

**SCHEME OF EXAMINATION**

**&**

**DETAILED SYLLABUS**

**For**

**B.Sc.(ZOOLOGY)**

**FACULTY OF SCIENCE**

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**B.Sc. (ZOOLOGY)(3 yrs Programme)**

<b>First Year</b>				
<b>Code No.</b>	<b>Subject</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
BZL101	Invertebrate and Vertebrate	30	70	100
BZL102	Cell Biology & Developmental Biology	30	70	100
BZL103	Life and Diversity of Animals Nonchordates(Protozoa to Annelida)	30	70	100
BZL104	Physical Chemistry-I	30	70	100
BZL105	Inorganic Chemistry -I	30	70	100
BZL106	Organic Chemistry- I	30	70	100
BZL107	Diversity of Cryptogams and Gymnosperms	30	70	100
BZL108	Algebra and Trigonometry	30	70	100
BZL109	Fundamentals of IT	30	70	100
BZL110	English –I	30	70	100
BZL111	Hindi –I	30	70	100
BZL101-P	Invertebrate and Vertebrate -Lab	20	30	50
BZL102-P	Cell Biology & Developmental Biology -Lab	20	30	50
BZL103-P	Life and Diversity of Animals Nonchordates(Protozoa to Annelida)-Lab	20	30	50
BZL109-P	Fundamentals of IT-LAB	20	30	50
	<b>Total</b>	<b>410</b>	<b>890</b>	<b>1300</b>

<b>Second Year</b>				
<b>Code No.</b>	<b>Subject</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
BZL201	Genetics	30	70	100
BZL202	Animal Physiology	30	70	100
BZL203	Applied Zoology I	30	70	100
BZL204	General Mammalian Physiology I	30	70	100
BZL205	Physical Chemistry-II	30	70	100
BZL206	Inorganic Chemistry -II	30	70	100
BZL207	Organic Chemistry- II	30	70	100
BZL208	General Microbiology and Biochemistry	30	70	100
BZL209	Advanced-Calculus	30	70	100
BZL210	Environmental Science	30	70	100
BZL211	English -II	30	70	100
BZL212	Hindi -II	30	70	100
BZL201-P	Genetics -Lab	20	30	50
BZL202-P	Animal Physiology -Lab	20	30	50
BZL203-P	Applied Zoology I -Lab	20	30	50
BZL204-P	General Mammalian Physiology I-Lab	20	30	50
	<b>Total</b>	<b>440</b>	<b>960</b>	<b>1400</b>

<b>Third Year</b>				
<b>Code No.</b>	<b>Subject</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
BZL301	Applied Zoology II	30	70	100
BZL302	Environmental Biology and Evolution	30	70	100
BZL303	General Mammalian Physiology II	30	70	100
BZL304	Life and Diversity of Animals-Chordates (Protochordata to Amphibia)	30	70	100
BZL305	Cell Biology	30	70	100
BZL306	Molecular Biology and Immunology	30	70	100
BZL307	English -III	30	70	100
BZL308	Hindi -III	30	70	100
BZL301-P	Applied Zoology II-Lab	20	30	50
BZL302-P	Environmental Biology and Evolution -Lab	20	30	50
BZL303-P	Life and Diversity of Animals Nonchordates(Arthropoda to Hemichordata- Lab	20	30	50
BZL304-P	General Mammalian Physiology II-Lab	20	30	50
BZL305-P	Cell Biology -Lab	20	30	50
BZL306-P	Molecular Biology and Immunology -Lab	20	30	50
	<b>Total</b>	<b>340</b>	<b>710</b>	<b>1050</b>

**YEAR-I**

## **Invertebrate and vertebrate**

### **Unit-I**

Classification of Non Chordates upto classes according to Parker and Haswell.(7thEdition)

1. Classification of lower Invertebrates.
2. Classification of higher invertebrates.
3. Protozoa – Type study of Plasmodium.
4. Porifera – Type study of Sycon.

### **Unit-II**

1. Coelenterata – Type study of Obelia.
2. Helminthes – Type study of Liver Fluke.
3. Annelida – Type study of Earthworm, Metamerism, Trochophore Larva.

