); structures andbiological importance of N-carotene. 2 hrs
7. Heterocyclic Compounds: Structural and nomenclature of furan, pyran, thiophene, thizole, pyrrole, imidazole, pyridine, pyrimidine, purine, isoalloxazine and indole; biological compounds containing the above skeletons. reactions of imidazole and pyridine; Aromaticity of furan, thiophene, pyrrole and pyridine. 2 hrs
13
8. Drugs: Classification of drugs; synthesis and uses of sulphanilamide and pentothal. Antibiotics: Definition; types; sources; structures and antimicrobial spectrum of action of penicillin, chloroamphenicol, streptomycin and tetracyclines. 2 hrs
Unit - III **13 hrs**
9. Colloids:
Types of colloidal systems, electrical properties of colloids. Emulsions and emulsifiers; Gels; Applications of emulsions in lipid chemistry. 2 hrs
10. Photochemistry:
Laws of Photochemistry; Chemiluminescence; Bioluminescence; Photocatalysis and photochemical reactions. 2 hrs
11. Stereochemistry:
Stereoisomerism: types, stereochemical terminology; optical isomerism: Molecular dissymmetry; chirality: glyceraldehyde, lactic acid, tartaric acid; Nomenclature of enantiomers – the RS system and DL notation; diasterioism, epimers, mutarotation, racemization and resolution; Fischer's projection formulae; Geometrical isomerism: *cis-trans* isomerism in alkenes and ring compounds; structure and properties of maleic and fumaric acids; (E)-(Z) system of specifying geometrical isomers; significance of chirality in biological system.
9 hrs
Unit - IV
13 hrs
12. Introduction To Biochemistry:
Aim and scope, historical account of development of biochemistry, mention of the landmark developments, contributions of Paracelsus, van Helmholtz, Karl Sheele, Lavosier, Wohler, Emil Fisher, Louis Pasteur, Embden, Meyerhoff, Hans Kreb, Michaelis Menton, Watson & Crick, Chargaff and H. G. Khorana; biochemical composition of living organism: elemental and chemical compositions; properties of water which makes it as solvent of life. 5 hrs
13. Identification and Separation Techniques:
Spectroscopic methods- principle and applications of UV- Visible, IR, ESR and NMR spectroscopy. Separation techniques: principle, types and applications of centrifugation, chromatography and electrophoretic techniques. 8 hrs

Biochemistry Practical- III

3 hrs / wk

1. Systematic Qualitative Analysis of organic compound (8 practicals)
The following compounds may be given for systematic qualitative analysis
1. Resorcinol 2. Urea 3. Glucose 4. Aniline
5. Benzoic Acid 6. Salicylic acid 7. Phenol 8. m-Cresol
9. Benzyl alcohol 10. Benzaldehyde 11. Acetophenone 12. Ethyl benzoate
13. Toluene 14. Chlorobenzene 15. Benzamide 16. Nitrobenzene
2. Determination of BOD
3. Determination of COD
4. Separation of compounds by TLC
5. Determination of U max

B.Sc. Biochemistry – Fourth Semester
Biochemistry – IV

52 hrs

Unit – I **13 hrs**

1. Tissues:
Classification, epithelial, connective tissues, role of collagen and elastin in bone composition, growth and remodeling, factors affecting growth. 3 hrs

2. Blood and Body fluids:
Composition of body fluids; blood; Properties, composition and functions; Erythropoiesis, blood coagulation - outline of extrinsic and intrinsic pathway; Composition and functions of CSF and Lymph. 5 hrs

3. Respiratory system:
Anatomy of Respiratory tract, Mechanism of respiration, Transport of gases and artificial respiration. Acid base balance by lungs and kidneys. Bohr's effect, transport of gases, chloride shift. 5 hrs

Unit – II **13 hrs**

4. Digestive system:
Outline of digestive system ; composition and functions of major digestive secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. 5 hrs

5. Excretory system:
Structure and functions of nephron; glomorular filtration, tubular absorption and secretion; Concentration of urine, GFR, kidney function tests, composition of urine, renal failure, nephrites. 4 hrs

6. Endocrinology:
Introduction - Endocrine glands - chemistry of hormones and hormonal action. Functions of the hormones of hypothalamus, pituitary glands, adrenal cortex, thyroid, parathyroid and pancreas (Insulin, Glucagon and Somatostatin) Diabetes mellitus & Hyperinsulinoma; Local hormones and its biological action (PGE_2, PGI_2, TXA_4 and LTA_4). 4 hrs

Unit – III **13 hrs**

7. Cardiovascular system:
Blood vessels- anatomy and physiology; ECG, Blood pressure. Regulation of heart rate, hemorrhages. 3 hrs

8. Nervous system:

Structure and classification of neurons, membrane potential, resting membrane potential and action potential; Mechanism of synaptic transmission, EEG; Neurotransmitters– classification, neurotransmitters receptors. 5 hrs

9. Muscular system:

Muscle types; ultra structure of skeletal and cardiac muscle fibers; Muscle proteins – contractile and non contractile. Definition of sarcomeres and mechanism of contraction. Energetics of muscle contraction. Regulation of skeletal muscle contraction. Muscular dystrophies. 5 hrs
16

Unit – IV **13 hrs**

11. Nutrition:

Energy content of foods, Balanced diet- Definition, characteristic feature of balanced diet, proximate analysis of foods for carbohydrate, proteins, fats, fiber material and water content. Bomb calorimeter- diagram and description, Determination of calorific value of foods (Carbohydrate, fat and protein); respiratory quotient of food stuffs and significance of RQ. BMR determination by direct and indirect method; BOD; SDA- definition; SDA for carbohydrate, fat and mixed diet and its significance. RDA for different physical activities: pregnant women, lactating woman, infants and children. 6 hrs

12. Macronutrients

Carbohydrate, proteins, lipid and fiber; Essential aminoacids, semi essential and non essential aminoacids; complete and incomplete proteins, protein efficiency ratio; Nitrogen balance- Positive and negative nitrogen balance.; Fortification - Definition and Biomedical importance; Protein Energy malnutririon: Marasmus & Kwashiorkar- causative factors , treatment and prevention. 4 hrs

13. Micronutrients:

Nutritional importance of vitamin, classification, source, daily requirements and functions; Deficiency symptoms- hypervitaminosis of fat soluble vitamins. Nutritional importance of Minerals- Definition, classification, source, daily requirement and deficiency symptoms.
3 hrs

Biochemistry Practical- IV

3 hrs / wk

List of experiments

1. Paper chromatography of amino acid by circular method
2. Preparation of m- dinitrobenzene from nitrobenzene
3. Preparation of p- nitroacetanilide from acetanilide
4. Preparation of p- bromoacetanilide from acetanilide
5. Preparation of buffers (phospate and citrate buffer)
6. Determination of titrable acidity of urine
7. Estimation of bilirubin by sulpanalic acid method
8. Estimation of haemoglobin by Wong’s method
9. Qualitative analysis of non protein nitrogenous substance in urine
10. Determination of A/G ratio in serum by biuriet method

B.Sc. Biochemistry – Fifth Semester
Biochemistry - V

52hrs

Unit – I **13 hrs**

1. Carbohydrates:

Biological importance ; Monosaccharides : Elucidation of structure of glucose (open chain and ring structure); Epimers and Anomers-defination and example ; Brief review on configurational and conformational aspects of carbohydrates; Derived monosaccharides: structures and biological importance of **:** Amino sugars: glucoseamine and galactosamine and their Nacetylated forms, Sugar phosphates: D-ribose-5-P,N-D-ribose-5-P,glucose-6-P and fructose -1,6-diphosphate, Sugar acids: types with examples; Disaccharides: Structure of isomaltose, cellobiose and trehalose; brief discussion on reducing property; Polysacchraides: classification with examples ;structure,properties and importance of homo and hetero polysaccharides-Blood group and bacterial polysaccharides; glycosaminoglycans, cardioglycosides, Glycoproteinsstructure
and functions, Lectins-characteristics and biological importance.

