

2018  
-19

# Multani Mal Modi College, Patiala

Unit Planning B. Sc (Hons.) Biotechnology



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**(2018-19)**

**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( 1<sup>st</sup>SEMESTER)**

**Paper: BHB1**

**Subject: Biochemistry & Metabolism**

**Max Marks: 74**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

**Amino acids & Proteins:** Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins. Fibrous and globular proteins.

**Carbohydrates:** Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions.

**Lipids:** Structure and functions-Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, lipoproteins.

**Nucleic acids:** Structure and functions: Physical & chemical properties of Nucleic acids,

Nucleosides & Nucleotides, purines & pyrimidines. Biologically important nucleotides,

**DNA structure** and forces responsible for A, B & Z - DNA, denaturation and renaturation of DNA.

**TILL MST-II**

**Enzymes:** Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites,

**Enzyme specificity:** types & theories.

**Carbohydrates Metabolism:** Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions.

**TILL FINAL EXAM**

**Pathways:** Pentose phosphate pathway and its significance Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)

UNIT PLANNING (SESSION 2018-19)

2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**BSc-I Biotechnology(Hons.) SEMESTER-I**  
**Paper- BHB3**  
**Subject : English Communication skills**

**Max Marks: 75**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
The Kabuliwallah : Rabindranath Tagore The Eyes Are Not Here: Ruskin Bond The Death of A Hero: Jai Nimbkar, Grief: Anton Chekov, Unit 1 to 13, A5.  Uncle Podger Hangs A Picture: Jerome K. Jeromentonyms  Synonyms
<b>TILLMST-II</b>
Words Denoting Numbers, Words Denoting Places, Words Denoting Professions or Trades, Unit 14 to 26, The Doctor's Word: R.K. Narayan,
<b>TILLFINAL EXAM</b>
Names by which persons with certain characteristics are known, Words frequently mis-spelt.

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( 1<sup>st</sup>SEMESTER)**

**Paper: BHB1**  
**Subject: Cell Biology**

**Max Marks: 74**

**Maximum Time: 3 Hrs.**

<b>TILL MST-I</b>
<p><b>Cell:</b> Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation.</p> <p><b>Cell Membrane and Permeability:</b> Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.</p> <p><b>Membrane Vacuolar system, cytoskeleton and cell motility:</b> Structure and function of microtubules, Microfilaments, Intermediate filaments.</p> <p><b>Endoplasmic reticulum:</b> Structure, function including role in protein segregation.</p> <p><b>Golgi complex:</b> Structure, biogenesis and functions including role in protein secretion.</p> <p><b>Lysosomes:</b> Vacuoles and micro bodies: Structure and functions</p> <p><b>Ribosomes:</b> Structures and function including role in protein synthesis.</p>
<b>TILL MST-II</b>
<p><b>Mitochondria:</b> Structure and function, Genomes. Chloroplasts: Structure and function, genomes.</p> <p><b>Nucleus:</b> Structure and function, chromosomes and their structure.</p> <p><b>Extracellular Matrix:</b> Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.</p>
<b>TILL FINAL EXAM</b>
<p><b>Cancer:</b> Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis cancer.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( 1<sup>st</sup>SEMESTER)**

**Paper: BHB4**  
**Subject: Chemistry**

**Max Marks: 74**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, quantum numbers, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions. Position of element in the periodic table. Atomic and ionic radii, ionization energy, electronic affinity and electronegativity. Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.</p> <p>Intermolecular forces, structure of liquids Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states. Molecular velocities: Root mean square, average and most probable velocities. Liquifacation of gases (based on Joule-Thomson effect).</p>
<b>TILLMST-II</b>
<p>Nomenclature and isomerism in alkanes, methods of formation, physical properties and Chemical reactions. Nomenclature of alkenes-methods of formation, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes.</p> <p>Optical activity, polarization, orientation of dipoles in an electric field, dipole moment. Induced dipole moment, measurement of dipole moment temperature method and refractivity method.</p>
<b>TILLFINAL EXAM</b>
<p>Dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism.</p>

### Mode of Assessment

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**BSc-I Biotechnology (Hons.) SEMESTER-I**  
**Paper- BHB5**  
**Subject : Punjabi**

Max Marks: 75

Maximum Time: 3 Hrs.

<b>TILLMST-I</b>
<b>TILLMST-II</b>
<b>TILLFINAL EXAM</b>

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( II SEMESTER)**

**Paper: BHB6**  
**Subject: Mammalian Physiology**

**Max Marks: 74**

**Maximum Time: 3 Hrs.**

<b>TILL MST-I</b>
<p><b>Digestion:</b> Mechanism of digestion &amp; absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice</p> <p><b>Respiration:</b> Exchange of gases, Transport of O<sub>2</sub> and CO<sub>2</sub>, Oxygen dissociation curve, Chloride shift.</p> <p><b>Composition of blood,</b> Plasma proteins &amp; their role, blood cells, Haemopoiesis, Mechanism of coagulation of blood.</p> <p><b>Mechanism of working of heart:</b> Cardiac output, cardiac cycle, Origin &amp; conduction of heart beat.</p> <p><b>Structure of cardiac,</b> smooth &amp; skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction.</p>
<b>TILL MST-II</b>
<p>Physical, chemical &amp; electrical events of mechanism of muscle contraction.</p> <p><b>Excretion:</b> modes of excretion, Ornithine cycle, Mechanism of urine formation.</p> <p><b>Mechanism of generation &amp; propagation of nerve impulse,</b> structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters. Mechanism of action of hormones (insulin and steroids).</p>
<b>TILL FINAL EXAM</b>
<p><b>Different endocrine glands-</b> Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo &amp; hyper-secretions.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( II SEMESTER)**

