

Class : **B.Sc. II Year**
Subject : **Chemistry**
Paper : **I**
Paper Title : **Physical Chemistry**
Max Marks : **36(28+08)**

Unit I

A. Thermodynamics : Basic concept of thermodynamics, First Law, Second Law of Thermodynamics: Need for the law, different statement of the law, Carnot cycle and its efficiency, Carnot theorem, Thermodynamic scale of temperature, concept of entropy: Entropy as a state function. Entropy as a function of P&T and T&V, entropy change in physical change. Clausius inequality. Entropy as criteria of spontaneity and equilibrium. Entropy change in ideal Gases and mixing of gases, Nernst heat theorem. Statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions, Gibbs function(G) and Helmholtz function (H) as a thermodynamics quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change,.

B. Thermochemistry: standard state, standard enthalpy of formation: Hess's Law of heat summation and its application. Enthalpy of neutralization.

Unit II

Phase equilibrium: Statement and the meaning of terms: phase component and the degree of freedom, thermodynamic derivation of the Gibbs phase rule. One component system: water, CO₂ and S system. Two component system: solid-liquid equilibrium. Simple eutectic system: Bi-Cd; Pb-Ag system, Desilverisation of lead.

Solid solution: Systems in which compound formation with congruent melting point (Zn-Mg) and incongruent melting point (NaCl-H₂O) and (CuSO₄-H₂O) system, Freezing Mixtures: acetone – dry ice.

Liquid-liquid mixtures: Ideal liquid mixture, Raoult's and Henry's law, Non - ideal system. Azeotropes: HCl – H₂O and ethanol water system .

Partial Miscible liquids: Phenol-water, trimethylamine-water and nicotin-water system. Immiscible Liquids, steam distillation. Nernst distribution law: thermodynamic derivation, applications.

Unit III

Electrochemistry I

Electrical transport, conduction in metals and in electrolyte solutions. Specific and equivalent conductivity, measurement of equivalent conductance, effect of dilution on conductivity migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations. Weak and strong electrolytes, Ostwald's dilution law, Theory of strong electrolytes, DHO theory and equation. Transport numbers determination of transport numbers by Hittorf method and moving boundary method.

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Unit IV

Electrochemistry II

Types of reversible electrodes: Gas-metal ions, Metal-metal ion, metal-insoluble salt anion and redox electrodes. Electrodes reaction, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, electrochemical series and its significance. Electrolytic and galvanic cell, reversible and irreversible cell, conventional representation of electrochemical cell, Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titration. Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrode by potentiometric methods.

Buffers: mechanism of buffer action, Henderson-Hazal equation, hydrolysis of salts.

Unit V

Surface Chemistry: Adsorption, adsorption and absorption, types of adsorption, adsorption of gases and liquid in solid adsorbent, Freundlich and Langmuir adsorption isotherms, surface area and determination of surface area .

Catalysis: Characteristics of catalyzed reactions, classification of catalysis, application of catalysts, Miscellaneous examples.

Recommended Books:

1. Physical Chemistry – Puri, Sharma and Pathania- Vikas publications, New Delhi
2. Physical Chemistry – G M barrow, International Student Edition McGraw Hills
3. The Elements of Physical Chemistry, P W Atkins, Oxford University Press
4. Physical Chemistry – R A Alberty, Wiley Eastern Limited
5. Physical Chemistry through Problems, SK Dogra and S Dogra, Wiley Eastern

Class	:	B.Sc. II Year
Subject	:	Chemistry
Paper	:	II
Paper Title	:	Inorganic Chemistry
Max Marks	:	32(26+06)

Unit I

Chemistry of Elements of first Transition series:

Characteristic properties of d-block elements.

Properties of the elements of the first transition series, their binary compounds such as Carbides. Oxides and Sulphides. Complexes illustrating relative stability of their oxidation states.

Co- ordination number and geometry.

Unit II

Chemistry of Elements of Second and Third Transition Series.

General characteristics, comparative treatment with their 3d- analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit III

A. Co –ordination Compounds

Werner's co–ordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of co-ordination compounds, isomerism in co–ordination compound, valence bond theory of transition metal complexes.

B. Oxidation and Reduction

Use of redox potential data: analysis of redox cycle, redox stability in water: Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of elements.

Unit IV

A. Chemistry of Lanthanide elements

Electronic structure, Oxidation states, ionic radii and lanthanide contraction , complex formation, occurrence and isolation, Lanthanide compounds.

B. Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and later lanthanides

Unit V

A. Acids and Bases

Arrhenius, Bronsted–Lowry, the Lux- Flood, solvent system and Lewis concepts of acids and bases.

B. Non- aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and Liquid SO_2 .

Recommended Books:

1. Inorganic Chemistry- J D Lee, John Wiley
2. Inorganic Chemistry- Cotton and Wilkinson, John Wiley
3. Inorganic Chemistry- Huheey, Harper Collins pub.USA
4. Inorganic Chemistry GR Chhatwal, Harper Publication
5. Fundamental concepts of Inorganic Chemistry- Esmarch, S Gilreath. McGraw Hill

Class : B.Sc. II Year
Subject : Chemistry
Paper : III
Paper Title : Organic Chemistry
Max Marks : 32(26+06)

Unit I

Electromagnetic Spectrum: Absorption spectra:

Ultraviolet (UV) absorption spectroscopy—absorption laws (Beer Lambert 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.

Infra red (IR) absorption spectroscopy- Molecular vibrations, Hookes law, selection rules, intensity and position of IR bands, Measurement of IR spectrum, finger print region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Unit II

A-Alcohols: Classification and nomenclature. Monohydric alcohols- Nomenclature, methods of formation, reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acid nature and reactions of alcohols.

Dihydric alcohols—nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$\text{Pb}(\text{OAc})_4$ and HIO_4] and pinacol–pinacolone rearrangement. Trihydric alcohols- Nomenclature, methods of formations, Chemical reactions of glycerols.

B. Phenols: Nomenclature, structure and bonding. Preparations of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ions. Reactions of phenols- Electrophilic aromatic substitution, acylation and carboxylation. Mechanism of Fries rearrangement, claisen rearrangement, Gattermann synthesis, Hauben – Hoesche reaction, Lederer Manasse reaction and Reimer Teiman reaction.

Unit III

Aldehydes and Ketones:

Nomenclature, structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, perkin and knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig and Mannich reaction. Use of acetals as protecting groups,

Oxidation of aldehydes, Baeyer- Villiger oxidation of ketones, Cannizzaro reaction, Meerwein – Ponnoff–Verley reactions, Clemmensen, Wolf -Kishner, LiAlH_4 and NaBH_4 reductions. Halogenation of enolizable ketones. An introduction to (α β) α , β unsaturated aldehydes and ketones.

Unit IV

A Carboxylic Acids : Nomenclature, structure and bonding, physical properties and acidity of carboxylic acids, Effect of substituent on acid strength. Preparation of carboxylic acids and reactions of carboxylic acids. Hell-Volhard- Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, hydroxy acids, Malic, tartaric and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids- Methods of formation and effect of heat and dehydrating agents.

B Ether: Nomenclature of ethers and methods of their formation. Physical properties and chemical reactions. Cleavage and auto oxidation, Ziesel's method.

Unit V

Organic compounds of Nitrogen: Preparation of nitro-alkanes and nitro-arene. Chemical reactions of nitro-alkanes. Mechanism of nucleophilic substitution in nitro-arenes and their reductions in neutral, acidic and alkaline media.

Halonitroarenes: reactivity, structure and nomenclature of amines, Physical properties, stereochemistry of amines, separation of mixture primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase transfer catalyst. Preparation of alkyl and aryl amine (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel- Phthalimide reaction, Hoffmann-Bromamide reaction. Reactions of Amines. Electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acids. Synthetic transformations of aryl diazonium salts, Azo coupling.

Recommended Books:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall
2. Organic Chemistry, L G Wade Jr, Prentice Hall
3. Fundamentals of Organic Chemistry, Solomon, John Wiley
4. Organic Chemistry, F A Carey Mc Graw Hills Inc.
5. Organic Chemistry, Vol. I,II,III, S.M Mukherji, S.P.Singh and R.P Kapoor

Class : B.Sc. II Year
Subject : Chemistry
Paper : Chemistry Practical

Max. Marks: 50

Inorganic Chemistry

- (i) Analysis of inorganic mixture containing five radicals with at least one interfering radical.
- (ii) Determination of acetic acid in commercial vinegar using NaOH.
- (iii) Redox titrations.
- (iv) Estimation of hardness of water by EDTA.

Physical Chemistry

- (i) Determination of transition temperature of given substance by thermometric method.
- (ii) To determine the enthalpy of neutralization of strong acid, strong base.
- (iii) Verification of Beer's – Lambert law.
- (iv) To study the phase diagram of two component system by cooling curve methods.

Organic Chemistry (any two)

- (i) Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.
- (ii) Use of Paper chromatography / Thin layer chromatography: determination of R_f values, separation and identification of organic compounds.
 - a. Separation of green leaf pigments (spinach leaf may be used)
 - b. Separation of dyes.

Class	:	B.Sc. III Year
Subject	:	Chemistry
Paper	:	I
Paper Title	:	PHYSICAL CHEMISTRY
Maxi Marks	:	36 (28+08)

Unit I

A. Elementary Quantum Mechanics: Black-body radiation. Planck's radiation law, Photoelectric effect, heat capacity of solids. Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.

de-Broglie hypothesis, the Heisenberg's uncertainty principle. Sinusoidal wave equation. Hamiltonian operator. Schrodinger wave equation and its importance, Physical interpretation of the wave function, postulates of quantum mechanics, particles in a one-dimensional box.

B. Molecular orbital theory: Basic ideas-criteria for forming M.O. from A.O. construction of M.O.'s by LCAO-H₂ ion, calculation of energy levels from wave functions. Physical picture of bonding and antibonding wave functions, Concept of σ - σ^* , π - π^* orbitals and their characters. Hybrid orbitals- sp, sp², sp³. Calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H₂ ion, comparison of M.O. and V.B. models.

Unit II

Spectroscopy:

Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degree of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotor (Semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum: Infra-red spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Unit III

Raman Spectrum: Concept of polarizability, Pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

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 $\sigma\pi$ and n M.O. their energy levels and the respective transition.

UV Spectroscopy: Electronic excitation, elementary idea of instrument used. Application to organic molecules. Woodward-Fieser rule for determining λ_{\max} of enes, polyenes and α,β unsaturated carbonyl compounds.

Unit IV

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus- Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.)

Unit V

Physical Properties and Molecular Structure:

Optical activity, Polarisation (Clausius-Mossotti equation). Orientation of dipoles in an electric field, dipole moment, induced dipole moment measurement of dipole moment, temperature method and refractive method, dipole moment and structure of molecules, magnetic properties – paramagnetic, diamagnetism and ferromagnetism.

Recommended Books:

1. Physical Chemistry – Puri, Sharma and Pathania- Vikas publications, New Delhi
2. Physical Chemistry – G M Barrow, International Student Edition McGraw Hills
3. The Elements of Physical Chemistry, P W Atkins, Oxford University Press
4. Physical Chemistry – R A Alberty, Wiley Eastern Limited
5. Physical Chemistry through Problems, SK Dogra and S Dogra, Wiley Eastern

Class	:	B.Sc. III Year
Subject	:	Chemistry
Paper	:	II
Paper Title	:	INORGANIC CHEMISTRY
Max. Marks	:	32(26+06)

Unit I

1. Hard and Soft Acids and Bases (HSAB)

Introduction: Classification of hard and soft acid-base, Hard and Soft acids- base concept of Pearson, Application of hard-soft acid base theory, Symbiosis, acid-base strength and hardness and softness. Theoretical basis of hardness and softness, electronic theory, π -bonding theory, and Drago-wayland theory electronegativity and hardness and softness, limitations of hard soft acid –base concept.

2. Silicones and Phosphazenes

Introduction: Silicones-methods of preparation, classification, properties and application (uses). Phosphazenes (Phosphonitrilic chloride)- Methods of preparation and properties: Structure of triphosphazene. Some other phosphazenes and uses of phosphazenes.

Unit II

1. Metal Ligand Bonding in Transition Metal Complexes.

Introduction: Limitation of valence bond theory, crystal field theory, crystal field splitting of d-orbitals, d-orbital splitting and stabilisation energy in octahedral, tetrahedral and square planar complexes: factors affecting the crystal field parameters. Applications of crystal field theory and limitations of crystal field theory.