Unit – II **13 hrs**

2. Lipids:

Biological importance; Classification. Fatty acids: definition,classification,examples and structures, properties of fatty acids: melting point,solubility, cis-trans isomerism, reaction with NaOH, alcohol, catalytic hydrogenation, Acylglycerols: mono, di, triacylglycerols (general,structure). Hydrolysis of acylglycerols:Saponification,saponifaction number; Acid hydrolysis of triglycerides, unsaturation in acyl glycerols and iodine number; Rancidity : definition,oxidative and hydrolytic rancidity; Phosphoglycerides:structure and biological roles of phosphatidylcholine, phospatidyl ethanolamine, phosphaatidylserine,phospatidyl inositol;Sphinogolipds:structure of 4- sphingenine, ceramids and sphingomyelin, biological importance to be mentioned.Glycosphingolipids: Biological importance and general structure of cerebrosides and gangliosides; Prostaglandins: definition and example,structure of PGE2 and PGF2 and biological role ofprostaglandins in general; Thoromoboxanes and leukotrienes; Waxes: definition,types,biological importance; Lipoproteins: Types and functions, clinical significance; Membrane:common features of membranes ,behavior of amphipathic lipids in water; formation of micells, bilayers and vesicels; Biological membranes - fluid mosaic model, functions and composition; Steroids: definition, functions of cholic acid.

Unit – III **13 hrs**

3. Proteins:

Structure and classification of M-amino acids based on the polarity of R group; amino acids as amphoytes – zwitterion structure of amino acids, Isoelectric pH, titration curve of alanine; reactions of amino acids with ninhydrin ,FDNB, Edman's reagent and decarboxylation of amino acids; peptides: structure and conformation, biological importance of peptides; Proteins: classification based on composition shape and function with examples; color reactions:ninhydrin, xanthoproteic, Lowry, Sakaguchi's and Biuret reaction; Overview of structural organization of proteins: Primary structure-importance of restoration of primary structure by taking sickle cell anemia as example, Secondary structure-Types –M-helix, N-pleated structure, triple helix – example and characteristic features of each type; Tertiary structure and Quaternary structurefactors
stabilizing both; Denaturation-Denaturating agents and mechanism of operation,

renaturation of ribonuclease-Anfinsen's experiment.
18

Unit – IV **13 hrs**

4. Bioenergetics and Biological Oxidation:

Laws of thermodynamics ; Definition of bioenergetics, stages of energy transformationphotosynthesis,
respiration and utilization of energy; free energy concepts: free energy change: exergonic and endergonic reactions, meaning of VG,VG°,VG°W;Biochemical standard state and VG°W,VG and Keq(relationship). High energy compound: Definition and examples; energy coupling-explain the concept by taking suitable example; Biological oxidation:Comparison of biological oxidation with combustion using glucose as an example; Calculation of thermodynamic efficiency of biological oxidation for a mole of glucose; Redox potential of some biologically important half reactions(Ex:components of electron transport system); Calculation of energy yields from biological Red-ox reaction(problems to be solved); Electron transport chain: components sequence and their arrangement,4 complexes and their functions to be mentioned;Structure and reaction associated with ubiquinone, coenzyme Q,NAD, FMN and FAD. Scheme and sites of energy conservation;Cytochromes and NHI proteins; Oxidative phosphorylation: definition,salient features of chemiosmotic theory, P:O ratio.

Biochemistry Practical- V

3 hrs / wk

List of experiments:

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of amino acids and proteins.
3. Qualitative analysis of lipids.
4. Preparation of solid derivatives of monosaccharide – osazones.
5. Determination of total Carbohydrate content in cereal by anthrone method.
6. Estimation of amino acids by formal titration.
7. Estimation of ascorbic acid from biological samples by titrimetric method.
8. Determination of iodine value of a lipid.
9. Determination of saponification value of a lipid.
10. Estimation of Calcium from milk.

B.Sc. Biochemistry – Fifth Semester
Biochemistry - VI

52hrs

Unit - I **13 hrs**

1. Enzymes:

Nomenclature (E.C. No. upto 2nd digit) and classification of enzymes, Holoenzyme, apoenzyme, prosthetic group.Substrate enzyme interaction – lock and key model, induced fit model. Active site and its characteristics. Enzyme specificity and theories. Enzyme assay– methods, enzyme units. Chemical nature of enzymes, catalysis and energy of activation. Enzyme kinetics of single substrate reactions- Michaelis theory, steady state theory. Michaelis-Menten equation (No derivation), Significance of Km and V max and their determination using Line Weaver– Burk plots. Effect of pH and temperature. Monomeric and oligomeric enzymes; cooperativity in catalysis, sigmoidal kinetics, allosteric effectors. Enzyme Inhibition: Types - reversible, irreversible, competitive, non-competitive, uncompetetive and mixed inhibitors. Partial inhibition, substrate inhibition and allosteric inhibition. Cofactors- metal cofactors, coenzymes (definition and role of NAD, TPP and PLP).

Unit - II **13 hrs**

2. Nucleic acids:

Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico- chemical properties of nucleic acids - effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson-Crick model), Nucleoproteins – histone and nonhistone. Isolation of nucleic acids and sequencing.

Unit – III **13 hrs**

3. Genetic material:

Experimental proofs; Genome organization- from nucleotide to chromatin; the versatility of RNA. Basic features of DNA replication in vivo: semi - conservative replication, bidirectional replication-visualization of replication forks by autoradiography, unique origins of replication, DNA polymerases and DNA synthesis in vitro: Discovery of DNA polymerases, multiple DNA polymerases; the complex replication apparatus: semi- discontinuous synthesis, replication initiation, elongation and termination- Enzymology, outline of DNA replication in eukaryotes. 9 hrs

4. Mutation:

Mutagens – chemical and physical, Molecular basis of mutation: spontaneous and induced mutations. Types of mutation, reversion and suppression, DNA repair mechanisms- repair systems, direct (photoactivation), excision repair – base excision and nucleotide excision repair. 4 hrs

Unit - IV **13 hrs**

5. Transcription:

Transfer of genetic information: the central dogma, RNA polymerases, different types of RNA polymerases, promoters, regulatory elements, constitutive and inducible promoter, operators. Initiation (role sigma factor), elongation and termination (rho dependent and independent); regulation of gene expression in prokaryotes: positive and negative control using lac operon as an example, attenuation: trp opero. Overview of eukaryotic transcription, post transcriptional processing: capping, splicing and polyadenylation. 8 hrs

6. Translation:
Genetic code– features; Translation machinery– ribosomes, composition and assembly. Translation - overview, mechanism, isoaccepting tRNA, wobble hypothesis, outline of translation in eukaryotes. Inhibitors of translation. 5 hrs

Biochemistry Practical-VI

3 hrs / wk

List of experiments:
1. Determination of total activity of M/N amylase
a) Standard curve for maltose
b) Determination of rate of amylase activity
2. Determination of optimum temperature for M/N amylase
3. Determination of optimum pH for M/N amylase
4. Determination of total activity of acid phosphatase
a) Standard curve for p-nitro phenol
b) Determination of rate of acid phosphatase activity
5. Determination of optimum temperature for acid phosphatase
6. Determination of optimum pH acid phosphatase
7. Determination of total activity Urease
a) Standard curve for ammonium sulfate
b) Determination of rate of Urease activity
8. Determination of optimum temperature for Urease
9. Determination of optimum pH Urease
10. Estimation of DNA by Diphenylamine method