**Paper: BHB7**

**Subject: Plant Anatomy & Physiology**

**Max Marks: 74**

**Maximum Time: 3 Hrs.**

<b>TILL MST-I</b>
<p><b>Anatomy:</b> The shoot and root apical meristem and its histological organization, simple &amp; complex permanent tissues, primary structure of shoot &amp; root, secondary growth, growth rings, leaf anatomy (dorsi-ventral and isobilateral leaf).</p> <p><b>Plant water relations:</b> Importance of water to plant life, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata &amp; their mechanism of opening &amp; closing.</p> <p><b>Micro &amp; macro nutrients:</b> criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport.</p> <p><b>Photosynthesis-</b> Photosynthesis pigments, concept of two photo systems, photophosphorylation, calvin cycle, CAM plants, photorespiration, compensation point.</p>
<b>TILL MST-II</b>
<p><b>Nitrogen metabolism-</b> inorganic &amp; molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants.</p> <p><b>Growth and development:</b> Definitions, phases of growth, growth curve, growth hormones (auxins, gibberlins, cytokinins, abscisic acid, ethylene).</p>
<b>TILL FINAL EXAM</b>
<p><b>Physiological role and mode of action,</b> seed dormancy and seed germination, concept of photoperiodism and vernalization.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**B.Sc.(HONS.) BIOTECHNOLOGY PART I ( II SEMESTER)**

**Paper: BHB9**  
**Subject: Chemistry II**

Max Marks: 74

Maximum Time: 3 Hrs.

**TILLMST-I**

**Ionic Solids-** Concept of close packing, Ionic structures, semiconductors, lattice energy, solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and bond theories.

**Solutions, Dilute Solutions and Colligative Properties-** Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficients. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, elevation of boiling point and depression of freezing point.

**Chemical Kinetics and catalysis-** Rate of a reaction, factors influencing the rate of a reaction- concentration, temperature, pressure, solvent, light, catalyst. Characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Theories of chemical kinetics, effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy. Catalysis and general characteristics of catalytic reactions. Homogeneous catalysis, acid base catalysis and enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis and its mechanism.

**TILLMST-II**

Concept of isomerism. Types of isomerism: Optical isomerism-elements of symmetry, molecular chirality, enantiomers, optical activity, properties of enantiomers, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. D & L and R & S systems of nomenclature. Geometric isomerism, E & Z system of nomenclature. Conformational isomerism. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Definition of colloids, classification of colloids. Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure.

**TILLFINAL EXAM**

Stability and carbon-carbon bond lengths of benzene, resonance structure, Huckel rule. Aromatic electrophilic substitution, role of  $\sigma$  and  $\pi$  complexes. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**BSc-I Biotechnology(Hons.) SEMESTER-II**  
**Paper- BHB8**  
**Subject : English Communication skills**

Max Marks: 75

Maximum Time: 3 Hrs.

<b>TILLMST-I</b>
The Kabuliwallah : Rabindranath Tagore The Eyes Are Not Here: Ruskin Bond The Death of A Hero: Jai Nimbkar, Grief: Anton Chekov, Unit 1 to 15.  Uncle Podger Hangs A Picture: Jerome K. Jeromentonyms  Words denoting Numbers  Words denoting Places
<b>TILLMST-II</b>
Words Denoting Numbers, Words Denoting Places, Words Denoting Professions or Trades, Unit 16 to 21, The Doctor's Word: R.K. Narayan,
<b>TILLFINAL EXAM</b>
Names by which persons with certain characteristics are known, Unit 22 to 26, Words frequently mis-spelt.

### Mode of Assessment

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**

**UNIT PLAN**

**BSc-I Biotechnology(Hons.) SEMESTER-II**

**Paper- BHB10**

**Subject : Punjabi**

**Max Marks: 75**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<b>TILLMST-II</b>
<b>TILLFINAL EXAM</b>

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**B. Sc. Biotechnology -II(SEMESTER-III)**

**Paper: I (2018-19)**

**Subject: English**

**Max Marks: 75**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>An essay of 300-350 words on a topical or reflective subject (one to be attempted out of the five given).</p> <p>Letter-writing with internal choice between personal and official letters.</p> <p>Precise.</p> <p>Comprehension of an unseen passage</p> <p>Translation of a given passage from Punjabi/Hindi into English.</p>
<b>TILLMST-II</b>
<p>Analysis of sentences: Converting simple sentences into complex and compound ones and identifying adverb clause, noun clause and adjective clause in the given sentences.</p> <p>Synthesis of sentences: (i) combining two simple sentences into a single simple sentence by using a participle, an infinitive, a noun or phrase in apposition, too/ enough + adjective/adverb + infinitive and the bare infinitive. (ii) Combining simple sentences into complex ones by using a noun clause, adjective clause or an adverb clause. (iii) Combining simple sentences into compound ones by using conjunctions such as 'and', 'as well as', 'not only....but also' or 'either..... or', 'neither.....nor', 'but yet', 'nevertheless', 'so', 'therefore', for each.</p> <p>Transformation of sentences. (i) Transformation of degree, i.e., from positive to comparative degree and positive to superlative degree.</p>
<b>TILLFINAL EXAM</b>
<p>Transformation of kinds of statements, i.e. from rhetorical or interrogative into assertive statements, from affirmative into negative sentences and from statement into exclamatory sentences. (iii) Transformation from active into passive voice and vice-versa and from direct speech into indirect speech and vice-versa.</p>