2. Thermodynamic and Kinetic Aspects of Metal Complexes.

Introduction: Thermodynamic aspects of metal complexes, factors affecting thermodynamic stability of complexes, kinetic aspects of metal complexes, stabilisation reactions of square planar complexes and factors affecting the rate of substitution reactions in square planar complexes.

Unit-III

Magnetic Properties of Transition Metal Complexes.

Introduction: Types of magnetic behaviour, diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetism. Origin and calculation of magnetism. Methods of determining magnetic susceptibility- Gouy, Bhatnagar Mathur. Quincke's, Curie and Nuclear magnetic Resonance method. Magnetic moment; L-S coupling, Determination of ground state term symbol, Correlation of μ_s and μ_{eff} values. Orbital contribution to magnetic moments and application of magnetic moment data for 3d-metal complexes.

Unit IV

A. Electronic Spectra of Transition Metal Complex

Introduction: Type of electronic transition. Selection rules for d-d transitions, spectroscopic ground states-Notations, Spectroscopic states and spectroscopic ground state in complexes, Spectrochemical series, Orgal energy level diagram-Uses in octahedral and tetrahedral complexes having d1 to d9 states, Electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.

B. Organometallic Chemistry

Introduction: Nomenclature and Classification of Organometallic compounds, General methods of Preparation, Alkyl and aryl organometallic compounds of Lithium-Preparation, Properties, Bond nature and application, Organometallic compounds of Al, Hg, Sn and Ti-Preparation, Properties, Bond nature and applications.

Unit V

A. Bio-Inorganic Chemistry

Introduction: Essential and trace elements in biological processes. Biological function of the bio-elements, Availability of bio-metals and bio-non-metals. Metalloporphyrins, Hemoglobin structure and biological function, Myoglobin –mechanism of oxygen transfer through haemoglobin and myoglobin, Relation between haemoglobin and myoglobin and chemical reaction of haemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} , Nitrogen fixation.

B. Metal Nitrosyl Complex

Nitrosylating agents. Synthesis, structure, Properties and Bonding.

Recommended Books:

1. Inorganic Chemistry- J D Lee, John Wiley
2. Inorganic Chemistry- Cotton and Wilkinson, John Wiley
3. Inorganic Chemistry- Huheey, Harper Collins pub.USA
4. Inorganic Chemistry GR Chhatwal, Harper Publication
5. Fundamental concepts of Inorganic Chemistry- Esmarch, S Gilreath. McGraw Hill

Class : **B.Sc. III Year**
Subject : **Chemistry**
Paper : **III**
Paper Title : **ORGANIC CHEMISTRY**
Max Marks : **32(26+06)**

Unit I

Spectroscopy: Nuclear Magnetic Resonance Spectroscopy.

Proton Magnetic Resonance(¹HNMR) Spectroscopy, Nuclear shielding and de-shielding, chemical shift and molecular structure, spin-spin coupling and coupling constant, region of signals, Explanation of PMR spectra of simple organic molecules like ethyl bromide, ethanol acetaldehyde, 1,1,2 tribromo ethane, ethyl acetate, toluene and acetophenone. Applications of UV, IR and PMR spectroscopy for simple organic compounds.

Unit II

A.Organometallic compounds:-

Organomagnesium compounds- Grignard reagent, preparation, structure and chemical reactions.

Organozinc compounds- Preparations and chemical reactions.

Organolithium compounds- Preparations and chemical reactions.

B.Organo sulphur compounds.

Nomenclature, structural characteristics.

Thiol, Thio-ether, sulphonic acid, sulphonamide and sulphaguanidine – methods of preparations and chemical reactions.

C.Organic synthesis by enolates:

Acidity of hydrogen, alkylation of diethyl malonate and ethyl acetoacetate, synthesis of ethyl acetoacetate, Claisen condensation. Keto-enol tautomerism in ethyl acetoacetate. Alkylation of 1,3 dithiane. Alkylation and acetylation of enamine.

Unit-III

(A) Carbohydrates-

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose into fructose. Ascending and descending series in aldose. Configuration of monosaccharides. Stereo isomers of erythro and threo sugars. Conversion of glucose into mannose. Glycosides, determination of the size of the ring of monosaccharides. Ring structure of D(+) glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose. Disaccharides-introductory idea of maltose, sucrose, and lactose (Excluding structures) Polysaccharides-introductory idea of starch and cellulose (Excluding structures).

(B) Fat, Oil and Detergents:

Natural fat, edible and industrial oil of plant origin. Normal fatty acids, glycerides. Hydrogenation of unsaturated oil, saponification value, iodine value and acid value.

Synthetic Detergents:- Alkyl and aryl sulphonate.

Unit IV

A.Amino Acid, Peptide. Protein and nucleic acid, Classification of amino acids, structure and stereochemistry. Acid base behaviour, Isoelectric point and electrophoresis, Preparations and chemical reactions of alpha amino acids.

Nomenclature and structure of peptide and proteins. Classifications of proteins, determination of peptide structure, end group analysis, selective hydrolysis of peptides, peptide synthesis, solid phase peptide synthesis. Structure of peptide and proteins, level of proteins structure, denaturation of proteins.

Nucleic Acids: Constitution of nucleic acids, ribonucleoside and ribonucleotide. Double helix structure of DNA.

B. Synthetic dyes:

Colour and constitution (electronic concept). Classification of dyes-Methyl orange, Congo red, Malachite green, crystal violet, phenolphthalein, Fluorescein, Alizarine and indigo-Chemical study and synthesis.

Unit V

Heterocyclic compounds:

Introduction to pyrrole, furan, thiophene and pyridine, Aromatic character and molecular orbital picture, methods of synthesis and specific chemical reactions with reference to electrophilic substitutions. Reaction mechanism of nucleophilic substitution in pyridine derivatives. Comparison of basicity between pyridine, piperidine and pyrrole.

Introductory idea about five and six – membered condensed heterocyclic compounds. Indole, Quinoline and isoquinoline –preparations and chemical properties (Fischer-Indole synthesis, Skraup's synthesis, Bischler Naoiaralsky synthesis). Electrophilic substitution reactions of Indole, Quinoline and Isoquinoline.

Recommended Books:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall
2. Organic Chemistry, L G Wade Jr, Prentice Hall
3. Fundamentals of Organic Chemistry, Solomon, John Wiley
4. Organic Chemistry, F A Carey Mc Graw Hills Inc.
5. Organic Chemistry, Vol. I,II,III, S.M Mukherji, S.P.Singh and R.P Kapoor

Class : **B.Sc.**
Year : **Third**
Subject : **Chemistry**
Paper : **Chemistry Practical**

Max. Marks: 50

Inorganic Chemistry

- Gravimetric analysis:

Barium as Barium sulphate, Copper as cuprous-thiocyanate.

- Complex compound preparation

- a. Potassium chlorochromate(IV)
- b. Tetramine copper(II) sulphate monohydrate
- c. Hexaamminenickel(II) chloride

- Effluent water analysis, Identification of cations and anions in different samples.
- Water analysis, To determine dissolved oxygen in water samples in ppm.

Physical Chemistry

To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ ethyl acetate catalysed by hydrogen ions at room temperature.

- Determination of partition coefficient of iodine between carbon tetrachloride and water.
- Job's method.
- pH-metric titrations, conductometric titrations.

Organic Chemistry

- Binary mixture analysis containing two solids: Separation, identification and preparation of derivatives
- Preparation

(i) Acetylation (ii) Benzoylation (iii) Meta dinitrobenzene (iv) Picric acid

Class	:	B.Sc. II YEAR
Subject	:	Computer Science
Paper	:	I
Paper Title	:	Object Oriented Programming Concepts Using C++
Compulsory	:	Compulsory
Max. Marks	:	Theory - 40 CCE - 10 Total - 50

Unit I

Introduction to C++: Programming paradigms, key concepts of Object-oriented Programming, Advantages of OOP's. Input and Output in C++: Pre-defined streams, Unformatted console I/O operations, formatted console I/O operations.

Unit II

C++ Declaration: Parts of C++ Program, types of Tokens, Keywords, Identifiers, data types, constants, Operators, Precedence of operators, referencing and dereferencing operators, scope access operator. Control structures: Decision Making Statements, looping statement.

Unit III

Functions: main (), parts of function, passing arguments: value, address, reference, inline functions, functions overloading: principles, precautions, library functions. Classes and objects: declaring classes and objects, accessing class members, keyword: public, private, protected, defining member variables and functions, friend function, friend classes, overloading member functions.

Unit IV

Constructors and Destructors: characteristics, application, constructors with arguments, overloading constructors, types of constructors, Operator overloading: overloading unary operator, binary operator. Inheritance: access specifiers: public inheritance, private inheritance, protected data with private inheritance, Types of inheritances: single, multiple, hierarchical, multilevel, hybrid, multipath, virtual Base class.

Unit V

Pointers & arrays: pointer declaration, pointer to class & object, Array: declaration & initialization, array of classes. Polymorphism: Static (Early) binding, Dynamic (Late) Binding, Virtual function, pure virtual function.

Recommended Text books -

1. Object-Oriented Programming with ANSI & Turbo C++ by Ashok N. Kamthane.
2. Object Oriented Programming in C++ by E. Balagurusamy

Reference Books -

1. C++ The complete Reference by Herbert Schildt, TMH Publication.
2. Object Oriented Programming in C++ by Robert Lafore.

Class : **B.Sc. II YEAR**
Subject : **Computer Science**
Paper : **II**
Paper Title : **Data Structures**
Compulsory : **Compulsory**
Max. Marks : **Theory - 40 CCE - 10 Total - 50**

Unit I

Concept of data structure and analysis of algorithm, abstract data structure, introduction to stack and primitive operations on stack, stack as an abstract data type, stack application: infix, prefix, postfix and recursion, introduction to queues, primitive operation on queues, circular queue, dequeue, priority queue and applications of queue.

Unit II

Introduction to linked list, basic operations on linked list, stacks and queues using linked list, doubly linked list, circular linked list, applications of linked list.

Unit III

Trees-basic terminology binary trees, tree representations as array and linked list, basic operations on binary tree, traversal of binary trees :- in order, preorder, preorder, postorder, Applications of binary tree, threaded binary tree, AVL tree, binary tree representations of trees.

Unit IV

Sequential search, binary search, insertion sort, selection sort, quick sort, bubble sort, heap sort, comparison of sorting methods.

Unit V

Hash Table, Collision resolution technique, Introduction to graphs, Definition, Terminology, Directed, Undirected and Weighted Graph, Representation of Graph, Graph Traversal-Depth first, Breadth first search, Spanning tree, Minimum Spanning tree, Shortest path algorithm.

Recommended Text Books -

1. Data Structure: By Lipschultz (Schaums Outline Series)
2. Data Structures through C (A Practical Approach) by G.S. Baluja
3. Data Structures : By Trembley & Sorrenson

Reference Books -

1. Fundamental of Data Structure By S. Sawhney & E. Horowitz

Suggested list of programs for Lab practicals

Max.Marks: 50

Min. Marks: 17

A: C++ Programming

1. Write a program to find average of 3 numbers.
2. Write a program to find biggest among 3 numbers.
3. Write a menu driven program (Switch case) to perform arithmetic operations.
4. Write a program to check whether entered number is Prime or not.
5. Write a program to check whether entered number is even or odd.
6. Write a program for addition of two matrixes.
7. Write a program for multiplication of two matrixes.
8. Write a program to find transpose of a matrix.
9. Write a program to print:
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10. Write a program to print:
1
22
333
11. Write a program to print:
1
23
456
12. Write a program to check whether entered string is palindrome or not.
13. Write a program to print Fibonacci series.
14. Write a Program to find factorial of a given number.
15. Write a program to demonstrate use of static data member.
16. Write a program to demonstrate use of a static member function.
17. Write a program to create array of objects.
18. Write a program to demonstrate use of friend function.
19. Write a program to illustrate use of copy constructor.
20. Write a program to demonstrate constructor overloading.
21. Write a program to illustrate use of destructor.
22. Write a program to overload a unary operator.
23. Write a program to overload a binary operator.
24. Write a program to demonstrate single Inheritance.
25. Write a program to demonstrate multiple Inheritance.
26. Write a program to demonstrate multilevel Inheritance.
27. Write a program to demonstrate hierarchical inheritance.
28. Write a program to demonstrate hybrid Inheritance.
29. Write a program to demonstrate the use of function overloading.
30. Write a program to demonstrate the use of inline member function.
31. Write a program to demonstrate the use of parameterized constructor.