B.Sc. Biochemistry – Sixth Semester

Biochemistry-VII **52hrs**

Unit – I **13 hrs**

1. Introduction to metabolism and Carbohydrate metabolism:
Definition, phases of metabolism, Anabolism and Catabolism- definition, schematic representation of metabolism. Glycolysis; definition, individual reactions with energetic. Irreversible reactions/ATP dependent reactions. Substrate level phosphorylation reactions of glycolysis. Net reaction of glycolysis. Entry of lactose, sucrose and glycogen into glycolysis. Fate of pyruvate- formation of Acetyl-CoA, Ethanol and Lactate. Stoichiometry and energetics of Glycolysis. Regulation of Glycolysis. TCA cycle- Individual reactions. Net reaction of TCA cycle. Number of ATP molecules production. Functions of TCA cycle- Amphibolic roles (Anapleorosis). Regulation of TCA cycle, energetics of TCA cycle. Pentose phosphate pathways (PPP/ HMP)- Significance , reactions. Gluconeogenesis- Definition and significance, flow chart for gluconeogenesis. CORI cycle-explanation, diagram, purpose. Substrate level phosphorylation (SLP) from TCA cycle. Glycogen metabolism- Glycogenolysis- definition, reactions. Glycogenesis- definition, reaction, Cori-diseases. Regulation of blood glucose level; role of Insulin and Glucagon.

Unit - II **13 hrs**

2. Lipid metabolism:
N-oxidation of saturated fatty acids; individual reactions, enzymes, coenzymes. Energetics of N-

oxidation of palmitic acid and stearic acid (one to be worked in the class room and remaining two may be given as home assignment), role of carnitine, Oxidation fatty acids-with odd number of carbon atoms, fate of propionyl coA, oxidation of unsaturated fatty acids. Fatty acid synthetases; structure and functions. Biosynthesis of fatty acids-general flow chart, fatty acid oxidation v/s fatty acid synthesis.Cholesterol- structure and functions. cholesterol biosynthesis-(chemical reactions up to the formation of mevalonate, remaining reactions may be given as flow scheme). Regulation of cholesterol biosynthesis. Atherosclerosis-cause, blood cholesterol levels (mentioning). Ketone bodies-cause for the production. Ketogenesis-reactions, utilization, over production (ketosis).

Unit – III **13 hrs**

3. Amino acid metabolism:

General reactions- transamination- definition, reactions catalyzed by SGOT and SGPT, importance of transamination; Deamination - definition, oxidative and non-oxidative, examples for oxidative deamination- L-glutamate and non-oxidative- serine, aspartic acid and glutamine. Decarboxylation - definition, decaboxylation of glutamic acid, Histidine. Urea cycle- individual reactions, importance of urea cycle, hyperammonemia, regulation of urea cycle. Interrelationship between urea cycle and TCA cycle. Biosynthesis of glycine from serine and choline. Biosynthesis of alanine from transamination reaction. Biosynthesis of cysteine from L- serine. Epinephrine and Nor-epinephrine- importance and biosynthesis from tyrosine. Histamine; biological importance and synthesis. PKU and AKU characteristic features, metabolic reasons. 8 hrs

4. Nucleic acid metabolism: Biosynthesis of purine and pyrimidine nucleotides- sources of nitrogen and carbon atoms of purine and pyrimidine ring. Precursors of purine and pyrimidine

biosynthesis. Reactions involved in the biosynthesis. Conversion of nucleotides to deoxynucleotides. Orotic acid uria- general features. Gout; general features. 5 hrs

Unit - IV **13 hrs**

5. Photosynthesis:

Photosynthetic pigments and Photosynthetic unit. Light reactions – photosystem- I and II and their interactions. Synthesis of NADPH, photolysis of water, synthesis of ATP in cyclic and non-cyclic photophosphorylation. Dark reactions - chemical reactions upto the synthesis of fructose-6-phosphate. Trans- ketolation and aldolation reactions (shall be given in the form of flow chart). Interdependence of light and dark reactions. C_3 and C_4 plants- definition and C_4 pathway (HSK pathway). Bacterial photosynthesis. 10 hrs

6. Biological Nitrogen Fixation:

Nitrogen cycle, components of nitrogenase complex, stoichiometry of nitrogen fixation, nif genes. 3 hrs

Biochemistry Practical-VII

3 hrs / wk

List of experiments:

1. Estimation of protein by FC method
2. Estimation of Iron using ammonium thiocyanate by Colorimetric method
3. Colorimetric Estimation of Inorganic Phosphate by Fiske Subbarow method
4. Colorimetric Estimation of Creatine and Creatinine by Jaffe’s metod
5. Colorimetric Estimation of Lactose in milk by D.N.S method

6. Estimation of amino acid (alanine/glycine) using ninhydrin by colorimetric method
7. Estimation of serum cholesterol by Zak's method
8. Extraction of DNA from onions
9. Conductometric titration of amino acid against NaOH.
10. Conductometric titration of amino acid against HCl

B.Sc. Biochemistry – Sixth Semester
Biochemistry –VIII

52 hrs

Unit - I **13 hrs**

1. Industrial Microbiology:

Principles and methods of sterilization; physical chemical, filtration, UV- radiation, ultrasonic methods with example. Isolation of pure cultures; enrichment, dilution-plating, streak- and spread-plate and micromanipulations. Preservation of microorganism, sub-culturing, lyophyliztion.

Microbial growth kinetics; growth curve, kinetics in batch, continuous and fed-batch culture. Measurement of growth (cell count), immobilization of microbes.

Use of microorganisms in fermentation, strain improvement strategies. Fermentation Technology; design of fermentors, types, media inoculation. Fermentation types; single, batch, submerged and solid state. Production of ethanol, Glycerol, Citric acid, Penicillin and biofuels by microbial fermentation. Single cell proteins (SCP) definition and production.

Unit - II **13 hrs**

2. Molecular and Immunological techniques:

Blotting techniques: principle and applications of Western, Southern and Northern blotting; Molecular biology techniques: PCR- types, principle, applications; Hybridization techniquestypes
and applications. Fluorescent In situ Hybridisation (FISH), microarrays, Immunochemical techniques: principle and applications of Precipitation, agglutination, Immunodiffusion; Immunoelectrophoresis, RIA and ELISA. Autoradiography; principle and applications.

Unit – III **13 hrs**

3. Immunology:

Organs and cells of Immune system - Primary and secondary Lymphoid organs, Characteristic and features of monocytes, granulocytes, mast cells and dendrite cells. Immunity– Definition, Types, Innate immunity – Mechanism of immune response anatomic, physiological, phagocytic and inflammatory barriers. Adaptive immunity cell mediated and humoral immunity –Mechanism of immune response. Complement system **–** Definition**,** functions, classical, alternate and lectin pathways. Antigens - Chemical nature of antigens, hapten, antigenicity, immunogenicity, epitope.

Immunoglobulins - History, Isotypes, structures and functions IgG, IgM, IgE. Methods of raising antibodies –adjuvants, immune sera, IgG fraction. Monoclonal antibodie – definition and production. Major histocompatibility complex proteins (MHC): Definition. Types, physiological role, Antigen processing and presentation. Vaccines- classification, methods of production of live, attenuated and toxoids, modern vaccines – recombinant and peptide vaccines Hyper sensitivity reactions- definition, types and examples, Type-I HS reaction and its mechanism.