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part II (Semester-III)**

**Paper -II**

**Subject: INORGANIC CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
Coordination Compounds: Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Oxidation and Reduction: Use of redox potential data-analysis of redox cycle, redox stability to water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.
<b>TILLMST-II</b>
Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases. Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics.
<b>TILLFINAL EXAM</b>
reaction in non-aqueous solvents with reference to liquid $\text{NH}_3$ and liquid $\text{SO}_2$ .

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part II (Semester-III)**

**Paper -II**

**Subject: ORGANIC CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Carboxylic Acids: Nomenclature, structure and bonding. physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxyacids, maleic and tartaric acid, citric acids. (Structural formula only). Methods of formation and chemical reaction of unsaturated monocarboxylic acids. Dicarboxylic acids, methods of formation and effect of heat and dehydrating agents. Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, esters. amides and acid anhydrides. Relative stability and reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterification and hydrolysis (acidic and basic).</p>
<b>TILLMST-II</b>
<p>Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autooxidation, Ziesel' s Method. Synthesis of epoxide, acid and base catalysed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide. (3 Hrs.) Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. (3 Hrs.) Organic Compounds of Nitrogen (a) Nitro Compounds: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid.</p>
<b>TILLFINAL EXAM</b>
<p>Amines: Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines Separation of a mixture secondary and tertiary amines. Structural features effecting the basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hoffmann bromamide reaction.</p>

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part II (Semester-III)**

**Paper -II**

**Subject: PHYSICAL CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Phase Equilibrium: Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems.</p> <p>Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag systems, desilverisation of lead.</p> <p>Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-Hp), (FeCl<sub>3</sub>-H<sub>2</sub>O) systems. Freezing mixtures, acetone-dry ice.</p> <p>Liquid-Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law.</p> <p>Non-ideal system-azeotropes-HCl-HP and ethanol-water systems.</p> <p>Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation.</p> <p>Nernst distribution law, thermodynamic derivation &amp; applications.</p> <p>Electrochemistry-I (a): Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.</p> <p>Migration of ions and Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only).</p>
<b>TILLMST-II</b>
<p>Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K<sub>a</sub> of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.</p> <p>Electrochemistry-II: Types of reversible electrodes-gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode. potential, sign conventions, electrochemical series and its significance.</p> <p>Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.</p> <p>EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage.</p>
<b>TILLFINAL EXAM</b>
<p>Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations.</p> <p>Definition of pH and pK<sub>a</sub>, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.</p> <p>Buffers - mechanism of buffer action, Henderson-Hasselbalch equation, Hydrolysis of salts,</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part II (Semester-III)**

**Paper III**

**Subject: Biochemistry**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

## TILL MST-I

**Introduction to Biochemistry**, water as a biological solvent, dissociation of water, pH, buffer solutions, Handerson Hasselbalch equation. Amino acids, amino acids titration curves, physical & chemical properties of amino acids, peptide bonds, rigid & planar nature of a peptide bond, Ramachandran Plot, folding of peptide chains into regular repeating structure (helix, pleated sheets),  $\beta$  turns in polypeptides.

**Amino acid** sequencing of polypeptides. Proteins: Levels of structure in protein architecture, forces stabilizing structure and shape of proteins, native proteins & their conformations, denaturation of proteins, protein folding & design.

**Carbohydrates:** Fisch & Hawarth structures of carbohydrates, stereoisomerism & mutarotation, anomeric forms of monosaccharides, reactions of monosaccharides, characteristics of the aldehyde, ketones and hydroxyl groups, glycosidic bonds, amylase, amylopectin, starch., cellulose, chitin, pectins, glycosaminoglycans (mucopolysaccharides).

**Structure & functions of lipids**, fatty acids, triacylglycerols, glycerophospholipids, sphingomyelins, lipoproteins, Liposomes, biological membranes and micelles.

$\beta$ -Oxidation of fatty acids, formation of Ketone bodies, Biosynthesis & catabolism of triglycerides, phosphoglycerides & sphingolipids, synthesis of cholesterol and fatty acids.

## TILL MST-II

**Nucleic Acids:** Structure & properties of purine and pyrimidine bases. Nucleosides and nucleotides, biological function's of DNA and RNA species. Double helical model of DNA & forces responsible for it. Short hand representation of nucleic acid back bone, denaturation of DNA, methods for isolation and purification of nucleic acids. Biosynthesis & degradation of purines and pyrimidines.

Deamination, Transamination, decarboxylation reaction, hormones and vitamins, Urea cycle.