B: Data Structures

1. Write a program to find the factorial of a given no using recursion.
2. Write a program for bubble sorting.
3. Write a Program for linear search.
4. Write a Program for binary search.
5. Write a Program for selection sorting.
6. Write a Program for quick sorting.
7. Write a Program for insertion sorting.
8. Write a Program to print Fibonacci series using recursion.
9. Write a Program to perform insertion and deletion operation in the stack.
10. Write a Program to perform insertion and deletion operation in the queue using static implementation.
11. Write a Program to perform insertion and deletion operation in queue using dynamic implementation.
12. Write a program to insert a node at the beginning in singly linked list.
13. Write a program to insert a node at the middle in singly linked list.
14. Write a program to insert a node at the last in singly linked list.
15. Write a program to delete a node from the beginning in singly linked list.
16. Write a program to delete a node from the middle in the singly linked list.
17. Write a program to delete a node from the last in the singly linked list.
18. Write a program to traverse all the nodes in singly linked list.
19. Write a program to insert a node in the beginning in the circular linked list.
20. Write a program to insert a node at the last circular linked list.
21. Write a program to perform all the insertion operations in the singly linked list using switch case.
22. Write a program to perform all the deletion operations in the singly linked list using switch case.
23. Write a program to count the number of nodes in binary tree.
24. Write a program to evaluate postfix operation.
25. Write a program to convert infix operation to postfix operation.

Class	:	B.Sc. III YEAR	
Subject	:	Computer Science	
Paper	:	I	
Paper Title	:	Database Management System	
Compulsory	:	Compulsory	
Max. Marks	:	Theory - 40 CCE - 10	Total – 50

UNIT-1

Purpose of database system, views of data, data models: relation, network, hierarchical, instances and schemas, data dictionary, types of database languages:-DDL, DML, structure of DBMS, advantages and disadvantages of DBMS, 3-level architecture proposal:-external, conceptual & internal levels.

UNIT-II

Entity relationship model as a tool of conceptual design: entities & entities set, relationship and relationship set, attributes and mapping constraints, keys, ER diagram:-strong and weak entities, generalization, specialization & aggregation, reducing ER diagram to tables.

UNIT-III

Fundamentals of set theoretical notations: relations, domains, attributes, tuples, concept of keys: primary key, super key, alternate key, candidate key, foreign key, fundamentals of integrity rules: entity & referential integrity, extension and intention, relational algebra: select, project, Cartesian product, different types of joins: theta, equi, natural, outer joins, set operations.

UNIT-IV

Functional Dependencies, Good & Bad Decomposition and Anomalies as a database: A consequences of bad design, Universal relation, Normalization: 1NF , 2NF, 3NF , & BCNF normal forms, multivalued dependency, join dependency, 4NF, 5NF.

UNIT-V

Basic concepts:- Indexing and Hashing, B-tree Index files, Hashing: Static & Dynamic hash function, Index definition in SQL: Multiple key accesses.

Text Books-

Database System Concepts by Henry Korth and A. Silberschatz.

Simplified approach to DBMS, Prateek Bhatia, Gurvinder Singh Kalyani Publication

Reference Books-

An Introduction to Database System by Bipin Desai

An Introduction to Database System by C.J. Date.

List of programs for practical

Create the appropriate table and apply the following queries

1. WAQ to insert some new records in emp table.
2. WAQ to list the number of employees whose name is not 'ford', 'jams' or 'jones,
3. WAQ to list the name and salary and sort them in descending order of their salary
4. WAQ to list the details of employees whose name is starts from 'a'
5. WAQ to delete all records from emp table
6. WAQ to insert values in 3 fields.
7. WAQ to list the student name having 'd' as second character.
8. WAQ to list the name and salary and sort them in descending order of their salary
9. WAQ to list the name and salary and sort them in descending order of their salary
10. WAQ in employee table find all the manager who earns between 1000 and 2000.
11. Display record of employee who have salary between 1000 and 2000
12. List the name salary and department number of the employee and order them by their salary in descending order.
13. In employee table change the city of employee from existing one to new one.
14. Add a column salary of datatype 'number' & having size '5' with default 1000.
15. WAQ to find the employee who earns the lowest salary in each department. Display in ascending order of salary.
16. List the employee who earns maximum salary in their department. Find the name of all employee who works for 'first bank corporation'. Display the record of employee whose name start with 's' & age is greater than 18.
17. Find the name, street & city of residence of all employee who works for 'fbc'
18. WAQ to update the salary of employee number 1902 to Rs. 10,000
19. WAQ to find the name, street and city of all employee who works for 'fbc' and who earn more than 1000.
20. WAQ to increase the salary by 2000 and rename the column as "newsalary"
21. WAQ to find the name, street and city of all employee who works for 'fbc' and who earn more than 1000.
22. WAQ to find total of salaries of all employees from emp table
23. WAQ to decrease the salary of emp from 5000 and rename column as 'newsalary'
24. List the employee number of employee who belone to department 10,20.
25. List the employee no of employees who earn greater than 2000
26. Insert new field called category in emp table.
27. Display different jobs in departments 20,30
28. List the names of employees having two 'aa' in the name
29. Print the name, emp no. salary of employees in emp table.
30. List the names of employees who do the job of clerks or salesman.

Class	:	B.Sc. III YEAR		
Subject	:	Computer Science		
Paper	:	II		
Paper Title	:	Operating System Concepts		
Compulsory	:	Compulsory		
Max. Marks	:	Theory - 40	CCE - 10	Total – 50

UNIT -I

Operating system definition, its components evolution of operating system, types of operating system: batch multiprogramming multitasking ,multiprocessor ,real time , client-server, peer-to-peer, distributed ,distributed ,clustered , operating system services ,system calls, protection of I/O ,memory and CPU.

UNIT-II

Process scheduling : concept of a process, process states, PCB process life cycle, operations on processes, context switch, types of schedulers, CPU burst-I/O burst cycles, dispatcher, scheduling criteria, scheduling algorithms – FCFS,SJF,STRN, Round Robin, priority event driven, multilevel queue. Performance evaluation of algorithms through deterministic modeling.

UNIT-III

Memory Management: address binding ,logical and physical address space ,dynamic loading and linking. Contiguous memory allocation: static and dynamic partitioned memory, fragmentation, swapping relocation, compaction protection. Non-contiguous memory allocation: Paging Segmentation. Virtual Memory: demand paging, page replacement algorithms-FIFO, LRU, optimal. Thrashing, page fault frequency.

UNIT IV

Intercrosses communication need for synchronization, Deadlocks- definition, avoidance, prevention detection and recovery. Disk organization, Directory structure, disk space management-contiguous and non –contiguous allocation strategies, disk address translation ,disk caching , disk scheduling algorithms. Device Management: dedicated devices, shared devices. Security and protection: security threats and goals, penetration attempts. Security policies and mechanisms, authentication, protection and control.

UNIT V

Linux: History and features of Linux, Linux architecture, file system of Linux, hardware requirements, Linux standard directories, Linux Kernel.

Working with Linux: KDE and Gnome graphical interface, various types of shells available in Linux. Vi Linux , Linux commands. File commands. File security in Linux.

TEXT BOOKS AND REFERENCE BOOKS

1. **Operating system Concepts: by Silberschatz , Galvin and Gagne.**
2. **Operating system Design and Concepts,by Milan Milenkovic**
3. **Operating system by Andrew Tanenbaum**
4. **Operating system by Peterson**
5. **Linux Bible by Christopher Negus**
6. **Linux by Sumitabh Das**

Suggested Practical
Basic Linux Commands and vi editor

Class	:	B.Sc. II YEAR
Subject	:	Mathematics
Paper	:	I
Paper Title	:	Abstract Algebra
Compulsory	:	Compulsory
Max. Marks	:	Theory - 40 CCE - 10 Total – 50

Unit 1: Definition of basic properties of groups, subgroups, subgroup generated by a subset, Cyclic groups and simple properties.

Unit 2: Coset decomposition, Lagrange's theorem and its corollaries including Fermat's theorem, Normal subgroups, Quotient groups.

Unit 3: Homomorphism and Isomorphism of groups, Fundamental theorem of homomorphism, Transformation and Permutation group, S_n (various subgroups of S_n , $n < 5$ to be studied), Cayley's theorem.

Unit 4 : Group Automorphism, Inner Automorphism, group of Automorphisms, Conjugacy relation and Centraliser, Normaliser, Counting principle and class equation of a finite group. Cauchy's theorem for finite abelian groups and non-abelian groups.

Unit 5: Definition and basic properties of rings, Ring homomorphism subrings, Ideals and Quotient rings, Polynomial rings & its properties, integral domain and Field.

Text Books:

1. J.N. Herstein- Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1977.
2. PB Bhattacharya, S.K. Jain and S.R. Nagpaul-Basic Abstract Algebra, Wiley Eastern Ltd. New Delhi, 1977.

Reference Books:

1. Shantinayakan-A text Book of Modern Abstract Algebra, S. Chand and Company, New Delhi.
2. Surjeet Singh – A text book of Modern Algebra.
3. N. Jacobson – Basic Algebra, Vol. I and II, W, II, Freeman.
4. I.S. Luther and I.B.S. Passi- Algebra, Vol. I and II, Narosa Publishing House.

Class	:	B.Sc. II YEAR
Subject	:	Mathematics
Paper	:	II
Paper Title	:	Advance Calculus
Compulsory	:	Compulsory
Max. Marks	:	Theory - 40 CCE - 10 Total – 50

Unit 1: Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, series of non-negative terms, comparison test. Cauchy's integral test, Cauchy's root test, ratio tests, Raabe's tests, logarithmic tests. Alternating series, Leibnitz's test, Absolute and conditional convergence.

Unit 2: Continuity of functions of single variable, sequential continuity, properties of continuous functions, uniform continuity, chain rule of differentiability, Mean value theorems and their geometrical interpretations, Darboux's intermediate value theorem for derivatives.

Unit 3: Limit and continuity of functions of two variables, partial differentiation, change of variables, Euler's theorem on homogenous functions, Taylor's theorem for functions of two variables, Jacobians.

Unit 4: Envelopes, Evolutes, Maxima and Minima of functions of two variables, Lagrange's multiplier method, Beta and Gamma Functions.

Unit 5: Double and triple integrals, volumes and surfaces of solids of revolution Dirichlet's integrals, change of order of integration in double integrals.

Text Books:

1. R.R. Goldbeg- Real Analysis, Oxford & I.B.H. Publishing co. , New Delhi.
2. Gorakh Prasad- Differential Calculus, Pothishala Pvt. Ltd. Allahabad.
3. Gorakh Prasad- Integral Calculus, Pothishala Pvt. Ltd. Allahabad.

Reference Books:

1. Gabriel Klaumber- Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. T.M. Apostol- Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. D. Soma Sundaram and B. Choudhary- A first Course in mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
4. Murray R. Spiegel- Theory and problem of advance Calculus, Schauma Publishing Co., New York.
5. O.E. Stanaitis- An introduction to Sequences, Series and improper Integrals.

Class	:	B.Sc. II YEAR		
Subject	:	Mathematics		
Paper	:	III		
Paper Title	:	Differential Equations		
Compulsory	:	Compulsory		
Max. Marks	:	Theory - 40	CCE - 10	Total – 50

Unit 1: Series solutions of differential equations, Power series method, Bessel and Legendre equations, Bessel's and Legendre's functions and their properties- recurrence and generating function. Orthogonality of functions.

Unit 2: Laplace Transformation, Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems, Differentiation and integration of transforms.

Unit 3 : Inverse Laplace transforms, Convolution theorem, Application of Laplace transformation in Solving linear differential equations with constant coefficients.

Unit 4: Partial differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method.

Unit 5: Partial differential equations of second and higher orders, classification of partial differential equations of second order, homogeneous and non-homogeneous equations with constant coefficients, partial differential equations reducible to equations with constant coefficients.

Text Books:

1. Sharma and Gupta- Integral Transform, Pragati Prakashan, Meerut.
2. Sharma and Gupta- Differential Equation, Pragati Prakashan, Meerut.
3. Raisinghania- Differential Equation, S. Chand & Company, New Delhi.

Reference Books:

1. D.A. Murray – Introductory course in differential equation, Orient Longman, India, 1967.
2. G.F. Simmons – Differential Equations, Tata Mcgraw Hill, 1972.
3. E.A. Conington – An Introductory to Ordinary differential equations, Prentice Hall of India, 1961.
4. H.T.H. Piaggio – Elementary Treatise on Differential equations and their applications, C.B.S. Publisher and Distributors, Delhi, 1985
5. E.D. Rainville – Special Functions, The Macmillan Company, New York.