Unit – IV **13 hrs**

4. Recombinant DNA Technology and Genetic Engineering:

Tools of Recombinant Technolog – Genetic engineering; definition, gene cloning-definition, use of DNA polymerase, restriction endonuclease, ligase and other DNA modifying enzymes in cloning. Cloning vectors- definition, characteristic features of plasmid vectors (pUC18, pBR322), features and advantages of cosmids, phage and yeast artificial chromosome. Outline of the methods of producing recombinant DNA. Cloning hosts - features of an ideal host (*E.coli*). Transformation - types, selection of transformants by colony hybridization, insertional inactivation and blotting. Gene libraries and cDNA libraries- outline of their construction and uses.

Biochemistry Practical-VIII

3 hrs / wk

List of experiments:

1. Determination of energy of activation for hydrolysis of Methyl acetate.
2. Determination of pKa value of acetic acid by pH metric titration.
3. Determination of pKa value of amino acid (glycine) by pH metric titration.
4. Preparation of microbial culture media and sterilization.
5. Gram staining and endospore staining.
6. Isolation of microorganisms from fermented foods (Demonstration)
7. Alcoholic fermentation of fruit juice. (Demonstration)
8. Identification of antigen by Ouchterlony Immunodiffussion technique.
9. Immunoelectrophoresis of serum or any biological sample.
10. Restriction digestion of DNA and separation by agar-gel-electrophoresis.

I SEMESTER B.Sc – GENETICS

Theory Syllabus

(Paper – GNT 101: Fundamentals of Cell Biology) 56 Hrs.

UNIT I **14Hrs**

a. Scope of Genetics

b. Microscopy:

- Use of Microscopes in Cytology,
- Principles, Magnification, Resolving Power and Handling of different Microscopes - Compound, Dark field, Bright field, Phase Contrast, Fluorescent and Electron Microscopes.

c. Model organisms: Life cycle of:

- Viruses : *TMV*
- Bacteriophage - Lambda phage
- Bacteria - *E coli*
- *Neurospora*
- *Coenorhabdites elegans*
- *Drosophila,*
- *Arabidopsis thaliana*

UNIT II **14Hrs**

a. Ultra structure of cell and cell organelles:

- Cell Theory: Prokaryotic cell and Eukaryotic cell.

- Cell wall: Ultrastucture. Chemical composition and Function; Extracellular matrix: Cytoskeletal structure - Actins and Microtubules.

- Plasma a membrane: Chemical composition, Utrastructure - Fluid mosaic Model. Functions - Osmosis, Phagocytosis, Pinocytosis, Active Transport.
- Microvilli and Demosomes.

UNIT III **14Hrs**

b. Ultra structure of cell and cell organelles:

- Ultrastructure Chemical composition, Functions of Cytoplasmic Organelles :- Endoplasmic Reticulum, Ribosomes, Centrosomes, Lysosomes, Golgi complex and Peroxisomes.

- Mitochondria: Ultrastructure, Chemical composition, Enzymes and Co- enzymes. Functions — Kreb's cycle, Electron — transport system and Oxidative Phosphorylation.
- Plastids: Types, Ultra structure of Chloroplast and role in Photosynthesis.
- Nucleus: Morphology, Nuclear - envelope; Nucleolus; Nucleoplasm, Chromatin.

UNIT IV **14Hrs**

Cell cycle and cell division:

- Cell cycle: G1, S, G2 and M Phase. Check points.

- Mitosis: Essentials of mitosis, Mitotic apparatus, its structure and chemistry.

Mitotic phases, Cytokinesis. Mitotic blockage and Stimulation of cell division, Significance of Mitosis.

- Meiosis: Stages, Synaptonemal complex, Crossing over and Chiasma formation; Significance of Meiosis.

- Cell senescence and Cell death (Apoptosis): Death of specified cells, Programmed cell death, mechanism of cell Death and significance.

I SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 101)

15 Prs.

1. Microcopy: 02 Prs.
Handling of dissection, stereo and compound microscopes.

2. Model Organisms and their significance in Genetic studies: 05 Prs.
a) Virus - TMV (Tobacco leaves)
b) Bacteriophage - Lambda phage
c) Bacteria - *E coli* (slide)
d) *Neurospora* (slides)
e) *Coenorhabdites elegans*.
f) *Drosophila melanogaster*
g) *Arabidopsis thaliana*

3. Staining Techniques: 04 Prs.
a) RNA & DNA – Methyl green and Pyronin
b) Mitochondria - Janus green
c) Lactobacillus and *E. coli* - Gram Staining

4. Observation of: Mitotic stages in permanent slides 01 Prs.

5. Temporary squash preparation of: Onion root tip for mitosis 03 Prs.

II SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT 201: Principles of Genetics)

56 Hrs.

UNIT I **15Hrs**

b. History of Genetics:

- Definition and scope of Genetics.

- Pre-mendelian genetic concepts- Pre-formation, Epigenesis, Pangenesis, Inheritance of acquired characters, Germplasm theory.
- Heredity and Environment; Genotype and Phenotype; Heredity and Variation.
- Clones, Purelines and Inbred lines.
- Norms of reaction and Phenocopies.

c. Biography of Mendel and his experiments with pea plant.

d. Law of segregation:

- Monohybrid cross, back cross and test cross.
- Dominance and Recessive ness,
- Co-dominance and Incomplete dominance.
- Genetic problems related

d. Law of Independent Assortment:

Dihybrid cross in Pea plant and *Drosophila*,
Back cross and test cross.
Genetic problems related.

UNIT II **14Hrs**

a. Multiple alleles:

- Definition, Eye color in Drosophila, Blood groups and Rh factor in Human.

- Genetic problems related. **b. Gene interactions:**
- Deviations from Mendelism:
  - Inter allelic-
- Complementry gene interaction (9:7) Ex. *Lathyrus odoratus*
- Supplementry gene interaction (9:3:4) Ex. Grain color in Maize.
- Epistasis: - Dominant –Ex. Fruit color in *Cucurbita pepo.*
- Epistasis:- Recessive –Ex. Coat color in Mice.
  - Inter allelic Non Epistatic: Ex. Comb pattern in Fowl.

UNIT III **15Hrs**

Elements of biometry:

- Measures o f Central tendency – Mean, Median and Mode.
- Measures of Dispersion – Range, Variance, Standard deviation and Standard error.
- Test of Hypothesis – Student‘s_t‘ test, Chi square test.
- Probability- Basic concepts; Distribution- Normal, Binomial and Poisson.

UNIT IV **12Hrs**

Sex determination: .

- Chromosomal theory of sex determination-XX-XY, XX-XO, ZZ-ZW; Genic balance theory of Bridges, Y chromosome in sex determination in *Melandrium.*
- Environment and sex determination.
- Hormonal control of sex determination (free martin).
- Gynandromorphs / Intersexes, Super sexes in *Drosophila.*
- Sex differentiation and Dosage compensation (*Drosophila* and Man).

II SEMESTER B.Sc. GENETICS
Practical Syllabus
(Paper – GNP 201)

15 Prs.

1. Study of floral structure of: 02 Prs.
a) Pea / *Crotolaria / Pongamia*,
b) Maize
c) *Arabidopsis / Brassica juncea*.

2. Temporary squash preparation of: 03 Prs.
a) Onion flower buds and
b) Grasshopper testes.

3. Study of: 01 Pr.
a) Flower color in *Antirrhinum / Mirabilis*,
b) Coat color in Mice
c) Comb pattern in fowl. .

4. **Blood typing**. 01Pr.