### **Unit-III**

1. Arthropoda – Type study of Prawn.
- 2 Mollusca – Type study of Pila.
3. Echinodermata – External Features of Star Fish and Echinoderm Larvae.

### **Unit-IV**

1. Origin of Chordates. Classification of phylum Chordata upto orders according to Parker and Haswell (Latest edition).
2. Hemichordata – External features and affinities of Balanoglossus.

### **Unit-V**

1. Urochordata – Type study of Herdmania (excluding Development). Cephalochordata – Type study of Amphioxus. Affinities of Amphioxus.

## **Practical:**

The Practical's work will be based on theory syllabus and the candidates will be required to show knowledge of the following –

1. Study of Museum Specimens, slides relevant to the type study in theory
2. Mounting ( Temporary)
  - a. Mouth parts of insects
  - b. Statocyst of Prawn
  - c. Ctenidium and Osphradium of Pila
  - d. Scales of Teleost fish
  - e. Mounting Material
3. Major Dissection
  - a. Earthworm: Digestive system, nervous system and reproductive system.
  - b. Cockroach: Digestive system, Nervous system,
  - c. Prawn: Nervous System, Appendages.
4. Minor Dissection
  - a. Hastate plate and appendages of Prawn.
  - b. Salivary glands of Cockroach.
  - c. Radula of Pila.
5. Cell Biology
  - a. Study of Prokaryotic and eukaryotic cell.
  - b. Study of DNA and RNA models.
  - c. Squash preparation of chromosomes from onion root tip.
  - d. study of meiosis in grasshopper testis.

1. The cell – History of Cell Biology, Cell theory, Prokaryotic and Eukaryotic cell.
2. Microscopy: Compound and Electron Microscopy.

## **Unit-II**

1. Nuclear Organization of cell.
2. Extra nuclear organization of cell.
3. Cell reproduction – Amitosis, mitosis, meiosis.

## **Unit-III**

1. Comparison between Petromyzon and Myxine.
2. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).

## **Unit-IV**

1. Parthenogenesis.
2. Gametogenesis.
3. Fertilization, Patterns of cleavage

## **Unit-V**

1. Frog and chick embryology upto the formation of three germinal layers.
2. Fate map construction in frog & chick Gastrulation in frog and chick upto the formation of germinal layers.
3. Concept of competence, determination and differentiation.
4. Extra embryonic membranes in chick.
5. Concept of regeneration

## **Practical:**

The practical work will be based on theory syllabus and the candidates will be required to show knowledge of the following:

1. Study of museum specimens and slides relevant to theory paper.
2. Osteology
  - a. Girdles and limb bones of : Frog, Varanus, Fowl and Rabbit
3. Cell Biologya.
  - a. Preparations of polytene chromosome in chironomous larva
  - b. Squash preparation of chromosome from Onion root tip.
  - c. Study of Meiosis in Grasshopper testis.
4. Embryology: Study of different developmental stages of frog and chick – whole mounts and sections.

## **Life and Diversity of Animals - Nonchordates (Protozoa to Annelida)**

### **Unit – I**

- 1.1 **Protozoa** : General characters and classification up to classes
- 1.2 **Paramecium** : Structure and reproduction
- 1.3 **Plasmodium** : Structure and life cycle
- 1.4 **Parasitic Protozoans of Man** : Entamoeba, Trypanosoma, Giardia and Leishmania - Mode of infection and its control

### **Unit – II**

- 2.1 **Porifera**: General characters and classification up to classes
- 2.2 **Sycon** : Structure, reproduction and development, Canal system in sponges
- 2.3 **Coelenterata** : General characters and classification up to classes
- 2.4 **Obelia** : Structure and life cycle, corals and coral reef formation 3

### **Unit – III**

- 3.1 **Helminthes** : General characters and classification up to classes
- 3.2 **Ascaris**: External morphology, reproductive system and life cycle
- 3.3 **Taeniasolium** : Structure and life cycle
- 3.4 Elementary idea of parasitic adaptations in helminthes

### **Unit – IV**

- 4.1 **Annelida** : General characters and classification up to classes
- 4.2 **Leech** : Morphology, digestive and urinogenital system
- 4.3 Trochophore larva and its significance
- 4.4 Vermiculture and its importance

## Physical Chemistry-I

### Unit-I :Mathematical Concepts

Logarithmic relations, curves stretching, linear graphs and calculation of slopes, Differentiation of functions like  $Kx$ ,  $ex$ ,  $xn$ ,  $\sin x$ ,  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful / relevant functions; permutations and combinations. Factorials, Probability, General introductions to computers, different components of a computers. Hardware and software, input-output devices, binary numbers and arithmetic; introduction to computer languages, Programming and operating systems.