Class	:	B.Sc. III YEAR
Subject	:	Mathematics
Paper	:	I
Paper Title	:	Linear Algebra & Numerical Analysis
Compulsory	:	Compulsory
Max. Marks	:	Theory - 40 CCE - 10 Total – 50

Unit 1: Definition and examples of Vector spaces, subspaces, sum and direct sum of subspaces, linear span, linear dependence, independence and their basic properties, basis, Existence theorem for basis, Extension Theorem, invariance of the number of elements of a basis, Dimension, finite dimensional vector space, existence of complementary subspace of a subspace of finite dimensional vector space, Dimension of sum of subspaces, Quotient space and its dimension.

Unit 2: Linear transformations and their representation as matrices, Algebra of linear transformations, Rank-Nullity theorem, change of basis, dual space, bi-dual space and natural isomorphism, adjoint of a linear transformation, eigen values and eigen vectors of a linear transformation, diagonalisation, Bilinear Quadratic and Hermitian forms.

Unit 3: Inner Product Space- Cauchy-Schwartz inequality, orthogonal vectors, orthogonal components, orthonormal sets and bases, Bessel's inequality for finite dimensional spaces, Gram-Schmidt orthogonalization process.

Unit 4 : Solution of Equations: Bisection Secant, RegulaFalsi, Newton's Methods, Roots of second degree Polynomials. Interpolation: Lagrange interpolation, Divided differences, Interpolation formula using Differences, Numerical Quadrature, Newton- Cote's formulae. Gauss Quadrature formulae.

Unit 5: Linear equations direct methods for solving systems of linear equations (Gauss elimination, LU decomposition, Cholesky decomposition), Iterative methods (Jacobi, Gauss-Seidel reduction methods). Ordinary differential equations: Euler method, Single step method, Runge-Kutta's method, Multistep methods, Milne Simpson method, Methods based on Numerical Integration Methods based on numerical differentiation.

Text Books:

1. K.B. Datta- Matrix and Linear Algebra, Prentice hall of India Pvt. Ltd., New Delhi, 2000.
2. S.S. Sastry- Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd.

Reference Books:

1. K. Hoffman and R. Kunze- Linear Algebra, 2nd Edition, Prentice Hall Englewood Cliffs, New Jersey, 1971.
2. S.K. Jain, A Gunawardena & P.B. Bhattacharya- Basic Linear Algebra with MATLAB Key College Publishing (Springer- Verlag), 2001.
3. S. Kumarsaran- Linear Algebra, A Metric Approach Prentice Hall of India, 2000
4. Balaguruswamy- Numerical Methods, Tata McGraw Hill publication, New York.

Class	:	B.Sc. III YEAR
Subject	:	Mathematics
Paper	:	II
Paper Title	:	Real & Complex Analysis
Compulsory	:	Compulsory
Max. Marks	:	Theory - 40 CCE - 10 Total – 50

Unit 1: Riemann integral, Integrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus, partial derivatives and differentiability of real-valued functions of two variables, Schwarz's and Young's theorem, Implicit function theorem.

Unit 2: Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests. Frullani's integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter. Fourier series of half and full intervals.

Unit 3: Definition and examples of metric spaces, neighbourhoods, limit points, interior points. Open and closed sets, closure and interior, boundary points. Subspace of metric space. Cauchy sequences, Completeness, Cantor's intersection theorem. Contraction principle, Real number as a complete ordered field. Dense subsets, Baire Category theorem, Separable countable and first countable spaces.

Unit 4: Continuous functions, Extension theorem, Uniformity continuity, Compactness, Sequential compactness, totally bounded spaces, Finite intersection property, Continuous functions and compact sets, Connectedness.

Unit 5: Complex numbers as ordered pairs, Geometric representation of complex numbers, Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions. Mobius transformations, Fixed points, Cross ratio. Inverse points, Conformal Mappings.

Text Books:

1. Mathematics analysis by S.C. Malik and Savita Arora, New Age Publication, Delhi.
2. G.F. Simmons – Introduction to Topology and Modern Analysis, McGraw Hill, New York, 1963.
3. L.V. Ahlfors, complex Analysis McGraw Hill, New York.

Reference Books:

1. Walter Rudin - Real and Complex Analysis, McGraw Hill, New York.
2. Ponnuswamy – Complex Analysis, Narosa Publication, New Delhi.
3. R.V. Churchill & J.W. Brown, Complex Variables and Application, 5th Edition, McGraw Hill, New York, 1990.

Class	:	B.Sc. III YEAR		
Subject	:	Mathematics		
Paper	:	III		
Paper Title	:	Discrete Mathematics		
Compulsory	:	Compulsory		
Max. Marks	:	Theory - 40	CCE - 10	Total – 50

Unit 1: Boolean functions-disjunctive & conjunctive normal forms (canonical & dual canonical), Bool's expansion theorem, Relations- Binary relation,inverse relation, composite relation, equivalence relation, equivalence classes & its properties ,Partition of a set.

Unit 2: Partial order relation, partially ordered sets, totally ordered sets, Hasse diagram, maximal and minimal element, first and last element Lattice- definition and examples, dual lattice, bounded lattice, distributive lattice, complemented lattice.

Unit 3: Graph- Definition, types of graphs, sub graphs walk, path, circuit, connected and disconnected graphs, Euler graph, Hamiltonian path and circuit, shortest path in weighted graph, Dijkstra's Algorithm for the shortest paths.

Unit 4: Trees and its properties,rooted tree, Binary tree, Spanning tree, Rank and nullity of a graph, Kruskal's Algorithm and Prim's Algorithm.

Unit 5: Matrix representation of graphs- Incidence and Adjacency matrix, cut set and its properties, Planer graphs (definition) Kuratowski's two graphs

Text Books:

1. C.L. Liu- Elements of Discrete Mathematics, McGraw Hill, New York.
Narsingh Deo- Graph Theory, Prentice Hall.

Class	:	B.Sc. II Year	
Subject	:	Physics	
Paper	:	I	
Paper Title	:	Optics	
Max. Marks:	Max. Marks	Theory – 40 CCE -10	Total 50

Unit – I Geometrical Optics

Reflection and refraction. Fermat's Principle. Reflection at a spherical surface, Aplanatic points and its applications. Lens formula. Combination of thin lenses and equivalent focal length. Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces. Ramsden and Huygens eye-piece.

Unit –II Interference of light

The principle of superposition. Two slit interference, coherence requirement for the sources, optical path retardation, Lateral shift of fringes. Rayleigh refractometer and other applications. Localised fringes thin films, interference by a film with two non- parallel reflecting surfaces, Newton's rings. Haidinger fringes (fringes of equal inclination). Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and Etalon.

Unit –III Diffraction

Fresnel's theory of half periods zone, diffraction at straight edge, rectilinear propagation. Diffraction at a slit, phasor diagram and integral calculus methods. Diffraction at a circular aperture and a circular disc. Rayleigh criterion of resolution of images. Resolving power of telescope and microscope. Outline of phase contrast microscopy. Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Resolving power of a grating and comparison with resolving power of prism and of a fabry parot etalon.

Unit –IV Polarisation

Transverse nature of light waves, Polarization of electromagnetic waves. Plane polarised light-production and analysis. Description of Linear, circular and elliptical polarisation. Propagation of electro magnetic waves in anisotropic media, uniaxial and biaxial crystals. Symmetric nature of dielectric tensor. Double refraction. Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal. Nicol prism. Production of circularly and elliptically polarized light, Babinet compensator and application. Optical rotation, Optical rotation in liquids and its measurement through polarimeter.

Unit- V Laser and Photosensors

A brief history of lasers, characteristics of laser light. Einstein prediction. Relationship between Einstein's coefficients (qualitative discussion). Pumping schemes. Resonators. Ruby laser, He-Ne laser. Application of lasers. Principle of Holography. Photodiodes, Phototransistors and Photomultipliers .

References Books:

1. Fundamentals of Optics : F.A. Jenkins H. E. White ,1976, McGraw-Hill.
2. Principles of Optics : B. K. Mathur 1995, Gopal printing .
3. University physics : F.W. Sears ,M.W. Zemansky and H.D. Young ,13/e.1986.
Addison – Wesley .
4. Optics : A.K. Ghatak , Mc Graw Hill publications .
5. Principles of optics : Max Born and Wolf, Pergamon press.
6. Optics and Atomic Physics, D.P. Khandelwal. Himalaya Publication.

Class	:	B.Sc. II Year	
Subject	:	Physics	
Paper	:	II	
Paper Title	:	Electrostatics, Magnetostatics and electrodynamics	
Max. Marks	:	Theory – 40 CCE -10	Total50

Unit –I Electrostatics

Coulombs law in vacuum expressed in vector forms, calculations of electric field E for simple distribution of charge at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between electric field and electric potential ($E = -\nabla V$), torque on a dipole in a uniform electric field and its energy, flux of the electric field. Gauss's law and its application for finding E for symmetric charge distribution. Capacitors, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector P , relation between displacement vector D , E and P . Molecular interpretation of Clausius-Mossotti equation.

Unit –II Magnetostatics

Force on a moving charge.

Lorentz force equation and definition of B , force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio. Biot and Savart's law, calculation of H for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla \times B = \mu_0 J$, $\nabla \cdot B = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (M), relationship B , H and M . Derivation of the relation $\nabla \times M = J$ for non-uniform magnetization.

Unit –III Current Electricity and Bio electricity

Steady current, current

density J , non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits decay constants, LCR circuits. AC circuits, complex numbers and their application in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q - factor, power consumed by an AC circuits, power factor. Y and Δ networks and transmission of electric power, Electricity observed in living systems. Origin of bioelectricity.

Unit –IV Motion of charged particles in Electric and Magnetic Fields

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. E as deflecting field – CRO. Sensitivity of CRO. Transverse B field; 180° deflection. Mass spectrograph and velocity selector. Curvatures of tracks for energy determination for nuclear particles: Principle and working of Cyclotron. Mutually perpendicular and parallel E & B fields: positive ray parabolas. Discovery of isotopes. Elements of Mass Spectrographs. Principle of magnetic focusing (lenses).

Unit -5 Electrodynamics

Electromagnetic induction, Faraday's Law, Electromotive force. Integral and differential form of Faraday's law. Self and mutual inductance. Transformers, Energy in a static magnetic field,

Maxwell's displacement current. Derivations of Maxwell's equations, Electromagnetic field energy density. Poynting vector. Electromagnetic wave equation. Plane electromagnetic waves in vacuum and dielectric media. Reflection at a plane boundary of dielectrics, Fresnel's Laws Polarization by reflection and total internal reflection. Waves in a conducting medium. Reflection and refraction by the ionosphere.

References:-

1. Berkeley Physics Course. Electricity and Magnetism Ed. E.M. Purcell McGraw Hill.
2. Physics Volume 2. D. Halliday and R. Resnick.
3. Introduction to Electrodynamics ; D.J. Griffiths, 4 Edition , Printice Hall.
4. Electricity and Magnetism: S.S Atwood Dover.
5. Electrodynamics: Emi Cossor and Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
6. From Neuron to Brain: Kuffler and Nicholas. Sinauer Associates. Inc Pub. Sunderland. Massachusetts.
7. Schaums Outline of Beginning Physics II: Electricity and Magnetism.

Class : B.Sc. II Year

Max. Marks:50

Subject : Physics Practicals

List of Practical's

- 1.Study of interference using biprism .
- 2.Study of diffraction at straight edge.
- 3.Use of plane diffraction grating to determine D1.D2. lines of Sodium lamp.
- 4.Resolving power of telescope.
- 5.polarization by reflection and verification of Brewster's Law.
- 6.Study of optical rotation in Sugar solution .
- 7.Refractive index and dispersive power of prism using spectrometer.
- 8.Absorption spectrum of material using constant deviation spectrograph .
- 9.Beam divergence of He –Ne Laser .
- 10.Determination of wavelength of Laser by diffraction .
- 11.Determination of radius of curvature of plano-convex lense by Newton's rings.
- 12.Characterstics of a Ballistic galvanometer .
- 13.Setting up and using an electroscope or electrometer .
14. Measurement of low resistance by Carey- Foster bridge or otherwise.
15. Measurement of inductance using impedance at different frequencies.
- 16.Measurement of capacitance using ,impedance at different frequencies.
17. Response curve for LCR circuits and response frequencies.
- 18.Sensitivity of a cathode- ray oscilloscope .
- 19.Use of a vibration magnetometer to study a field.
- 20.Study of magnetic field due to current using Tangent Galvanometer .
- 21.Study of decay of currents inLR and RC circuits.
- 22.Study of Lissajous figures using CRO.
- 23.Verification of Network theorms.