**Metabolic pathways:** Basic concept & design, glycolysis, TCA cycle, Pentosephosphate pathway, gluconeogenesis & glycogen metabolism.

## TILL FINAL EXAM

UNIT PLANNING (SESSION 2018-19)

**Enzymes** and coenzymes, units of enzyme activity, enzyme nomenclature and classification. Enzyme Kinetics, effect of substrate concentration on Michaelis - Menten equation, effect of pH and temperature on rates of enzymes catalyzed reaction.

**Enzyme inhibitors** and their importance, chemical methods of active site studies, Introduction of multi substrate enzymes, allosteric enzymes and enzyme regulation, isoenzymes, enzyme immobilization.

Mode of Assessment		
Sr. No.	Component	Weightage
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**BSc-II Biotechnology SEMESTER-III**

**PAPER-IV**

**Subject: Genetics**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

**Genetic material:** Evidence of DNA as genetic material; Griffith's transformation experiments Hershey and Chase experiment; Structure of DNA: Watson-Crick model; Structure of RNA: Clover leaf structure of RNA; eukaryotic mRNA-capping, polyadenylation.

**Genome concept:** Chromosome structure-Prokaryotic and eukaryotic chromosome nucleosome structure; Chromosome morphology: Position of centromere banding pattern, Telomeres; Nucleolar organizer region (NOR); Heterochromatin and euchromatin. Aneuploidy and polyploidy, Trisomy 21, Down's syndrome.

**Mendel's Laws:** Principle of segregation; Principle of independent assortment; Mode of inheritance: Recessive, Dominant, Sex linked, etc.; Extra chromosomal-Mitochondrial, chloroplast and plasmid inheritance DNA.

**Mutations:** Spontaneous (Basic mechanism) and induced mutagens; chemical: Base analogs, Base modifiers, intercalating agents; Physical: Ionizing and non-ionizing radiations.

**DNA replication:** Photoreactivation; Excision repair; Mismatch repair; SOS repair. Bacterial DNA replication; DNA replication in eukaryotes; Reverse transcription in retrovirus.

**Gene transcription:** Characteristics of genetic code, Transcription in prokaryotes and Transcription in eukaryotes: RNA polymerase, I, II, and III; Transcription factors, promoters and initiation complex.

**TILL MST-II**

**Regulation of gene expression in prokaryotes:** Organization of *E. coli* genes, Operon hypothesis. Regulations of gene expression in eukaryotes: Promoters enhancers, Response elements motifs: Zinc finger, Helix turn helix; Transcription factors, Hormones, Cytokines.

**Translation:** Charging of RNA initiation, elongation termination; Post translational modifications.

**Population genetics:** Genetics in population: Lardy-Weinberg equilibrium; factors

distorting equilibrium selection mutation, migration; Chi-square test.

## TILL FINAL EXAM

**Genetic diversity** and evolution: Source of variation, Mutation Vs selection, heterozygote advantage, drift and founder effect; chromosomal changes: Karyotype & banding pattern, chromosomal rearrangement; deletion, duplication, translocation inversion, sex chromosome anomalies, evolutionary effects; molecular clocks; phylogenetic trees.

### Mode of Assessment

Sr. No.	Component	Weightage
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**BSc-II Biotechnology SEMESTER-IV**  
**Paper- V**  
**Subject : English**

**Max Marks: 75**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>An essay of 300-350 words on a topical or reflective subject (one to be attempted out of the five given).</p> <p>Letter-writing with internal choice between personal and official letters.</p> <p>Precise.</p> <p>Comprehension of an unseen passage</p> <p>Translation of a given passage from Punjabi/Hindi into English.</p>
<b>TILLMST-II</b>
<p>Analysis of sentences: Converting simple sentences into complex and compound ones and identifying adverb clause, noun clause and adjective clause in the given sentences.</p> <p>Synthesis of sentences: (i) combining two simple sentences into a single simple sentence by using a participle, an infinitive, a noun or phrase in apposition, too/ enough + adjective/adverb + infinitive and the bare infinitive. (ii) Combining simple sentences into complex ones by using a noun clause, adjective clause or an adverb clause. (iii) Combining simple sentences into compound ones by using conjunctions such as 'and', 'as well as', 'not only....but also' or 'either..... or', 'neither.....nor', 'but yet', 'nevertheless', 'so', 'therefore', for each.</p> <p>Transformation of sentences. (i) Transformation of degree, i.e., from positive to comparative degree and positive to superlative degree.</p>
<b>TILLFINAL EXAM</b>
<p>Transformation of kinds of statements, i.e. from rhetorical or interrogative into assertive statements, from affirmative into negative sentences and from statement into exclamatory sentences. (iii) Transformation from active into passive voice and vice-versa and from direct speech into indirect speech and vice-versa.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****Class – B.Sc. Biotechnology Part II (Semester-1V)****Paper -VI****Subject: INORGANIC CHEMISTRY****Max Marks: 35****Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
Coordination Compounds: Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Oxidation and Reduction: Use of redox potential data-analysis of redox cycle, redox stability to water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.
<b>TILLMST-II</b>
Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases.
<b>TILLFINAL EXAM</b>
Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH <sub>3</sub> and liquid SO <sub>2</sub> .