5. Computation of: 02 Prs.
a) Mean, median and mode,
b) Standard deviation and standard error.

6. Problems on: Student‘s_t‘ test and Chi square test. 02 Prs.

7. Genetic Problems: a) Multiple alleles 02 Prs.
b) Gene Interaction. 02 Prs.

III SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT 301: Cytogenetics)

56 Hrs.

UNIT I **14Hrs**

a. Physical Basis of inheritance:

- Chromosome theory of inheritance.

- Eukaryotic Chromosome- Macro-molecular organization. Primary and Secondary constriction, Sat-bodies, telomeres.
- Heterochromatin and Euchromatin and its significance.

- Ultra structure of chromosome- Nucleosome model and Nucleosome Structure. Karyotype and Idiogram.

b. Special types of Chromosome:

Polytene chromosome- Salivary gland chromosome in *Drosophila*,
Lampbrush chromosome in amphibian Oocyte
B Chromosome.

UNIT II

a. Sex Linkage: **15 Hrs**

Meiotic behavior of chromosome and non- disjunction.

- Bridges theories of non-disjunction.
- Sex linkage in *Drosophila*.
- Sex linked genes in Poultry and moths.
- Sex related genes in maize.
- Attached X-chromosome.

b. Extra Chromosomal Inheritance / Cytoplasmic Inheritance:

- Introduction to Cytoplasmic Inheritance.
- Mitochondrial DNA,
- Chloroplast DNA,
- Kappa articles in *Paramoecium*,
- Sigma factor in *Drosophila*,
- Cytoplamic Male Sterility (CMS) in maize

UNIT III **15Hrs**

a. Linkage:

- Introduction and definition of Linkage,
- Coupling and Repulsion hypothesis,
- Linkage group- *Drosophila*, maize and man,
- Types of linkage-complete linkage and incomplete linkage,
- Factors affecting linkage- distance between genes, age, temperature, radiation, sex, chemicals, nutrition, etc.

b. Crossing over:

- Crossing over- definition and types of crossing over-germinal and Somatic crossing over,

- Cytological basis of crossing over- Sterns experiments in *Drosophila*, Creighton and Mc Clintock experiment in maize,

- Mechanism of crossing over- Chiasma type theory, the breakage first theory, the contact first theory, strain or torsion theory,
- Molecular mechanism of crossing over- Holiday model, single strand breaks,
- Crossing over in *Drosophila* and Tetrad analysis in *Neurospora*,
- Interference and coincidence, Construction of genetic maps*(Drosophila* and maize*)*

UNIT IV **12Hrs**

Chromosomal aberrations:

ιι) Numerical- Euploidy (Monoploidy, Haploidy and Polyploidy)
Polyploidy- Autopolyploidy and Allopolyploidy.
Aneuploidy- Monosomes, Nullisomes and Trisomes.
ιιι) Structural- Deletions, Duplication, Translocation and Inversions.
ιϖ) Evolutionary significance of chromosomal aberrations.s

III SEMESTER B.Sc. – GENETICS

Practical Syllabus

(Paper – GNP 301) 15 Prs.

1. Culturing and Handling of *Drosophila*: 02 Prs.
a) Media Preparation.
b) Cleaning and Sterilization of bottles.
c) Handling of *Drosophila*.

2. Study of at least five types of *Drosophila*: 02 Prs.
a) Body color mutant- Ebony body and Yellow body.
b) Wing mutant- Curly wing and vestigial wing.
c) Eye color mutant- Bar eye, white eye, sepia eye.

3. Mounting of Sex Comb of *Drosophila melanogaster*. 01 Prs.

4. Salivary gland Chromosome- 04 Prs.
a) Dissection of Salivary glands.
b) Preparation of Polytene chromosome.

5. Study of Chromosomal Aberrations: 03 Prs.
a) Observation of permanent slides of chromosomal aberrations.
b) Inversion- Salivary gland chromosomes of *Drosophila nasuta*.
c) Translocation- Flower buds of *Rhoeo discolor*.
d)
Induction of polyploidy in Onion root tips.

6. Genetic Problems on Linkage & Crossing over: 03 Prs.
a) *Drosophila*.
b) Maize.
c) Human (Sex Linkage).

IV SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT401: Molecular Genetics)

56 Hrs.

UNIT I **13Hrs**

a. Chemical Basis of Heredity:

- DNA as genetic material, Experiments of Griffith; Avery, Mc Cleod; Mc Carthy and Harshey Chase.
- RNA as genetic material- Experiment of Fraenkel and Singer.

b. Nucleic acids:

- DNA structure and types
- RNA types and structure
- Ribozymes

c. DNA Replication:

- DNA Replication in prokaryotes and rolling circle model

ε. DNA Replication in eukaryotes

UNIT II **15Hrs**

Gene Expression:

- Genetic code: Brief account.
- Protein synthesis in prokaryotes and eukaryotes.

➢Transcription (―rho‖ dependent and ―rho‖ independent termination) ➢ Post Transcriptional modifications ➢ Translation

- Regulation of Gene expression:-

➢Inducible operons – Galactose

➢Repressible operon – Tryptophan

UNIT III **14Hrs**

a. Genome organisation and Fine structure of the Gene : .

- Prokaryotic genome:- Chromosomal and plasmid
- Eukaryotic genome:- Chromosomal and organellar
- Fine structure of the Gene: Cistron, muton and recon

b. Bacterial Genetics :

- Transformation,
- Transduction-Generalized and specialized:
- Conjugation: F factor mediated, Hfr and Sexduction.

c. Introduction to Genomics and Proteomics

UNIT IV **14 Hrs**

a. Transposable elements :

Maize and *Drosophila*

b. Mutations:

Introduction and Types of Gene mutations - Base substitution, Frame shift mutation (insertion, deletion, missense, nonsense mutation).Mutagens - Physical and chemical. Reverse mutation in bacteria. DNA repair mechanism (Mismatch repair photoreactivation, excision and SOS repair) Beneficial and harmful effects of mutations.

IV SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 401)

15 Prs.

1. Instrumentation: 03 Prs.

a) Centrifuge,
b) Ultra centrifuge,
c) pH meter
d) Electrophoretic unit,
e) Micropipette,
f) Glass homogenizer,
g) Autoclave,
h) Shaker incubator.

2. Extraction of DNA: From 04 Prs.

a) Cauliflower ,
b) Coconut endosperm,
c) Bacteria
d) Liver Tissue

3. Paper Chromatography for Separation of: 03 Prs.

a) leaf pigments,
b) *Drosophila* eye pigments
c) Amino acids

4. Electrophoresis (Demonstration) 02 Prs.

a) Agarose gel electrophoresis
b) PAGE (Polyacrylamide gel electrophoresis)

5. Mutations : 03 Prs.

a) Study of examples of mutations

- Sickle cell Anaemia – Mis – sense mutation.
- Thalassemia – frame shift mutation.
- Identification of point mutation types based on the given representation

 Induction of Mutation in Drosophila and detection of sex linked lethal by Muller 5 stock

V SEMESTER – GENETICS
Theory Syllabus
(Paper – GNT 501: Recombinant DNA Technology)

40 Hrs.

UNIT I **15 Hrs**

a. Introduction to RDT:

Overview of major steps involved

 Tools for RDT:

Enzymes: Restriction endonucleases: Types and characteristic features; Nomenclature; Modification of cut ends, DNA ligases, Other enzymes:A brief account of Alkaline phosphatase, Polynucleotide kinase, Exonuclease III, DNase I, DNA polymerase and Klenow fragment, Terminal nucleotidyl transferase, RNA dependent DNA Polymerase.