Class	:	B. Sc. III Year
Subject	:	Physics
Paper	:	I
Title of the paper	:	Quantum Mechanics and Spectroscopy
Max. Marks	:	Theory – 40 CCE -10 Total 50

Unit-I

Quantum Mechanics-1

Particles and Waves: Photoelectric effect, Black body radiation. Planck's radiation law, Stefan Boltzmann law, Wien's displacement law and Rayleigh-Jean's law, Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigen values. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

Unit-II

Quantum Mechanics-2

Time Independent Schrodinger equation: One dimensional potential well and barrier. Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigen values from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator.

Unit-III

Atomic Spectroscopy

Atoms in electric and magnetic fields: Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, L-S and J-J coupling. Zeeman effect. Continuous and characteristic X-rays. Moseley's law.

Unit-V

Molecular Spectroscopy

Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank-Condon principle, singlet and triplet states. Fluorescence and phosphorescence.

Unit-V

Nuclear Physics and Elementary Particles

Basic properties of nucleus: Interaction with Neutron and Charged Particles with Matter. Nuclear detectors. Ionisation Chamber, Geiger-Muller Counter, Proportional Counter, scintillation counter, Cloud Chamber, Basic Properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttall law. Nature of beta ray spectra. The neutrino and its physics. Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reaction. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts).

Reference:-

1. Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005.
2. Quantum Mechanics: B.H. Bransden, Pearson Education, Singapore, 2005
3. Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville Tate University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009
4. Physics of Atoms and Molecules: B.H. Bransden and C.J. Joachaim, Pearson Education, Singapore, 2003
5. Fundamentals of Molecular Spectroscopy: C.M. Banwell and M. McCash, McGraw Hill (U.K.Edition)
6. Introduction to Atomic Physics: H.E. White
7. Quantum Mechanics: Schaums Outlines, Y. Peleg, R. Pnini, E Zaarur, E. Hecht.

Class	:	B. Sc. III Year		
Subject	:	Physics		
Title of the paper	:	Solid State Physics & Electronic Devices		
Paper	:	II		
Max. Marks	:	Theory – 40 CCE -10	Total	50

Unit-I

Solid State Physics -1

Crystal Structure and Bonding: Crystalline and Amorphous solids Translational symmetry. Lattice and basis. Unit cell. Reciprocal lattice. Fundamental types of lattice (Bravais Lattice) Miller indices Lattice Planes. Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer. Ionic, Covalent metallic, van der Waals and hydrogen bonding. Band theory of Solids. Periodic potential and Bloch theorem. Kronig-Penny model (Qualitative)

Unit-II

Solid state Physics-2

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss' theory of ferromagnetism and ferromagnetic domains. Discussion of BH hysteresis. Super conductivity, Meissner's effect, Josephson junction effect and high temperature superconductivity.

Unit-III

Semiconductor devices-1

Electronic devices: Types of Semiconductors (p and n), Formation of Energy Bands, Energy level diagram. Conductivity and mobility. Junction formation, Barrier formation in p-n junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equation for barrier potential, barrier width. Single p-n junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices. Junction field effect transistor (JFET). Two junction devices. Transistors as p-n-p and n-p-n. Physical mechanisms of current flow. Characteristics of transistor.

Unit-IV

Semiconductor devices-2

Amplifiers (only bipolar junction transistor). CB, CE and CC configuration. Single stage CE amplifier (biasing and stabilization circuits), Q-point equivalent circuit, input impedance, output impedance, voltage and current gain. Class A, B, C amplifiers (definitions). RC coupled amplifiers (frequency response Curve). Class B push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Out impedance and gain. Stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulations and demodulation.

Digital Electronics : Boolean Identities, De-Morgan's law, Logic gate and truth tables; simple logic Circuits; Thermistors, solar cells, Concepts of Microprocessors and digital computer.

Unit-V

Nano materials

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, 0D nanostructure materials and their density of states, surface and interface effects. Modeling of quantum size effect. Synthesis of nanoparticles – Bottom Up and Top Down approach, Wet Chemical Method. Nanolithography. Metal and Semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (qualitative description). Naturally occurring nano crystals. Applications of nanomaterials.

Reference:-

1. Introduction to Solid State Physics: C.Kittel, VIIIth , Edition, John, Wiley and Sons, New York, 2005
2. Intermediate Quantum Theory of Crystalline Solids: A.O.E. Animalu, Prentice-Hall of India private Limited, New Delhi 1977
3. Solid State Electronic devices: B.G. Streetman, II Editions Prentice Hall, India.
4. Microelectronic: J. Millman and A. Grabel, McGraw Hill New York
5. The Physics and Chemistry of Nanosolids: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008
6. The Physics of Low Dimensional Semiconductors: An Introduction, J.H. Davies, Cambridge University Press, U.K. 1998
7. Electronic fundamentals and applications: J.D. Ryder, Prentice Hall, India.

Class : **B. Sc. III Year**
Subject : **Physics Practicals**
Subject : **Physics**
Max. Mark : **50**

List of Practical's

1. Specific resistance and energy gap of a semiconductor.
2. Study of half wave and full wave rectification.
3. Characteristics of Zener diode.
4. Characteristics of a tunnel diode
5. Characteristics of JFET
6. Characteristics of a transistor.
7. Study of regulated power supply.
8. Study of RC coupled amplifiers.
9. Determination of Planck's constant.
10. Determination of e/m using Thomson's Method
11. Determination of e by Millikan's Method.
12. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
13. Absorption spectrum of iodine vapour.
14. Study of Zeeman effect for determination of Lande g -factor.
15. Study of Raman spectrum using laser as an excitation source
16. To draw B-H curve a transformer core.
17. Hysteresis curve a transformer core.
18. Hall Probe method for measurement of resistivity.

Class : **B.Sc. II Year**
Subject : **Biotechnology**
Paper : **I**
Paper Title : **Biophysics and Biochemistry**
Maximum Marks : **Theory: 40, CCE: 10, Total: 50**

Unit I

Thermodynamics- system, equilibrium, Thermodynamics laws and their applications. Different types of Thermodynamic processes, Thermodynamic variables and entropy, Thermodynamic potentials and relations. Maxwells equations , fundamental equation of heat flow.

Unit II

General biophysical method: measurement of pH... , radioactive labeling and counting. Autoradiography, diffusion, sedimentation, osmosis, viscosity- definitions, factors influencing them and their application in biology.

Braggs equation, reciprocal lattice, miller indices and unit cell, concept of different crystal structure , determination of crystal structure.

Unit III

Fundamentals of Biochemistry: Biochemistry as molecular logic of living beings. Axioms of living matter, major organic compounds of animate objects a general view. Chemical elements, structure of atoms, molecules and chemical bonds. Ionic, covalent, coordinate and hydrogen bond. Structure, functions and properties of water. Water as universal solvent. Acids, bases and salts. pH and buffers.

Unit IV

Biomolecule: Introduction and occurrence, Classification, properties, importance of carbohydrates, lipids , proteins, amino acids and nucleic acids and various types of RNA

Unit V

Enzymes: Structure, classification and function- Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km-Michaelis Menten Equation. Various types of enzymes inhibition and identification using double reciprocal plot. Introduction to allosteric enzymes. Definition of holoenzymes, apoenzyme, co-enzyme, cofactors, prosthetic group and their examples. Concept of ribozymes, multiple forms, isozymes and abzymes.

Class : B.Sc. II Year
Subject : Biotechnology
Paper : II
Paper Title : Bioinstrumentation, Biostatistics and Bioinformatics
Maximum Marks : Theory: 40, CCE: 10, Total: 50

Unit I

Microscopy light , phase contrast, fluorescence and electron microscopy.
Centrifugation technique. Principles types & separation of biological molecule.

Unit II

Chromatography and Electrophoresis

Chromatography: Principles and application, Principles and application of electrophoresis:
Agrose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.

Unit III

Spectrophotometry: Colorimetry (UV and visible) , Radio & non radio labeling,
Autoradiography .

Unit IV

Biostatistics Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability, definition. Random variable and its distribution. Binomial probability distribution.

Unit V

Computers: general introduction (characteristics, capabilities, generation), hardware: organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices) ; software : (system software ; application software, languages- low level, high level); internet application Basic bioinformatics: introduction to internet, search engines (google, yahoo, entrez etc.

Biological data bases sequence databases (EMBL, GENBANK, DDBJ, UNIPROT, PIR, TREMBL), protein family or domain data bases (PROSITE, PRINTS, Pfam, BLOCK, etc.). Cluster data bases- An introduction, specialized data bases (KEGG, etc.) data base technologies (flat file) structural databases (PDB).

List of recommended books for B.Sc. II year Biotechnology.

1. A Text book of bioinformatics – Sharma & Munjal
2. Bioinformatics- CSV Murthy
3. Basic Bioinformatics- S.Ignaemuthu
4. Bioinformatics – concepts, skills and application- S.C.Rastogi. N.Mendiratta & Parag Rastogi

5. Practical guide for Bioinformatics and Biostatistics- P. Tiwari & P.Pandey
6. Biostatistics- P.Prasad
7. Statistical method- S.P.Gupta
8. Fundamentals of Statistics- S.C.Gupta
9. Biostatistics- P.N.Arora
10. Principles of Biochemistry- Lehinger
11. Fundamentals of Biochemistry- J.L.Jain
12. Biochemistry- Voet and Voet
13. Textbook of Biochemistry- S.P.Singh
14. Biophysics- Mohan P.Arora
15. Biophysics- Pattab and Gautham
16. Biochemistry- A.C.Deb
17. Biomolecules- Mohan P.Arora
18. Principles of Biochemistry - Nelson & Cox.

PRACTICAL LIST

The practical's work will be based on theory syllabus and the candidates will be required to show the knowledge:-

1. Principles and working knowledge of instruments like colorimeter, pH meter, centrifuge, spectrophotometer, microscope etc.
2. Qualitative estimation of Carbohydrates, proteins, lipids in biological samples.
3. Quantitative estimation of proteins by Folin-Lowry's method.
4. Quantitative estimation of Sugar by Nelson Smogyi's method
5. Determination of enzyme activity by amylase.
6. Study of effect of pH on enzyme activity.
7. Study of effect of temperature on enzyme activity
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count .
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer input and output devices
20. Prepare a mark sheet of your class subjects.
21. Design your class time table.
22. Prepare a bar chart, pie chart, for analysis of election result.
23. Exercise based on PowerPoint presentation.
24. Design a presentation illustrating insertion of pictures, word art and clip art.
25. Use MS word to insert a table into document
26. Problem base don mean median, mode.
27. Hardy Weinberg law applied on population genetics.

28. Problem based on probability.
29. Exercise based on standard deviation.
30. Biological data resources and data retrieval.
31. Introduction to NCBI.
32. Retrieving DNA sequence from gene bank and analyzing various formats of the data stored.
33. Analyzing protein sequences.
34. Analyzing DNA sequence.

Note: 70% of the above list should be compulsorily performed.

Class : **B.Sc. III Year**
Subject : **Biotechnology**
Paper : **I**
Paper Title : **Molecular Biology and Genetic Engineering**
Maximum Marks : **Theory: 40, CCE: 10, Total: 50**

Unit I

DNA and RNA , Chemical Structure, Types and Properties, Experimental proof of DNA as genetic material, Genome- Concept, Plant, Animal, Bacterial and Viral Genome. DNA replication types, Experimental proof of semiconservative replication, Replicon- Concept, Proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication, Unidirectional, Bidirectional, Types of DNA replication, Y shaped, θ mode, rolling circle mechanism

Unit II

Eukaryotic chromosomal organization, Euchromatin, Heterochromatin, Chromatin Structure, nucleosomes, Histone and Non Histone proteins, Histone modification, Introduction to Epigenetics

Unit III

Origin of life, Chemical experiments and current concepts, Evolution of biological macromolecules, Evolution of early forms, Mendelian Genetics: Mendel's laws, Chromosomal basis of heredity, Chromosomal analysis, allelic, variation, dominance, linkage and crossing over.