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**UNIT PLAN**

**Class – B.Sc. Biotechnology Part II (Semester-IV)**

**Paper -VI**

**Subject: ORGANIC CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Nomenclature, structure and bonding. physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation.</p> <p>Methods of formation and chemical reactions of halo acids. Hydroxyacids, maleic and tartaric acid, citric acids. (Structural formula only).</p> <p>Methods of formation and chemical reaction of unsaturated monocarboxylic acids. Dicarboxylic acids, methods of formation and effect of heat and dehydrating agents.</p> <p>Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability and reactivity of acyl derivatives.</p> <p>Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.</p> <p>Preparation of carboxylic derivatives, chemical reactions.</p>
<b>TILLMST-II</b>
<p>Mechanism of esterification and hydrolysis (acidic and basic).</p> <p>Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autooxidation, Ziesel' s Method.</p> <p>Synthesis of epoxide, acid and base catalysed ring opening of epoxide, orientation of ring opening reactions of Grignard and organolithium reagents with epoxide.</p> <p>Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. (3 Hrs.)</p> <p>Organic Compounds of Nitrogen</p> <p>(a) Nitro Compounds: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid.</p>
<b>TILLFINAL EXAM</b>
<p>Amines: Reactivity, structure and nomenclature of amines, physical properties.</p> <p>Stereochemistry of amines Separation of a mixture secondary and tertiary amines. Structural features effecting the basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction, Hoffmann bromamide reaction.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part 1 (Semester-1I)**

**Paper -VI**

**Subject: PHYSICAL CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

**TILLMST-I**

Phase Equilibrium: Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems.

Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag systems, desilverisation of lead.

Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-Hp), (FeCl<sub>3</sub>-H<sub>2</sub>O) systems. Freezing mixtures, acetone-dry ice.

Liquid-Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law.

Non-ideal system-azeotropes-HCl-HP and ethanol-water systems.

Lower and upper consolute temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation.

Nernst distribution law, thermodynamic derivation & applications.

Electrochemistry-I (a): Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.

Migration of ions and Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations.

Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only).

Electrochemistry-I (b): Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K<sub>a</sub> of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations |

**TILLMST-II**

Electrochemistry-II: Types of reversible electrodes-gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode. potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations.

**TILLFINAL EXAM**

Definition of pH and pK<sub>a</sub>, determination of pH using hydrogen, quinhydrone and glass

electrodes, by potentiometric methods.

Buffers - mechanism of buffer action, Henderson-Hassel equation, Hydrolysis of salts,  
Corrosion - types, theories and methods of combating it.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



## MULTANI MAL MODI COLLEGE, PATIALA

## UNIT PLAN

## BSc-II Biotechnology SEMESTER-IV

## Paper VII

## Subject: Biophysics

Max Marks: 52

Maximum Time: 3 Hrs.

**TILL MST-I**

**Thermodynamics:** Laws of thermodynamics, concept of enthalpy, heat capacity at constant volume and pressure, isothermal expansion, differential scanning calorimetry, concept of entropy, statistical and thermodynamic definitions of entropy, entropy change due to mixing of ideal gases, entropy change due to heating, Gibb's free energy, free energy spontaneity criteria, dependence of free energy on temperature (Gibb's Helmholtz equation), dependence of free energy on pressure, Vant Hoff equation, bioenergetics, physical chemist and biochemist standard states, coupled reactions, high energy bonds.

**Chemical Kinetics:** Reaction rate, order of reaction, revaluation of DNA case study, half life of a reaction. Determination of reaction order, molecularity of reaction. Complex reaction, consecutive kinetics, isotope effect, reactions in solution, fast reaction in solution (the flow method and the relaxation method).

**Quantum Mechanics:** Wave theory of light. Planck's quantum theory, photoelectric effect, de Broglie's postulate, Bohr's theory of atomic spectra, Huckel theory; Schrodinger's wave equation, Heisenberg's uncertainty principles, particles in one dimensional box, quantum mechanical tunnelling.

**TILL MST-II**

**Spectroscopic Techniques:** Beer's Lambert Law, U.V. visible spectrophotometry, IR spectroscopy and spectro fluorimetry: principle & biological applications. ORD & CD spectroscopy, NMR & mass spectrometry Principle & biological applications.

**Electrophoretic Techniques:** Principles and applications of electrophoretic techniques in purification and characterization of biomolecules isoelectric focusing, & immunoelectrophoresis, SDS - PAGE & agarose gel electrophoresis.

**Chromatographic Techniques:** General principle of gas chromatography, HPLC.

**TILL FINAL EXAM**

**Chromatographic Techniques:** General principle of chromatography and applications of adsorption, partition and thin layer chromatography, Ion exchange, exclusion and affinity

chromatography.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****BSc-II Biotechnology SEMESTER-IV****PAPER-VIII****Subject: R-DNA Technology****Max Marks: 52****Maximum Time: 3 Hrs.****TILL MST-I**

- Introduction: A brief introduction to R-DNA technology
- Tools of R-DNA technology: DNA cutting tool, Restriction enzymes; DNA end modifying tools; 3' nucleotidyl transferase; 5 nucleotidyl kinase; alkaline phosphates; T4 DNA ligase joining DNA fragments; nucleic acid probes.
- Techniques for genetic engineering: Southern blotting, Northern blotting and Western blotting.
- DNA Sequencing: Maxam-Gilbert technique, Sanger's dideoxy chain termination; Polymerase chain reaction; Agarose gel electrophoresis.
- Introduction to Cloning Genes: Cloning by direct cDNA cloning.
- Vectors: Plasmids, bacteriophages, Shuttle vectors, Retro viruses.
- Transformation Techniques: Competent *E. coli* cells, Yeast spheroplasts, *Bacillus* protoplast; CaCl<sub>2</sub> method, Biolistic gun; Electroporation, Phage transfection.