Vectors:

Properties of an ideal vector

Types : Cloning and expression vectors

Cloning vectors: i) Prokaryotic vectors: Plasmids- pBR 322; pUC 18;
Bacteriophages- Lambda phage, Cosmids.
Eukaryotic vectors: YAC vectors; Shuttle vectors- Yeast and *E. coli.*
For higher plants: Integrative DNA transfer- *Agrobacterium* vectors-
Ti plasmid-Binary and Co integrated vectors; Non integrative
DNA transfer-Plant viral vectors (CaMV)
For animals: Animal viral vectors- SV 40 (3 types);
Expression vectors in Prokaryotes and Eukaryotes

UNIT II **13Hrs**

a. Isolation of the desired gene:

- cDNA library,
- Genomic library,
- Organo-chemical synthesis,
- Amplification through PCR

b. Direct gene transfer methods:

- Chemical methods,
- Lipofection,
- Electroporation,

Microinjection,
Ballistic method (Particle shot gun method)

c. Selection and screening of recombinants:

Identification and selection of transformed cells: Direct methods-Insertional inactivation, Visual screening method, Plaque formation, Complementation of mutation /nutrition
Indirect methods- Colony hybridization, Immunochemical detection Use of selectable and scorable genes:
Selectable genes: Plants- npt ; Animals-TK
Scorable genes: Plants-Gus; Animals-lux

UNIT III **12Hrs**

a) Technique for RDT:

Gel electrophoresis: AGE and SDS-PAGE
Hybridization: Southern; Northern; Western; Dot blots
Autoradiography
DNA sequencing: Sanger's Dideoxy method
Molecular probes

Applications:

Transgenic animals: Mouse(Knock-out; Methodology, applications); A brief account of Transgenic Sheep, , Poultry, Fish, Cow, , with value added attributes

Transgenic Plants: Resistance to diseases (Pathogen resistant-viral, fungal and bacterial); insects (Bt gene transfer); Fertilizer management- Nif gene transfer.

V SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 501)

15 Prs.

1. Instrumentation: 03 Prs.
a) Microneedle,
b) Magnetic Stirrer,
c) UV Transilluminator,
d) PCR

2. Vecors: 02 Prs.
2. pBR 322 and Cosmid,
3. YAC,
4. Ti plasmid - Binary vector,
5. SV 40 (any one type),

3. Transgenic organisms:
Plants-Bt cotton and Animals-Knock out Mouse 01 Pr.

4. Experiments: 05 Prs.
a) Quantification of DNA by DPA method
b) Quantification of RNA by Orcinol method
c) Agarose Gel Electrophoresis of DNA

5. Demonstrations: 04Prs.
a) Isolation of Plasmid DNA
b) Restriction Enzyme digestion
c) Ligation of DNA fragment
d) Transformation- α complementation

V SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT 502: Basic Human Genetics)

40 Hrs.

UNIT I **14 Hrs**

a. Human Chromosomes:

Normal Human Karotype: Paris Nomenclature , Flow karyotyping (Quantification of DNA of individual chromosomes) FACS-Fluorescence activated cell sorter

b. Genetic Diseases and Inheritance Pattern:

- **Autosomal inheritance- Dominant**
  (Ex.- Adult polycystic kidney, Achondroplasia and Neurofibromatosis)
- **Autosomal inheritance- Recessive**
  (Ex.- Albinism, Sickle cell anemia , Phenylketonuria)
- **X-linked – Recessive:** (Ex.- Duchenne muscular dystrophy-DMD)
- **X-linked ; Dominant** (Ex.- Xg blood group)
- **Y-linked inheritance** (Holandric gene Ex.- Testes determining factor - TDF)

Multifactorial inheritance
(Ex.-Congenital malformations- Cleft lip and palate , Rheumatoid arthritis and Diabetes)

Mitochondrial diseases: (Ex.- Leber's heriditary optic neuropathy)

c. Pedigree studies and Genetic Counseling:

Symbols used in pedigree studies, Pedigree analysis & construction,
Pedigree analysis for the inheritance pattern of genetic diseases,

Genetic Counseling.

Stage 1: History and pedigree construction

Stage 2: Examination

Stage 3: Diagnosis

Stage 4: Counseling

Stage 5: Follow up

UNIT II **14 Hrs**

a. Immunology and Immunogenetics:

- Introduction to immunology,
- Cells of immune system,
- Genetics of immune system,
- Immune response, immunity-innate & acquired.
- Inherited immunodeficiency- Ex. – X- linked agammaglobulinaemia.
- Major Histocompatibilty Complex- Study of twins (MHC),
- HLA disease associations.
- Transplantation, graft-versus-host disease.

b) Oncogenetics:
Properties of malignant cells,
Types of genes - Proto oncogenes, Oncogenes, Cellular oncogenes,
Tumor Suppressor genes,
Chromosomal abnormalities associated with the specific
malignancies- APL, CML & Retinoblastoma

UNIT III **12 Hrs**

a) Dermatoglyphics:
Introduction and classification, Flexion creases.
Dermatoglyphics in clinical disorders.
Clinical applications, its advantages and limitations.

b) Prenatal Diagnosis:
Introduction and Definition.

Various procedures used such as Amniocentesis, Chorionic villus sampling,
Ultrasonography and Fetoscopy.

c) Genetics and Society:
Eugenics: Positive and negative, Euthenics, Euphenics
Human genome project
Gene therapy with reference to Haemophilia
Stem cells- Definition, types & sources.
A brief account on Cord blood banking and Stem cell therapy.

V SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 502)

15 **Prs**.

1. Study of Mendelian traits: 2 Prs.
Straight hair (recessive), Curly hair, Widow's peak,
Dimpled cheeks, Mid digital hair, Hitchiker's thumb,
Clasping of hands, Attached earlobe.

2. Study of Karyotypes I: Normal Karyotyping in Humans 1Pr.
- Male (46,XY)
- Female (46, XX).

3. Study of Karyotypes II: Abnormal Karyotypes 1Pr.
- Down syndrome (autosomal).
- Turner syndrome (sex chromosomal)
- Kleinfelter syndrome (sex chromosomal)

4. Sex chromatin: 2Prs.
- Buccal smear study and staining methods for Barr bodies
- Blood smear study of drum sticks in Nuetrophils

5. Blood Cell counting: using Haemocytometer (RBC and WBC) 3 Prs.

6. Pedigree analysis: 2 Prs.

Symbols used in autosomal recessive disorder autosomal dominant disorder,
Sex chromosomal (X & Y linked).

7. Dermatoglyphics: 2 Prs.

Recording of print of fingertips and plam.
Classify ridges on the Finger tips arch, loop, and whorl.
Palm print - area demark as hypothenar, thenar and inter - digital areas
Record presence or absence of Simian crease.
Ridge Counting and atd angle calculation.

8. Immunology: 2 Prs

Demonstration of i. Octourlony Double Diffusion (ODD)
ii. Radial Immuno Diffusion (RID)

VI SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT 601: Developmental and Evolutionary Genetics)

40 Hrs.

UNIT I 13 Hrs

Developmental Genetics:

- General topics: - Role of Nuclear transplantation in development: Ex.:Amphibians and *Acetabularia.* Switching genes on and off during development- Tissue specific methylation. Ex. Differential expression of haemoglobin genes.
- Fate mapping.
- The genetics of development in plants- ***Arabidopsis***.: Flower development (floral morphogenesis and Homeotic gene expression).
- The genetics of development in Animals- ***Drosophila:*** Early development; Origin of anterior-posterior polarity:- Role of Maternal genes, Segmentation genes (gap, pair rule and segment polarity genes) and Homeotic selector genes; Establishment of dorso -ventral polarity.