Unit IV

Introduction to Recombinant DNA technology, Scope & importance, Gene cloning, PCR, Introduction to Restriction endonuclease, Vectors of DNA transfer and their types, Plasmids, Phagemids, Cosmids, BAC, Gene amplification.

Unit V

Plasmids, types, properties and cloning vectors. Recombinant DNA Techniques and cloning with restriction endonuclease and recombinant DNA. Mutation, Types of mutation, Point mutation (Base pair change, frame shift, deletion) Transcription, Translation and gene expression in eukaryotes (yeast), Alternate splicing.

Class	:	B.Sc. III Year
Subject	:	Biotechnology
Paper	:	II
Paper Title	:	Applied Biotechnology
Maximum Marks	:	Theory: 40, CCE: 10, Total: 50

Unit-I;

Microbial Biotechnology Food Microbiology-Microbial contamination and Spoilage, Food preservation. Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.

Unit-II:

Plant Biotechnology- Introduction to plant tissue culture, Nutritional requirements, In vitro culture. Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis. Protoplast culture. Somatic hybridization, Genetic manipulation of plants using *Agrobacterium tumefaciens*.

Unit-III;

Immunology and Animal Biotechnology Immunity- Innate and Acquired, Host defense mechanism- Infection and its types, Organs and Cells of Immune system, Vaccines and its types. Antigens- Properties and types, Adjuvants, Immunoglobulins- Structure, types and functions. Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions, History, Equipment and materials for animal cell culture technology. Physical requirement for animal cell and their growth curve in culture. Commonly used cell lines — their organization and characteristics, Differentiation of cells. Organ culture — techniques, advantage and applications.

Applications of animal biotechnology: Methods of Transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals, Stem cell culture, Transplantation of cultured cells, Bioreactors for large scale production of animal cells.

Unit-IV:

Fermentation Technology Fermentation Technology, Primary and Secondary Screening, Strain Improvement, Inoculum Development, Industrial Sterilisation process, Scale-up and Harvest and Recovery.

Types of fermentation — batch, continuous, fed batch process; Submerged and Solid State fermentation process, Basic design of a fermentor and factors affecting fermentor design. Types of fermentors- Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.

Unit-V:

Environment Biotechnology Environment: Basic concept, Significance, Public awareness, Environmental pollution, Assessment of water quality, Treatment of waste-water — Primary,

secondary and tertiary treatment. Solid waste management (composting, vermi-composting, methane production).

Biopesticides- Bacterial and Fungal, Genetically modified crops, Biofertilizers – Nitrogen fixers, PSB. Mycorrhiza and VAM, Microbial leaching, Microbial Enhanced Oil Recovery. Bioremediation and Biodeterioration. Modern fuels- Methanogenic bacteria and biogas, microbial hydrogen production.

List of Recommended Books

1. Industrial Microbiology : A. H. Patel
2. Microbial Biotechnology : Hazarre
3. Molecular biology: Avinash & Kakoli Upadhyay
4. Gene Biotechnology: Jogdand
5. Essential of Biotechnology: S.N.Das
6. Text book of Biotechnology: R.C. Dubey
7. Biotechnology & genomics : P.K. Gupta Fetal
8. Modern concept of Biotech: H.D. Menon
9. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K

LIST OF PRACTICAL

1. Chromosomal DNA isolation from Plant cells.
2. Chromosomal DNA isolation from Animal cells.
3. Genomic DNA isolation from Micro-Organisms.
4. Analysis of isolated DNA by Agarose gel electrophoresis.
5. Spectrometric analysis of RNA and DNA
6. UV as physical mutagen
7. Gradient Plate Technique
8. Estimation of DNA using diphenylamine method.
9. Estimation of RNA using orcinol method.
10. Isolation of RNA from Yeast..
11. Isolation of plasmid DNA from bacteria.
12. Effect of UV radiation on microbial cell
13. Demonstration of repair mechanism in microbes.
14. Bacteriophage and determination of latent period of infection
15. Isolation of total RNA from Plant tissue by SDS phenol method.
16. Elution of DNA from agarose gel band.
17. Transformation in E-coli cell.
18. Growth of plant tissue into undifferentiated mass of callus.
19. Preparation of animal cell culture media.
20. Separation and culture of lymphocyte from blood.
- 21, Demonstration of fermentor.
22. Preparation of wine.
23. Preparation of citric acid from *Aspergillus niger*
24. Production of ethanol by yeast.
25. Demonstration of PCR.
26. Immobilization of microbial cells.
27. Extraction and preparation of lactic acid.
28. Extraction and preparation of citric acid.
29. Demonstration of Radial immuno diffusion analysis. et S-
30. Isolation of microorganism from polluted site/ industrial waste. S : “<p wales
31. Blood group analysis.
32. Differential count of WBC.
33. To examine flocculation reaction using VDRL test.
34. To observe the agglutination reaction using WIDAL test
35. Determine the concentration of unknown antigen using Radial tmmuno Diffusion technique.

Note: 70% of the above list should be compulsorily performed.

Class	:	B.Sc. II Year
Subject	:	Botany
Paper	:	I
Paper Title	:	Structure, Development & Reproduction of flowering Plants
Max. Marks	:	Theory- 40 CCE – 10 Total - 50

Unit - I

Tissue System. Types of vascular bundles, apical meristem, Classification of meristem. The Root System: Root apical meristem. Differentiation of primary and secondary tissues and their role. Anatomy of Monocot and Dicot root. Secondary growth in root. Modification of root for Various Functions, Interaction of root with microbes.

Unit – II

The Shoot System: Shoot apical meristem and histological organization. Anatomy of Monocot and Dicot stem. Vascular cambium and its functions. Secondary growth in stem, characteristics of growth rings: sapwood and heart wood. Secondary Phloem Cork Cambium and Periderm. Anomalous Secondary growth in *Nycanthus*, *Boerhavia*, *Achyranthus*, *Leptadenia*, *Salvadora*, *Bignonia* and *Dracaena*.

Unit -III

The Leaf System - Origin and development of leaf. Diversity in size, shape and arrangement. Internal structure of Dicot and Monocot leaf. Adaptations to photosynthesis and water stress, senescence and abscission.

Unit -IV

Embryology: Concept of flower as a modified shoot. Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types. Pollination- Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.

Unit -V

Embryology: Double Fertilization and triple fusion. Development and types of endosperm and its morphological nature, Development of Embryo in Monocot and Dicot plants, fruit development and maturation, seed structure and dispersal. Mode of Vegetative Propagation.

Books Recommended:

- Gangulee, H.C., Das, K.S. And Dutta, C. 2007 College Botany Vol. I, New Central Book Agency (P) Ltd. Kolkata 70000.
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic press, London.
- Jones, S.B. Jr. And Luchisnger, A.E. 1986, Plant Taxonomy (III edition) Mc Graw Hill Book Co. New York.

- Maheshwari, P. 1978. Plant Embryology. Pandey, B.P. 2010. A Text book of Botany – Angiosperms, S.Chand & Company Ltd. Ramesh Nagar, New Delhi – II0055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row, New York.
- Shrivastava and Das, Modern text book of Botany Vol. III & IV.
- Singh, V., Pande P.C. and Jain, D.K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.

Class	:	B.Sc. II Year
Subject	:	Botany
Paper	:	II
Paper Title	:	Plant Ecology, Biodiversity and Phytogeography
Max. Marks	:	Theory- 40 CCE – 10 Total - 50

Unit - I

Ecosystems: Structure and types , Biotic and Abiotic components, Trophic levels, Food Chain, Food Web, Ecological pyramids, Energy Flow, Concept of Biogeochemical Cycles: Gaseous Liquid and Sedimentary cycles: Carbon, Nitrogen, Water, Phosphorus and Sulphur cycle.

Unit -II Ecological Adaptation: Morphological,, Anatomical and Physiological responses water adaptation (Hydrophytes and Xerophytes) Temperature adaptation (Thermoperiodism and Vernalization), Light adaptation (Heliophytes and Sciophytes), Photoperiodism, Plant Succession: causes, trends and processes, Types of succession _ Hydrosere and Xerosere.

Unit -III

Biodiversity & Population Ecology: Distribution patterns, Density, Natality, mortality, Growth curves, Ecotypes and Ecads: Community Ecology: Frequency, Density, Abundance, Cover and Life forms. Biodiversity: Basic concept, definition, importance, Biodiversity of India. Hotspots, *in situ* and *ex situ* conservation. Biosphere reserves, Sancturaries and National parks of Madhya Pradesh. Endangered and Threatened species, red data book.

Unit - IV

Soil & Pollution : Physical and Chemical properties, soil formation, Development of Soil Profile, Soil classification, Soil composition, soil factors; Pollution: Definition, Types & causes; Global Warming, Acid rain, Climate Change and Ozone Layer & Ozone Hole.

Unit - V

Phytogeography : Phytogeographical regions of India. Vegetation types of Madhya Pradesh. Natural resources: definition and classification. Conservation and management of natural resources, Land resource management, Water and wet land resource management.

Books Recommended:

- Benerjee, S. 1998. Bio Diversity conservation – Agrobotamica, Bikaner.
- Kumar, U.K.2006. Bio diversity principles and conservation, A grobios, Jodhpur.
- Odum, E.P. 5th ed. 2004 Fundamentals of Ecology, Natraj Publisher, Dehradun.
- Puri, G.S. 1960. Indian Forest Ecology.
- Sharma. P.D. 7th ed. 1998. Ecology and Environment, Rastogi Publication, Shivaji Road, Meerut. 250002. India.
- Shukla, R.S. & Chandel, P.S. 2006. A Text Book of Plant Ecology.

Practical Scheme

1. Section Cutting – Root/Stem/Leaf
2. Embryology – Anther / Ovule /Placentation
3. Exercise based on Ecology
4. Exercise based on Phytogeography/National Parks
5. Spotting
6. Viva Voce
7. Sessionals

Class	:	B.Sc. III Year
Subject	:	Botany
Paper	:	I
Paper Title	:	Plant Ecology, Biodiversity and Phytogeography
Max. Marks	:	Theory- 40 CCE – 10 Total - 50

Unit – I

Plant Water Relation : Properties of water, Importance of water in plant life, Diffusion, Osmosis & Osmotic relation to plant cell. Water Absorption. Ascent of Sap. Transpiration: Structure & Physiology of Stomata, Mechanism of Transpiration, Factors affecting the rate of Transpiration.

Unit – II

Plant Nutrition & Biomolecules: Mineral Nutrition, Essential macro & Micro Nutrients and their role, absorption of mineral nutrients and hydroponics, Translocation of organic solutes.

Biomolecules: Structure classification and functions of Carbohydrates, Amino acids, Proteins and Lipids.

Unit -III

Photosynthesis: Chloroplast, Photosynthetic pigments, Concept of two photosystems, Light reaction, Red drop, Emerson's effect, Dark reaction- Calvin cycle, Hatch & Slack cycle, CAM cycle, Factors affecting rate of photosynthesis & Photorespiration.

Unit -IV

Respiration:- Mitochondria, aerobic and anaerobic respiration, fermentation, Respiratory coefficient, mechanism of respiration- Glycolysis, Krebs's cycle, Pentose Phosphate Pathway, Electron transport system, Factors affecting rate of respiration, Redox potential and theories of ATP Synthesis.

Unit - V

Enzymology & Plant Hormones: Classification, nomenclature and characteristics of Enzymes, Concept of holoenzyme, apoenzyme, Co-enzyme and co-factors, Mode & mechanism of enzyme action, Factors affecting enzyme activity.

Plant Hormones: Discovery, structure mode of action and role of auxins, Gibberellins, Cytokinin, Abscissic Acid and Ethylene.

Books Recommended:

- David, L.N. and Michael, M.C. 2000. Leheniger's Principle of Biochemistry, Macmillan worth Pub. New York, U.S.A.

- Gengulee, H.C. Das, Datta, C. and sen, S. 2007. College Botany Voll. I, New Central Book Agency (P) Ltd. Kolkata. 700009.
- Hopkins, W.G. 1995. Introduction of Plant Physiology Pub. John Wiley and sons, New York.
- Taiz & Zeiger, E, 1998. Plant Physiology. Sinauer associates, Inc. Pub. Massachudetts, U.S.A.
- Salisbury & Ross – Plant Physiology.
- Devlin – Plant Physiology.
- Verma, S.K. & Verma, M.A. 1995. Text Book of Plant Physiology & Biotechnology. S. Chand & Company.
- Ver, V. 1995. Plant Physiology, Emkey Pub.