**TILL MST-II**

- Cloning in *E. coli*: Selection of transformants.
- Cloning in yeast: Selection of transformants.
- Cloning in plant cells: Selection of transformants.

**TILL FINAL EXAM**

- Application of R-DNA technology in agriculture, Medicine and Industry.
- RFLP and prenatal diagnosis.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****B. Sc. Biotechnology –III (SEMESTER-V)****Paper -I****Subject: INORGANIC CHEMISTRY****Max Marks: 35****Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Metal-ligand bonding in transition metal complexes: Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.</p> <p>Thermodynamic and kinetic aspects of metal complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.</p> <p>Magnetic properties of transition metal complexes: Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling.</p>
<b>TILLMST-II</b>
<p>Correlation of <math>\mu_s</math> and <math>\mu_{\text{eff}}</math> values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes.</p> <p>Electronic spectra of transition metal complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series.</p>
<b>TILLFINAL EXAM</b>
<p>Orgel-energy level diagram for <math>d^1</math> and <math>d^9</math> states, discussion of electronic spectrum of <math>[\text{Ti}(\text{H}_2\text{O})_6]^{3+}</math> complex.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****Class – B.Sc. Biotechnology Part III (Semester-V)****Paper -I****Subject: ORGANIC CHEMISTRY****Max Marks: 35****Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Spectroscopy: Nuclear magnetic resonance ( NMR) spectroscopy, Proton magnetic resonance (<sup>1</sup>H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromoethane, ethyl acetate, toluene and acetophenone.</p> <p>Electromagnetic spectrum: Absorption spectra-ultraviolet (UV) absorption spectroscopy, absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation; Concept of chromophore and auxochrome; Bathochromic, hypsochromic, hyperchromic and hypochromic shifts; UV spectra of conjugated enes and enones.</p> <p>Infrared (IR): Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region.</p>
<b>TILLMST-II</b>
<p>Characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds; Problems pertaining to the structure elucidation of simple organic compounds using UV, IR, and PMR spectroscopic techniques.</p> <p>Organometallic compounds: Organomagnesium compounds - the Grignard reagents formation, structure and chemical reactions; Organozinc compounds - formation and chemical reactions; Organolithium compounds - formation and chemical reactions.</p>
<b>TILLFINAL EXAM</b>
<p>Organosulphur compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, and sulphonamides.</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part III (Semester-V)**

**Paper -I**

**Subject: PHYSICAL CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
Elementary quantum mechanics: Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids; Sinusoidal wave equation Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box; Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions. Introduction to spectroscopy: Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.
<b>TILLMST-II</b>
Rotational spectrum: Diatomic molecules; Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect. Vibrational spectrum: Infrared spectrum-Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity.
<b>TILLFINAL EXAM</b>
Determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**

**UNIT PLAN**

**BSc-III Biotechnology SEMESTER-V**

**Paper II**

**Subject: ENVIRONMENTAL BIOTECHNOLOGY**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

**Introduction:** Brief introduction to environment; Indicators of pollution: Physicochemical and Biological

**Pollution:** Air pollution: Units of measurements, sources of pollutants and hazards. Soil pollution: sources of pollutants and hazards. Water pollution: sources of pollutants and hazards.

**Waste-water treatment:** Aerobic: Brief account of activated sludge reactors, aerated ponds and lagoons, trickling filters.

**Anaerobic waste-water treatment:** Outline of biogas production, up-flow anaerobic sludge blanket reactor, anaerobic filter reactor, contact reactor, factors affecting process operation, status of biogas production in India.

**TILL MST-II**

**Vermicomposting:** Vermicomposting process, types of vermicomposting systems, vermicomposting product, waste management by vermicomposting, effect of wastes vermicompost on the growth and yield of plants.

**Bioremediation:** General description of bioremediation and application of biotechnology; Removal/remediation of heavy metals, pesticides and xenobiotics, paper, dye and textile industry effluents

**TILL FINAL EXAM**

**Pollutant monitoring I:** Biosensors: Introduction Principle and Applications for the detection of heavy metal ions, pesticides and pathogens. **Pollutant monitoring II:** Principle, working and applications of GC and HPLC. **Pollutant monitoring III:** Spectroscopic techniques for monitoring pollutants.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%

3	Attendance	20%
---	------------	-----

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**BSc-III Biotechnology SEMESTER-V**

**Paper III**

**Subject: Immunology**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

**Introduction:** Basic concepts and history of immunology. Active and Passive immunity, Innate and Adaptive immunity; Antigen and antigenicity.