UNIT II 14 Hrs

a. Evolutionary Genetics:

Darwinism, Mutation theory and Neo Darwinism, Synthetic Theory.
Evolution at molecular level: - Nucleotide sequence.
Isolation Premating and post mating isolating mechanisms, role of isolation in Speciation.
Speciation: Methods of speciation-Allopatric and sympatric

b. Population Genetics:

Gene pool, Gene and genotype frequencies: Hardy-Weinberg principle,
Evolutionary agents:- Selection – differential selection, gametic selection, zygotic selection, fitness;
Migration; Mutation and Random drift.
Problems related.

c.Quantitative characters & inheritance:

Quantitative Characters:-Types- Continuous, meristic and thresh hold characters with examples.
Quantitative inheritance:-Features of polygenic traits in relation to oligogenic traits.
Assumptions of polygenic inheritance. Inheritance of kernel color in wheat, and skin colour in human.
Transgressive inheritance. Environmental effects.

UNIT III 13 Hrs

Biometrical Genetics:

- An introduction to Correlation, Regression and ANOVA (Analysis of Variance)
- Genetic analysis of quantitative trait:- Ear length in Corn
- Variances in polygenic traits: - Phenotypic, genotypic, environmental, additive, dominance and Epistatic variance; Genotype and environmental interaction.

- Heritability: - Broad sense and Narrow sense heritability, Methods of estimation of heritability, Response to selection.
- Quantitative trait loci (QTL).
- Significance of polygenic inheritance in as animal breeds.
- Problems related to Variance and Heritability.
-

VI SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 601)

15 Prs.

1. Differential staining of blood sample 02 Prs.
2. Genetics of development in *Arabidopsis* –Homeotic gene expression (Slide/Chart) 02 Prs.
3. Genetics of development in *Drosophila*- Anterior and posterior polarity/Metarnal genes/ Segemntation genes/Homeotic genes/ dorsoventral polarity (Slide/Chart) 02 Prs.
4. Study of Quantitative inheritance in Kernal color in wheat/Skin colour in man(Chart) 01Pr.
5. Biometrical problems: Minimum 5 problems in each topic 08 Prs.
6. Quantitative Inheritance: Problems on Kernel color in Wheat, Ear length in Corn and Skin color in Human.
7. Genetic problems on polygenic variance and Heritability.
8. Problems in Population Genetics.

VI SEMESTER B.Sc. – GENETICS
Theory Syllabus
(Paper – GNT 602: Applicative Genetics)

40 Hrs.

UNIT I — 13 Hrs

a. Genetics in Medicine & Industry:

Production of recombinant Insulin, Interferon and Human Growth hormone (HGH)
Vaccines- Hepatitis B vaccine.

Preparation of DNA probes, Monoclonal antibodies and Diagnostic kits (Typhoid, Syphilis).

b. DNA Fingerprinting:

Methodology of DNA fingerprinting.
Molecular markers-RFLP & RAPD, Micro satellite, SNPs, STR.
Applications with examples in forensic science, medico legal aspects, wild life crying.

c. Bioinformatics:

- Introduction, World Wide Web – Types of Web sites
- Internet - Types of information
- Bioinformatics in Genome analysis

UNIT II — 14 Hrs

a.Genetic Resources and Biodiversity:

- Germplasm, classification, Germplasm activities, and organizations associated with germplasm (NBPGR, IBPGR).

- Genetic Erosion, biodiversity, centers of Diversity, Vavilovian Centers of Diversity, Law of Parallelism,
- Gene sanctuaries, Gene bank and Cryopreservation.

b Introduction to plant tissue culture

- Embryo, Anther and Ovary Cultures
- Shoot and Root Meristem Cultures
- Callus Culture from Undifferentiated cells
- Protoplast Culture

- Economic benefits of Tissue Culture—Resistance to pests and Pathogens, Improvement in Nutritive value etc.

UNIT III — 13Hrs

Heterosis in Animals and Plants:

Introduction to Heterosis and characteristics

In Animals:

a. Animal breeding – Introduction to animal breeds, inbreeding,

grading, cross breeding.

b. Fish breeding (Selection, Induced Polyploidy,Gynogenesis and Androgenesis, Inbreeding)
c. Production of breeds: crossing of inbred lines for commercial production.

d. Breeding strategies for improvement of livestock for milk, meat, wool production.
e. Breeding strategies for improvement of Poultry.

In Plants:

a. Genetic concepts- dominance – over dominance. Estimation of heterosis- Heterobeltosis, Economic heterosis,Standard heterosis .

b. Hybridization techniques – intergeneric and interspecific hybridization. Identification of hybrid plants.
c. Inbreeding depression.
d. Hybrid vigor exploitation in Rice, Tomato.

VI SEMESTER B.Sc. – GENETICS
Practical Syllabus
(Paper – GNP 602)

15 Prs.

1. **Tissue culture techniques:** 6 Prs.
   - . Sterilization
   - Explants preparation
   - Media Composition and preparation
   - Culturing of all kinds of explants for callus induction, multiple shoot proliferation.
   - Synthetic seed preparation
2. **Study of different techniques in plant hybridization** 1 Pr.
3. **Study of pollen fertility** 2 Prs.
4. **Study of diagnostic kits –** WIDAL & VDRL 2 Prs.
5. **Study of hybrid plants**- Rice, Cotton, Chilly, and Tomato**.** 1Pr.
6. **Study of hybrid animals**- Poultry, dairy, fishery**.** 1Pr.
7. One day field visit to Plant/ animal breeding Insitutes. 2Prs.

Report to be submitted during practical exam

SEMESTER-I

BTT 101 – CELL BIOLOGY AND GENETICS

Total hours: 52

PART A: CELL BIOLOGY

Unit 1. Cell as a Basic unit of Living Systems

Discovery of cell, The cell Theory.

Ultra structure of an eukaryotic cell- (Both plant and animal cells)

Unit 2. Surface Architecture

Structural organization and functions of plasma membrane and cell wall of eukaryotes.

Unit 3. Cellular Organelles

Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin).

Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).

Unit 4. Chromosomes

Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype.

Ultrastructure: Single-stranded and multi-stranded hypothesis, folded- fibre and nucleosome models

Special type of chromosomes: Salivary gland and Lampbrushchromosmes.

Unit 5. Cell Division

Cell Cycle and regulation, mitosis and meiosis.

Unit 7. Cell Senescence and programmed cell death

PART B: GENETICS

Unit 1. Structure of DNA and RNA – a brief account

Unit 2.Mendelism

Mendel's work, Laws of heredity, Test cross, Incomplete dominance and simple Problems.

Unit 3. Interaction of Genes

Supplementary factors: comb pattern in fowls

Complementary genes- Flower colour in sweet peas

Multiple factors – Skin colour in human beings

Epistasis – Plumage colour in poultry

Multiple allelism: Blood groups in Human beings.

Unit 4. Sex Determination in Plants and animals

Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types

Unit 5. Linkage and Crossing Over

Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.

Unit 6. Chromosomal variations

A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.

Unit 7. Cytoplasmic Inheritance

Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in paramecium.

Unit 8. Mutations

Types: Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Mutations in plants, animals and microbes for economic benefit of man.

Unit 9. Human Genetics

Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).