Class	:	B.Sc. III Year
Subject	:	Botany
Paper	:	II
Paper Title	:	Cell Biology, Genetics and Biotechnology
Max. Marks	:	Theory- 40 CCE – 10 Total - 50

Unit - I

The cell envelopes and organelles: Plasma membrane, lipid bilayer structure, functions of the cell wall, Structure and function of cell organelles: Nucleus Chloroplast, Mitochondria, Golgibodies, ER, Peroxisome and Vacuole.

Unit - II

Chromosomal Organization: Structure and functions of Chromosome, centromere and telomere. Nucleosome model, special types of Chromosomes, Mitosis and Meiosis, Variation in Chromosome Structure: Deletion, Duplication, Translocation and Inversion; Variation in chromosome number, Euploidy, Aneuploidy, DNA: The genetic material, DNA Structure and replication.

Unit - III

Genetic inheritance: Mendelism: laws of segregation and independent assortment; Linkage analysis; Interactions of genes. Cytoplasmic inheritance, Mutations: spontaneous and induced: Transposable elements; DNA damage and repair.

Unit - IV

Gene: Structure of gene, genetic code, transfer of genetic information: Transcription, translation, protein synthesis, tRNA, and ribosomes, Regulation of gene expression in prokaryotes and eukaryotes.

Unit - V

Biotechnology: Defination; basic aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis Important achievements of biotechnology in agriculture.

Genetic engineering: Tools and techniques of recombinant DNA technology; cloning vectors; biology of Agrobacterium; vectors for gene delivery and marker genes. Genomic and cDNA library: Gene mapping and chromosome walking.

Books Recommended:

- Alberts B.D. Lewis, J. Raff, M. Rubers, K. nad Watson I.D. 1999 molecular Biology of Cell Garland pub. Co. Inc. New York, U.S.A.

- P.K.Gupta 1999 a text Book of Cell and Molecular Biology Rastogi Pub. Meerut India.
- Kleinsmith L.J. and Molecular Biology (2nd edition) Harper Collins College Pub. New York USA.
- P.K.Gupta Genetics Rastogi Pub. Meerut.
- Sinha & Sinha Cytogenetics & Plant Breeding Vikas Pub.

Practical Scheme

1. Exercise based on Physiology
2. Biochemical Test
3. Exercise based on Cytology
4. Exercise based on Genetic Problem
5. Spotting
6. Viva Voce
7. Sessionals

Class : **B.Sc. II Year**
Subject : **Microbiology**
Paper : **I**
Paper Title : **Biochemistry and Microbial Physiology**
Maximum Marks : **Theory: 40, CCE: 10, Total: 50**

Unit – I

General Properties, Classification and function of Carbohydrates, lipids, proteins and amino acids, General properties, classification and nomenclature of enzymes. Factors affecting enzyme activity. Mechanism of enzyme action, Regulations of enzyme activity, Applications of enzymes.

Unit –II

Growth and measurement of growth, Mathematical expression of growth, growth curve, growth yield, factors affecting growth, effect of nutrients, temperature, oxygen, pH, osmotic pressure, Cell count, direct and indirect method, dry weight and wet weight method, synchronous cultures, continuous culture and batch cultures.

Unit – III

Energy production in anaerobic and aerobic process, glycolysis, Pentose phosphate pathway, Entner Duodoroff pathway, fermentation, glucose fermentation by *E-coli*, TCA cycle, heterotrophic carbon dioxide fixation, Glyoxylate cycle, Catabolism of lipids, α and β -oxidation, catabolism of proteins, aerobic respiration, Principles of Bioenergetics, oxidation-reduction reaction, Redox-potential, oxidative phosphorylation hypothesis.

Unit – IV

Utilization of Energy, Methods of studying Microbial biosynthesis, assimilation of Ammonia, Nitrogen and sulphate Utilization of energy in non-biosynthetic and biosynthetic process, Diffusion, gaseous exchange, osmosis, Plasmolysis, transport of nutrients in bacteria- active transport, passive diffusion, facilitated diffusion, group translocation.

Unit – V

Energy production by photosynthesis, photochemical reaction, cyclic and non cyclic photophosphorylation, role of ATP in metabolism, role of reducing power in metabolism, role of precursors of metabolism, component of electron transport chain and arrangement of ETC in cell membrane.

Recommended Books

- Lehniger - Principles of Biochemistry- Nelson DL & Cox MM, 4th edition (CICS Publishers, New Delhi).
- Microbial Physiology- Moat AG, Foster JW & Spector MP, 4th edition (John Wiley & Sons).
- Fundamentals of Biochemistry- Jain JL, Jain S & Jain N, 8th edition (SChand & Co. New Delhi).
- Biochemistry- Satyanarayana U, 4th edition (Elsevier, India).
- Outline of Biochemistry by Cohn and Stumph.
- Biochemistry by Campbell & Farell

Class	:	B.Sc. II Year
Subject	:	Microbiology
Paper	:	II
Paper Title	:	Microbial Genetics and Molecular Biology
Maximum Marks	:	Theory: 40, CCE: 10, Total: 50

Unit - I

Structure and genetic material of microbes, Nuclie acid as genetic material, Physical and chemical structure and different forms of DNA, Melting curve of DNA and T_m value of determination, Buoyant density of DNA and its relationship with mole (G+C) content in DNA, Types of RNA, mRNA, rRNA, tRNA, Gene structure and functions.

Unit – II

Types of DNA replication, Replication of DNA in prokaryotes and eukaryotes, Conservative, Semi-conservative and Dispersive mode of replication, mechanism of replication, Messelson and Stahl experiment, DNA topology, Supercoiling of DNA and linking number, Enzymes involved in replication of DNA. Molecular Mechanism of chromosomal replication, Models of chromosomal replication, Cairns model, Rolling Circle model. Translation and transcription in prokaryotes and eukaryotes.

Unit – III

Basic features of genetic code, Biological significance of degeneracy, Wobble hypothesis, Poly cistronic RNA, overlapping genes, deciphering of genetic code, gene translocation Ribosomes, and role in protein synthesis, t RNAs, initiation, elongation and termination of protein synthesis in prokaryotes, post translational modification of polypeptides, regulation of protein synthesis, Lac operon, Repressible operon.

Unit – IV

Genetic recombination in bacteria, transformation, conjugation, F factor, Hfr strains, transduction in microbes, plasmids and binary vectors, transposons, transformation techniques, use of bacteria and viruses in genetic engineering.

Unit – V

DNA mutation and repair, types of mutation, evidence of spontaneous nature of mutation, fluctuation test, new comb's experiment and replica testing, mode of action of physical, chemical and biological mutagens – UV rays, nitrous acid, 5-bromouracil, 2-aminopurine, EMS, Reversion in mutation, true reversion, suppression and types of suppressor mutation, DNA repair mechanism, Photo reactivation, excision, mismatch, SOS repair and dealkylation repair.

Recommended Books

- Principles of Genetics by Gardner, Simons & Snustad
- Principles of Genetics : Gardner, Simons & Snustad

- Molecular Biology: Avinash & kakoli Upadhyay
- Gene biotechnology ; Jogdand
- Biotechnology Demystifying the concept; Bourgaize, jewell & Burser

List of Practicals

1. Study of Osmosis and Plasmolysis.
2. Diffusion of gases.
3. Isolation of *E. coli* bacteria from sewage water sample.
4. Study of growth kinetics of *E. coli*.
5. Isolation of sulphur bacteria from soil.
6. Isolation of Methanogens from waste material.
7. Demonstration of evolution of O₂ during Photosynthesis.
8. Identification of *Staphylococcus* /*Aspergillus*/ *Candida*
9. Biochemical test of carbohydrate, protein and lipids
10. Estimation of Carbohydrate by Colorimeter / Spectrophotometer (standard graph plot).
11. Measurement of cellulose activity by Viscometric Technique.
12. Determination of cellulose and amylase activity by reducing sugar assay test.
13. Effect of UV radiations on microorganisms.
14. Study of Repair mechanism
15. Mechanism of isolating mutants by replica plating technique

Class	:	B.Sc. III Year
Subject	:	Microbiology
Paper	:	I
Paper Title	:	Applied and Environmental Microbiology
Maximum Marks	:	Theory: 40, CCE: 10, Total: 50

Unit - I

Design and types of Fermentor, factors affecting fermentation process, Industrial production of alcohol, organic acid economically important enzymes, amino acids, antibiotics, vitamins. Method of immobilization and applications. Strategy for improvement of industrially important microbial strain.

Unit - II

Physical and microbial spoilage of food and food products, spoilage of stored products, fruits and vegetables, spoilage of milk, milk products and meat. Food born diseases. Food preservation methods, asepsis, pasteurization, canning, desiccation, low temperature, anaerobiosis, filtration, chemical preservation of food- salt and sugar, organic acids, use of sulphur dioxide, ethylene and propylene oxides, wood smoke. Application and production of SCP.

Unit -III

Physical and chemical characteristics of soil, soil microflora, soil fertility and management of agricultural soil, rhizosphere and phyllosphere, Microbial diseases of crop plants with special reference to wheat, rice. VAM and its importance. Nitrogen fixation by symbiotic and non-symbiotic microbes. Use of microbes as biofertilizers, mass cultivation of Rhizobium and Azotobacter, use of blue green algae as biofertilizer.

Unit - IV

Concept of environment in relation to microbes, physiological adaptation in microbes, nature of microbial population in soil, water and air. Microbial interactions- neutralism, commensalism, synergism.

Unit -V

Bioremediation, biomagnifications, bioleaching, biopesticides, Microbial H₂ production. Impact of genetically modified organisms. Biodegradation of plastics. Liquid waste disposal, characteristics of solid and liquid waste, sewage treatment- primary, secondary and tertiary treatment.

Recommended Books

- Industrial Microbiology - Waites, Morgan, Rockey, Higton.
- Industrial Microbiology - L.E. Casida
- Industrial Microbiology - A Cruger
- Fermentation Microbiology - Ashok Pandey
- Fermentation Microbiology - Whittaker

- Industrial microbiology - A.H.Patel
- Food Microbiology - Jame Jay.
- Food Microbiology - Frazier
- Food Microbiology - Mudi
- PlantPathology-Malhotra
- Microbial Ecology : Atlas & bartha

Class	:	B.Sc. III Year
Subject	:	Microbiology
Paper	:	II
Paper Title	:	Immunology and Medical Microbiology
Maximum Marks	:	Theory: 40, CCE: 10, Total: 50

Unit - I

Structure composition and types of cells and organs involved in immune system. Innate and acquired immunity. Types, structure and functions of MHC molecules, antigen processing and presentation. Humoral and cell mediated immune responses.

Unit - II

Antigens- structure, properties and types. Haptens and adjuvants. Immunoglobulins – structure, heterogeneity, types and subtypes, physico-chemical and biological properties. Theories of antibody production. Generation of antibody diversity. Antigen-Antibody interactions- agglutination, precipitation, Immunofluorescence, ELISA, Radioimmunoassays. Hybridoma technology- Production and applications of monoclonal antibodies.

Unit - III

Tumor immunology – Cancer, origin, oncogenes, tumor antigens, immune response to tumors, tumor invasion of the immune system, immune diagnosis of tumors.

Unit - IV

Immunization- Modern methods of vaccine production, autoimmunity, hypersensitivity. Immunohematology, antigens of ABO and Rh blood group systems. Medical importance of blood groups- ABO and Rh incompatibility.

Unit - V

Host microbe interaction, mechanism of pathogenesis. Laboratory strategies in diagnosis of infective syndrome. Bacterial and viral diseases of human – Syphilis, pox, Hepatitis. Fungal diseases of human – Cryptococcus, Candidiasis, Dermatomycosis, Sexually transmitted diseases (STDs).

Recommended Books

- Kuby Immunology- Kindt TJ, Goldsby RA, Osborne BA, 6th edition (WH Freeman & New York).
- Text book of Microbiology - Ananthnarayan R and Panikar CKJ, 8th edition, (Univ Press Pvt. Ltd. Hyderabad).
- Textbook of Microbiology - Chakraborty P, 1st edition (New Central book agency Pvt Ltd).
- Fundamental Immunology- Paul WE, 7th edition (Lippincott Williams & Wilkins, USA).
- Fundamentals of Immunology-Coleman RM, Lombord MF and Sicard RE, 2nd edition (4th MC Brown, USA).
- Immunology-Weir DM and Steward I, 8th edition (Topley & Wilson, UK).

- Immunology-Rao CV, 2nd edition (Narosa Publishing House, New Delhi).
- Essentials of Immunology- Roitt IM, 11th edition, (Blackwell Pub, USA).
- Immunology- Elgert KD, 2nd edition (Wiley Blackwell).