Cells and organs involved in immune response; Complement system; Macrophage structure and function.

**Immune response:** Humoral immunity and cell mediated immune response.

**Immunoglobulins:** Structure and functions; Brief account of antibody diversity.

**Immunotechniques:** Techniques to evaluate humoral and cell mediated immune response.

**Hypersensitivity:** Types, mechanism and mediators.

Auto immunity and AIDS: Introduction, causes, prevention and vaccines.

**TILL MST-II**

**Major Histocompatibility complex:** Structure of MHC I and MHCII, tissue typing, Applications in immunity, diseases (Graft versus Host reaction)

**Transplantation.** Basic concept of immunomodulation: immunosuppression and immunopotentialiation

Hybridoma technology: Introduction, production of monoclonal antibodies; Applications.

**TILL FINAL EXAM**

**Vaccines:** Introduction to conventional and modern vaccines; Advantages, mechanism of action, mode of secretion.

**Mode of Assessment**

Sr. No.	Component	Weightage
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**  
**BSc-III Biotechnology SEMESTER-V**  
**Paper IV**  
**Subject: Biochemical Engineering**

Max Marks: 52

Maximum Time: 3 Hrs.

### TILL MST-I

Basic concepts of biochemical engineering, outlines of bioprocess development.

**Sterilization:** Medium sterilization in batch and continuous systems; Sterilization of air filters.

**Bioreactor:** Introduction to types of bioreactors; Aeration and agitation, Batch, fed batch and continuous systems of fermentation; Scale-up. Kinetics.

**Bioprocess control** and monitoring systems: General introduction on instrumentation for monitoring and controlling of bioreactors.

Transport phenomena in bioreactors: Mass transfer coefficient (KLa) for gases and liquids; Heat transfer coefficient; Determination of KLa; Factors affecting KLa in bioprocesses.

**Cell separation methods:** Extraction methods for products recovery.

### TILL MST-II

Principles of solid-liquid extraction and liquid-liquid extraction.

Microbial cell disruption of cells: Physical, chemical and enzymatic methods.

**Downstreaming processing I:** Separation of cells-foam separation, flocculation, agglomeration, filtration and centrifugation.

**Chromatography:** Brief account of chromatographic techniques for purification of bioproducts.

### TILL FINAL EXAM

**Finishing steps of purification:** Brief account of distillation, electro dialysis, evaporation, drying and crystallization. A brief account of cost determination of bioprocesses.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)

## UNIT PLANNING (SESSION 2018-19)

2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****BSc-III Biotechnology SEMESTER-VI****Paper- V****Subject: INORGANIC CHEMISTRY****Max Marks: 35****Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
Hard and soft acids and bases (HSAB): Classification of acids and bases as a hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness; Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness. Bioinorganic chemistry: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin; Biological role of alkali and alkaline earth metal ions with special reference to $\text{Ca}^{+2}$ , nitrogen fixation.
<b>TILLMST-II</b>
Silicones and phosphazenes: Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes. Organometallic chemistry: Definition, nomenclature and classification of organometallic compounds; Preparation, properties, bonding and applications of alkyls of Li, Al, Hg, Sn and Ti.
<b>TILLFINAL EXAM</b>
Brief account of metal-ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

**Mode of Assessment**

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA****UNIT PLAN****Class – B.Sc. Biotechnology Part II (Semester-IV)****Paper -VI****Subject: ORGANIC CHEMISTRY****Max Marks: 35****Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>	
<p>Heterocyclic compounds: Introduction – Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine; Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophilic substitution; Mechanism of nucleophilic substitution reaction in pyridine derivatives; Comparison of basicity of pyridine, piperidine and pyrrole; Introduction to condensed five and six membered heterocycles; Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis; Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.</p> <p>Synthesis of polymers: Ziegler-Natta polymerization and vinyl polymers; Condensation or step growth polymerization; Urea formaldehyde resins, epoxy resins and polyurethanes; Natural and synthetic rubbers.</p> <p>Organic synthesis via enolates: Acidity of <math>\alpha</math>-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate; Synthesis of ethyl acetoacetate – Claisen condensation; Keto-enol tautomerism of ethyl acetoacetate; Alkylation and acylation of enamines.</p>	
<b>TILLMST-II</b>	
<p>Carbohydrates: Classification and nomenclature, monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses; Configuration of monosaccharides; Erythro and threodiastereomers; Conversion of glucose into mannose; Formation of glycosides, ethers, and esters; Determination of ring size of monosaccharides; Cyclic structure of D (+)-glucose; Mechanism of mutarotation; Structures of ribose and deoxyribose; An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch and cellulose without involving structure determination.</p> <p>Amino Acids, peptides, proteins and nucleic acids: Classification, structure and stereochemistry of amino acids; Acid base behaviour, isoelectric point and electrophoresis; Preparation and reactions of <math>\alpha</math>-amino acids.</p>	
<b>TILLFINAL EXAM</b>	
<p>Structure and nomenclature of peptides and proteins; Classification of proteins; Peptide structure determination, end group analysis, selective hydrolysis of peptides; Classical levels of protein structure; Protein denaturation/renaturation; Nucleic acids – Introduction, constituents of nucleic acids, ribonucleosides and ribonucleotides, the double helical structure of DNA.</p>	