SEMESTER - I

BTP 102 – Cell biology and Genetics

Total units: 15

1. Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
2. Cell division: Mitotic and meiotic studies in grasshopper testes, onion root tips and flowerBuds
3. Chromosomes: Mounting of polytene chromosomes
4. Buccal smear - Barr bodies
5. Karyotype analysis - Human and Onion
Human – Normal and Abnormal – Down and
Turner's syndromes (With the help of slides)
6. Simple genetic problems (Problems on
Interaction of genes)
7. Isolation of Mitochondria
8.Vital staining of Mitochondria
9. RBC cell count by Haemocytometer

SEMESTER II

BTT 201- GENERAL MICROBIOLOGY AND BIOSTATISTICS

PART A: GENERAL MICROBIOLOGY

Unit 1. Introduction and Scope of Microbiology

Definition and history of Microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming. Importance of Scope of Microbiology as a modern science Branches of Microbiology.

Unit 2. Microscopy

Constructions and working principles of different types of microscopes – Compound, Dark field, Phase contrast, Fluorescence and Electron (Scanning and Transmission)

Unit 3. Microbial Techniques

A). STERILIZATION: Principles and applications of

a. Physical Methods: Autoclave, Hot air oven, laminar airflow, Seitz filter, sintered glass Filter and Membrane filter.

b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.

c. Radiation Methods: UV rays and Gamma rays.

B). STAINS AND STAINING TECHNIQUES: Principles of staining, Types of stains- Simple Stains, Structural stains and Differential stains

Unit 4. Microbial Taxonomy

Concepts of Microbial species and strains, Classification of bacteria based on Morphology (Shape and flagella), Staining reaction, nutrition and extreme environment

Unit 5. General Account of Viruses and Bacteria

A. VIRUSES – Structure and classification Plant Viruses – CaMV
Animal Viruses – Hepatitis B Bacterial Viruses – Lambda phage

B. BACTERIA – Ultra structure of a bacterial cell, cell wall, endospore and capsule

Unit 6. Eukaryotic Microorganism

Salient features, Classification and reproduction of fungi, mycoplasma and algae.

Unit 7. Pathogenic Microorganisms

A. Bacterial diseases of man – Tetanus, Tuberculosis, Typhoid and Cholera

B. Viral diseases: AIDS (HIV).

Unit 8. Microbial Metabolism

A) Respiration: EMP, HMP and ED Pathways, Kreb's cycle, Oxidative Phosphorylation.

B) Bacterial Photosynthesis: Photosynthetic pigments in Prokaryotes, Photophosphorylation & Dark reaction.

PART B-BIOSTATISTICS

Unit 1. Importance and application

Tabulation and classification of data, Frequency distribution and Graphical distribution of data.

Unit 2. Measures of Central Tendencies

Mean, Median, Mode and their properties

Unit 3. Measures of Dispersion

Mean deviation, Variance, Standard deviation and Coefficient of Variation

Unit 4. Hypothesis Testing

Student *t* and Chi-square test

Unit 5. Probability and Distribution

Concepts and problems on probability, Binomial, Poisson, Normal Distribution and their applications

BTP 202-GENERAL MICROBIOLOGY

1. Safety measures in microbiology laboratory
2. Cleaning and sterilization of glass wares
3. Study of instruments: Compound microscope, Autoclave, Hot air oven, PH meter, Laminar airflow and centrifuge.
4. Staining Techniques: Simple, Negative staining, Gram staining, Endospore staining fungal Staining, Bacterial mobility by hanging drop method.
5. Media preparation: Nutrient agar, MRBA and Nutrient broth.
6. Isolation of bacteria and fungi from soil, air, and water- dilution and pour plate methods.
7. Estimation of microorganisms - Total Count (haemocytometer)
8. Antibiotic sensitivity test – paper disc method
9. Biochemical tests – starch hydrolysis, catalase & gelatin liquefaction.
10. Study of Rhizobium from root nodules of legumes.

SEMESTER III BTT 301- BIOCHEMISTRY AND BIOPHYSICS

PART-A: BIOCHMEISTRY

Unit 1. Amino acids Classification and properties due to intra, centre and side chain, titration against acid and abase.

Unit 2. Proteins

Classification based on structure and functions, structural organization of proteins (Primary, secondary, tertiary and quaternary structure)

Unit 3.Enzymes

Introduction, classification, enzyme kinetics, factors influencing enzyme activity, co-Enzymes and co-factors.

Unit 4.Carbohydrates

Structure, properties and classification with examples, Carbohydrates as a source of Energy.

Unit 5.Lipids

Structure, properties and classification and functions.

Unit 6.Vitamins

Water Soluble and fat-soluble vitamins, Dietary source.
Unit 7.Hormones Steroid hormones- structure O, E_2, P_4, Glucocortocoid hormones.
mechanism of steroid hormone action.

PART-B: BIOPHYSICS

Unit 1. Introduction and scope of Biophysics.
Unit 2.pH and buffer concepts.
Unit 3. Chemical bonding – Ionic bond, covalent bond, hydrogen bond and peptide bond Vander waals forces, Principles of thermodynamics
Unit 4. Analytical techniques
Principles and applications of
a) Chromatography (Paper, thin – layer, column, GLC and HPLC)
b) Centrifugation (RPM and G, Ultra centrifugation
Unit 5.**Spectroscopic techniques**
Principles and applications of UV, Visible spectroscopy, X-ray crystallography, NMR, IR, fluorescence & atomic absorption.
Unit 6. **Iosotopes**
Types, their importance in biological studies, measure of radioactivity, GM counters and Scintillation counting.

BTP 302- Biochemistry and Biophysics

1. Preparation of Buffers-Citrate and Phosphate
2. Estimation of reducing sugars (Glucose, Maltose and Lactose) by DNS and Somoji's Methods
3. Estimation of Protein by Biuret method and Lowry's method
4. Assay of enzyme activity- Amylase
5. Separation of Sugars by TLC.
6. Estimation of Amino acids by ninhydrin method.
7. Estimation of inorganic phosphate by Subba row method

SEMISTER IV

BTT- 401 – MOLECULAR BIOLOGY

Unit 1.Molecular basis of life – an introduction RNA and DNA as genetic material, experimental proof of DNA as genetic material.

Unit 2.Nucleic Acids

Structure and functions of DNA and RNA

Watson and Crick model of DNA and other forms of DNA (A and Z)

Functions of DNA and RNA including ribozymes

Unit 3. DNA Replication

Prokaryotic and Eukaryotic – Enzymes and proteins involved in replication, Theta model and Rolling circle model

Unit 4. DNA Repair

Causes and mechanism – photoreactivation, excision repair, mismatch repair, SOS repair.

Unit 5. Recombination in prokaryotes

Transformation, Conjugation and Transduction

Unit 6. Structure of Prokaryotic and Eukaryotic gene – genetic code, Properties and wobble hypothesis

Unit 7. Transcription in Prokaryotes and Eukaryotes

Mechanisms, Promoters and RNA polymerase, transcription factors, Post transcriptional modifications of eukaryotic mRNA.

Unit 8. Translation

Mechanism of translation in prokaryotes and Eukaryotes, Post translational modification of Proteins.

Unit 9. Regulation of Gene Expression

Regulation of Gene expression in Prokaryotes – Operan concept (Lac and Tryp)

Regulation of Gene expression in Eukaryotes – transcriptional activation, galactose metabolism in yeast.

Unit 10. Gene organization and expression in Mitochondria and chloroplasts.

Unit 11. Insertional elements and transposons.

Transposable elements in Maize and Drosophila.

BTP 402 – Molecular Biology

1. Preparation of DNA model
2. Estimation of DNA by DPA method
3. Estimation of RNA by Orcinol method
4. Column chromatography – gel filtration (Demo)
5. Extraction and partial purification of protein from plant source by Ammonium Sulphate precipitatic
6. Extraction and partial purification of protein from animal source by organic solvents
7. Protein separation by polyacrylamide gel electrophoresis
8. Charts on conjugation, transformation and transduction