List of Practicals

1. Sauerkraut
2. Acid and gas production from fermented fruit juice.
3. Quality test of milk through MBRT.
4. SPC count of milk sample
5. Immobilization of enzymes.
6. Isolation and identification from bakery and dairy products.
7. Production of citric acid by fungi.
8. Demonstration of single cell protein by yeast / mushroom /algae.
9. Demonstration of alcohol production by yeast.
10. Screening of Phosphate solubilizing bacteria.
11. Effect of preservatives on microorganisms.
12. Isolation and identification of microorganisms from rotten vegetables, fruits.
13. Isolation and identification of microorganisms from old sweets.
14. Isolation and identification of microorganisms from spoiled milk.
15. Study of diseases of crop plants.
16. Physiochemical testing of soil.
17. Determination of your own blood group and Rh factor.
18. RBC and WBC count by heamocytometer.
19. Demonstration of ELISA test
20. Demonstration of RIA test

Note:- Visit to any two industry and submission of report (Compulsory).

Class	:	B.Sc. II YEAR
Subject	:	Zoology
Paper	:	I
Paper Title	:	Vertebrates & Evolution
Max. Marks	:	Theory - 40 CCE - 10 Total - 50

Unit I

1. Origin of Chordates Classification of phylum Chordata upto orders according to Parker and Haswell (Latest edition).
2. Urochordata – Type study of Herdmania.
3. Cephalochordata- Type Study of Amphioxus, Affinities of Amphioxus .
4. Comparison between Petromyzon and Myxine.

Unit II

1. Comparative account of integuments
2. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).
3. Comparative account of digestive system (Amphibia, Reptiles, Birds and Mammals).
4. Comparative account of respiratory system. (Amphibia, Reptiles, Birds and Mammals)

Unit III

1. Comparative account of aortic arches and heart.
2. Comparative account of brain
3. Comparative account of Urinogenital System.
4. Placentation in mammals.

Unit IV

1. Origin of life- Modern concepts only.
2. Lamarckism, Darwinism.
3. Modern synthetic theories: Variations, Mutation, Isolation & speciation.
4. Adaptation and Mimicry.
5. Micro, Macro evolution and Mega evolution.

Unit V

1. Fossils, Methods of fossilisation Determination of age of Fossils.
2. Study of Extinct forms: Dinosaurs and Archaeopteryx.
3. Zoogeographical distribution.
4. Evolution of Man.
5. Geological time scale and Insular fauna.

Class	:	B.Sc. II YEAR
Subject	:	Zoology
Paper	:	II
Paper Title	:	Animal Physiology and Biochemistry
Max. Marks	:	Theory - 40 CCE - 10 Total - 50

Unit I

Nutrition and Metabolism

1. Physiology of digestion in mammals.
2. Protein Metabolism: Deamination, Decarboxylation, Transamination of amino acids, and Ornithine cycle.
3. Carbohydrate metabolism- Glycogenesis, Glycogenolysis, Glycolysis, The Citric acid cycle, Gluconeogenesis.
4. Lipid Metabolism-Beta oxidation of fatty acids.

Unit II

Respiration, Excretion and Immune System

1. Mechanism and physiology of respiration in mammals (transport of gases, chloride shift).
2. Physiology of Excretion- urea and urine formation in mammals.
3. Innate and acquired immunity, immune cells and lymphoid system, immune response: cellular and humoral immunity

Unit III

Regulatory Mechanisms of Enzymes and Role of Vitamins

1. Thermoregulation.
2. Definition and nomenclature of enzymes, classification of enzymes.
3. Mechanism of enzyme action.
4. Co-enzymes.
5. Vitamins.

Unit IV

Neuromuscular Co- ordination

1. Types of neurons and glial cells.
2. Physiology of nerve impulse conduction.
3. Types and Structure of muscles.
4. Theory of muscle contraction and its biochemistry.

Unit V

Endocrine System

1. Structure and functions of Pituitary Gland.
2. Structure and functions of Thyroid Gland.
3. Structure and functions of Adrenal Gland.
4. Structure and functions of Parathyroid, Thymus and Islets of langerhan's.
5. Physiology of Male and female Sex hormones.

List of recommended books for I and II paper

Books of MP Hindi Granth Academy

Parker & Haswall : Text book vertebrate Zoology

Kotpal,RL	:	Vertebrate
Rastogi,VB	:	Organic evolution
Verma, PS	:	Animal Physiology
Jordan E.L and Verma P.S	:	Chordate Zoology
Singh and Chaturvedi	:	Organic evolution
Ernst W.Mayr	:	Evolution and diversity of life
Colbert	:	Evolution
Verma PS and Agrawal VK	:	Cell Biology , Genetics, Molecular Biology, Evolution
Nigam H.L.	:	Animal Physiology,
Wood, DW	:	Principle of Animal Physiology
Berry, A.K.	:	Animal Physiology and Biochemistry
Goyal and Shastri	:	Animal Physiology
Prosser, CL	:	Comparative Animal Physiology
Shrivastava, H.S.	:	Biochemistry
Lehninger	:	Biochemistry

List of Practical Work**Maximum Marks : 50**

1. Dissection of commercially available species of locally available Fishes (Efforts may be done to use computer simulation technique)
2. Study of museum specimens (Vertebrates)
3. Study of specimens of evolutionary importance viz living fossils, connecting link, extinct animals, fossils: Limulus, Latimeria, Dinosaurs, Asiatic chital, Archeopteryx, Peripatus, etc.
4. Osteology : Limb bones and girdle bones of Frog, Varanus, Pigeon and Rabbit.
5. Detection of Protein, Carbohydrate and Lipid / Study of Human salivary enzyme activity in relation to pH.
6. Hematological Experiment- RBC and WBC counting / Blood grouping in blood samples / Estimation of Hemoglobin and sugar in blood samples.
7. Histological study of various endocrine glands – T.S. of Ovary.
8. Histological study of Digestive and Visceral organ - T.S. of Stomach, T.S. of Intestine, T.S. of Pancreas T.S. of Liver, T.S. of Lungs and L.S. of Kidney.

Distribution of Marks

1. Dissection	08
2. Spot related to evolution	05
3. Spotting (4Spot, 2 Bones, 2 Slides)	16
4. Biochemical test/ Enzyme activity	05
5. Haematological Experiment	06
6. Viva-voce	05
7. Record	05
Total Marks	50

Class	:	B.Sc. III YEAR		
Subject	:	Zoology		
Paper	:	I		
Paper Title	:	Genetics		
Max. Marks	:	Theory - 40	CCE - 10	Total - 50

Unit I

Heredity and Genetic material

1. Mendel's laws of heredity.
2. Variations: Sources and Types.
3. Structure, molecular organization and function of DNA and RNA and types of RNA.
4. DNA replication in Prokaryotes.
5. Nucleosome (Solenoid model)

Unit II

Gene Expression

1. Genetic Code
2. Transcription in Prokaryotes.
3. Translation in Prokaryotes.
4. Gene expression : Regulation of protein synthesis and Lac operon model.
5. Split gene, overlapping gene, pseudo-gene.

Unit III

Linkage and Chromosomal aberration

1. Linkage and crossing over : Types and significance.
2. Sex determination : Chromosomal and genetic balance theory.
3. Sex linked inheritance (haemophilia, Colour blindness).
4. Structural and numerical changes in Chromosomes.
5. Mutation : Types and Mutagens.

Unit IV

Human Genetic

1. Human Karyotype
2. Human Genome Project.
3. Multiple allele and inheritance of blood group.
4. Autosomal and Sex Chromosome, Syndromes in human.
5. Genetic diseases in human : Sickle cell anaemia, Albinism and Thalassemia.

Unit V

Genetic Engineering

1. Recombinant DNA technology and Gene Cloning.
2. Polymerase chain reaction.
3. Blotting – Southern, Northern.
4. DNA finger printing.
5. Gene therapy.

Class	:	B.Sc. III YEAR
Subject	:	Zoology
Paper	:	II
Paper Title	:	Ecology and Applied Zoology
Max. Marks	:	Theory - 40 CCE - 10 Total - 50

Unit I

Concept of Ecology

1. Abiotic and biotic factors, Component of Ecosystem.
2. Energy flow in Ecosystem: Food chain, Food web and Pyramids.
3. Biogeochemical cycle : Carbon, Oxygen, Nitrogen, Phosphorus.
4. Population Concept : Characteristics of population. Factors affecting Population growth

Unit II

Habitat Ecology

1. Fresh water, marine and terrestrial habitat.
2. Ecological division of India.
3. Biodiversity : Natural resources and their conservation with special reference to forests.

Unit III

Wild life and Environment

1. Wild life Protection Act, National Parks and Sanctuaries of Madhya Pradesh.
2. Endangered species of India.
3. Types of pollution : Air, water, soil ,thermal and noise pollution.
4. Urbanisation and effect of human population on environment.

Unit IV

Aquaculture

1. Prawn culture : Culture of fresh water prawn, methods of prawn fishing, preservation and processing of prawns.
2. Pearl culture and pearl industry.
3. Frog culture.
4. Major carp culture : Management of ponds, preservation and processing of fishes.
5. Maintenance of Aquarium

Unit V

Economic Entomology

1. Sericulture : Species of silkworm, life history of *Bombyx mori*, Sericulture Industry in India.
2. Apiculture : Life cycle of honey bee, methods of bee keeping, products of bees, enemies of bees.
3. Lac culture: Lifecycle of lac insect and host plant of lac insects.
4. Common pests : Stored grains : *Sitophilus oryzae* and *Tribolium castanaeum*,
Vegetable pest : piers brassicae and *Dacus cucurbitae*.
5. Biological control of insect pests.

List of recommended books for I and II paper

Books of MP Hindi Granth Academy

Lewin	: Genetics (Latest Edition Strickberger : Genetics)
Gardner,MJ	: Principles of Genetics
Singh,BD	: Genetics
Singh,BD	: Biotechnology
Gupta,PK	: Genetics
Gupta,PK	: Molecular Biology and Genetic Engineering
Verma, PS and Agarwal,VK	: Genetics
Purohit	: Biotechnology
Kohli and Ansar	: Economic Zoology
Kohli	: Ecology
Odum,EP	: Fundamental Ecology
Sharma PD	: Environmental Biology and Toxicology
Natrajan,SS	: A Manual of fresh Water Aquaculture
Upadhaya	: Economic Zoology
Pal Ajay	: Cellular & Molecular Biology

List of Practical Work

Maximum Marks : 50

The practical's work will be as per theory syllabus and the candidates will be required to show the knowledge of the following:-

1. Study of fresh water, marine and terrestrial fauna, Major carps, Common stored grain pests and vegetable pests.
2. Water analysis – Dissolve Oxygen, pH, Hardness, Turbidity.
3. Study of Ecosystems and maintenance of Aquarium.
4. Study of instruments related to Genetics – Centrifuge, PCR, Gel electrophoresis, DNA finger printing.
5. Wild life – Endangered species.
6. Life cycle of silkworm, Honey Bee, Lac insect.

Distribution of Marks

1. Spotting	12
2. Analysis of water	04
3. Exercise based on wildlife	05
4. Ecosystem	04
5. Study of Instruments	05
6. Problem on Genetics	05
7. Life Cycle	05
8. Viva – voce	05
9. Practical Record and collection	05
Total Marks	50

Practical Outcomes

- Study of Museum specimens and slides related to invertebrate and vertebrate studied in theory.
- Understood the anatomy and physiology of invertebrate and vertebrate animals by dissection.
- Understood the mechanism of cell division (mitosis and meiosis).
- Understood the mechanism of developing embryo of chick and frog.
- Students are able to prepare slides to observe Giant chromosome.
- Obtained the knowledge about direct observation of fossils and evolutionary important specimen by which evolutionary relationship of animal groups.
- Skill development for the observation of blood cells and blood grouping and haemoglobin.
- Attained knowledge of qualitative analysis of protein, carbohydrate and lipids, excretory products, blood glucose.
- Understood the enzyme reaction and influence of temperature on enzyme action.
- Studied the histological slides of different visceral organs and endocrine glands.
- Understood the working, principle and applications of different instruments.
- Attained knowledge on the observation of preserved specimens of fresh water, marine and terrestrial fauna.
- Analyzed water quality like dissolved oxygen, hardness, pH, turbidity etc.
- Studied ecosystem, wild life and life cycle of economically important insects.