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)

UNIT PLANNING (SESSION 2018-19)

2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**Class – B.Sc. Biotechnology Part 1 (Semester-1I)**

**Paper -VI**

**Subject: PHYSICAL CHEMISTRY**

**Max Marks: 35**

**Maximum Time: 3 Hrs.**

<b>TILLMST-I</b>
<p>Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.</p> <p>Electronic spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle; Qualitative description of <math>\sigma</math>, <math>\pi</math> and n M.O., their energy levels and their respective transitions.</p> <p>Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical process; Laws of photochemistry- Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).</p>
<b>TILLMST-II</b>
<p>Solid state: Definition of space lattice and unit cell; Laws of crystallography – Law of constancy of interfacial angles, Law of rationality of indices, Law of symmetry elements in crystals; X-ray diffraction by crystals.</p>
<b>TILLFINAL EXAM</b>
<p>Derivation of Bragg's equation; Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).</p>

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%



**MULTANI MAL MODI COLLEGE, PATIALA**  
**UNIT PLAN**

**BSc-III Biotechnology SEMESTER-VI**

**Paper VI**

**Subject: Microbial Technology**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

A brief account of historical developments in microbial technology.

**Primary metabolites:** Production of vitamin B12, citric acid and lactic acid.

**Secondary metabolites:** Antibiotics (Penicillins, cephalosporins); Microbial lipids; Microbial siderophores.

**Enzyme technology:** Microbial production of alpha amylase, protease and lipase. Immobilization: Immobilization techniques, co-immobilization of cells and enzymes.

**Microbial biomass for food and feed:** Algal, bacterial, fungal and yeast biomass as single cell protein; Technologies for the production of SCP.

**Microbial transformations:** Types of transformation and industrial applications. Mineral leaching of copper and uranium.

**TILL MST-II**

**Biopesticides and biofertilizers:** A brief account of biopesticides/bioinsecticides and biofertilizers; Mass production.

**Genetically modified microorganisms/products:** Associated environmental hazards of genetically modified microorganisms and rDNA products.

**Biosafety:** Biohazard levels; Biosafety guidelines and regulations for rDNA products.

**TILL FINAL EXAM**

**Legal biotechnology:** Introduction to intellectual property rights, patents, copy rights, trade secrets and trade marks.

<b>Mode of Assessment</b>		
<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

## MULTANI MAL MODI COLLEGE, PATIALA

## UNIT PLAN

## BSc-III Biotechnology SEMESTER-VI

## Paper VII

## Subject: Tissue Culture Technology

Max Marks: 52

Maximum Time: 3 Hrs.

**TILL MST-I**

**Plant tissue culture:** Historical developments and major contributions; Culture media-composition and preparation.

**Cellular totipotency:** Concept, callus culture and cell culture.

Differentiation in callus culture: Organogenesis and embryogenesis. Micropropagation: Technique of micropropagation and virus free plant production.

Protoplast isolation and culture: Fusion of protoplasts and selection of fusion products.

**Transgenic plants:** *Agrobacterium* mediated-transgenic plants production.

Animal cell culture: Culture media, substratum, requirement of gases, serum requirements in medium.

**TILL MST-II**

**Establishment and maintenance** of culture: From primary culture to cell line; Properties of suspension and monolayer culture.

**Characterization of established cell culture;** Differentiation; Embryo transfer technology.

**TILL FINAL EXAM**

**Somatic cell fusion:** A brief discussion and applications. Industrial applications: A brief account of industrial applications of plant and animal tissue culture.

**Mode of Assessment**

Sr. No.	Component	Weightage
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

**MULTANI MAL MODI COLLEGE, PATIALA**

**UNIT PLAN**

**BSc-III Biotechnology SEMESTER-VI**

**Paper VIII**

**Subject: Fermentation Technology**

**Max Marks: 52**

**Maximum Time: 3 Hrs.**

**TILL MST-I**

**Raw materials:** Carbon and nitrogen substrates for industrial fermentation and their composition.

**Starter cultures:** Techniques for the development of inoculum and aseptic inoculation for the industrial fermentation.

**Fermentation types:** Submerged, surface and solid state/substrate fermentation, factors affecting these fermentations.

Recombinant fermentations: Applications of recombinant microbes in fermentation industry.

**Biofuels:** Fermentative production of ethanol, acetone-butanol.

**Alcoholic beverages:** Raw materials, culture, fermentation technology and post fermentation processing of distilled alcoholic beverages (Whisky, rum, brandy). Beer and wine: Types, production and post fermentation processing.

**TILL MST-II**

Vinegar: Raw materials, culture, fermentation conditions and recovery.

**Microbial polysaccharides:** Fermentative production of dextran, xanthan gum and pullulan.

Food additives and ingredients: Fermentative production of amino acids i.e., L-glutamic acid and L-aspartic acid.

**TILL FINAL EXAM**

**Microbial flavours:** Fermentative production of vanillin, benzaldehyde and lactones.

**Mode of Assessment**

<b>Sr. No.</b>	<b>Component</b>	<b>Weightage</b>
1	Mid Semester Test (MST)	40% (Average of 2 MST)
2	Written Assignments	40%
3	Attendance	20%