### Unit-2 Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of State, Critical phenomenon: PV isotherms of ideal gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state, Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision numbers, mean free path and collision diameter, Liquefaction of gases (based on Joule Thompson effect).

### Unit 3: Liquid State

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

### Colloidal State

Definition of colloids, classification of colloids. Solids in liquids (sols): properties- Kinetic, optical and electrical ; stability of colloids, protective action, Hardy-Schulz law, gold number. Liquids in liquids (emulsions) types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

### Unit- 4 Solid State

Definition of space lattice, Unit cell Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Laws of symmetry. Symmetry elements in crystals, X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method.) Catalysis. characteristics of catalysed reactions, classification of catalysis miscellaneous. Examples

### Unit- 5 Chemical Kinetics-

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light, catalyst concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero. order, pseudo order, half life and mean life Determination of the order of reaction differential method, method of integration, method of half life period and isolation method. Experimental methods of chemical kinetics- conduct metric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reaction Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis.) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

## **Unit I: Atomic Structure**

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of  $\psi$  and  $\psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rules, Electronic configurations of the elements, effective nuclear charge, Atomic and ionic radii, ionization energy, electron Affinity and electronegativity: definition, method of determination, trends in periodic table and applications.

## **Unit II : Chemical Bonding**

Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond, Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_4^-$  and  $\text{H}_2\text{O}$  Molecular Orbital theory for homonuclear and heteronuclear ( $\text{CO}$  and  $\text{NO}$ ) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. Weak interactions, hydrogen bonding, van der Waals forces.

## **Unit III Ionic Solids**

Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond free electron, Valence bond and Band theories Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

## **Unit IV p-Block Elements**

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16 Hydrides of boron-diborane and higher boranes. Borazine, borohydrides

## **Unit V p-Block elements**

Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens. Chemical properties of gases, chemistry of xenon, structure and bonding in xenon compounds.

## Organic Chemistry-I

### Unit I Structure and Bonding

Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clathrates, charge transfer complex, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding, **Mechanism of Organic reactions** : Curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.

### Unit II Stereochemistry

Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereoisomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configurations, sequence rules, D & L , R & S systems of nomenclature, Nomenclature E and Z system, geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Saw horse formulae, Fischer and Flying wedge formulae.

### Unit III Alkanes, Cycloalkanes and Aromaticity

IUPAC nomenclature, classification, isomerism in alkanes, sources, and methods of preparation (with special reference to Wurtz, Kolbe., Corey-House, reactions and decarboxylation of carboxylic acids), Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes, Cycloalkanes : nomenclature, methods of preparations, chemical reactions. Bayer's strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of strainless rings, Nomenclature of benzene derivatives. The aryl group Aromatic nucleus and side chain Structure of benzene molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution general pattern of the mechanism, role of (a and n complexes) Mechanism of nitration, halogenation. sulphonation. mercuriation and Friedel-Crafts reaction Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl

#### **Unit-IV Alkenes Cycloalkanes, Dienes and alkynes**

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration the Saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ , polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, industrial applications of ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes nomenclature and classification of dienes: isolated conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation and polymerization

#### **Unit-V Alkyl and Aryl Halides**

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions mechanisms of nucleophilic substitution reaction of alkyl halides,  $\text{S}_\text{N}2$  and  $\text{S}_\text{N}1$  reactions,

with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides, Synthesis and uses of DDT and BHC, Freon.

## Diversity of Cryptogams and Gymnosperms

### Unit I

Algae: General Characteristics of Algae. Important Features of Chlorophyceae, Pheophyceae and Rhodophyceae. - Life Cycle of Spirogyra, Ectocarpus, Polysiphonia. Economic Importance of Algae.

### Unit II

Fungi: General Characteristics of Fungi. Out line of Structure, Mode of Nutrition and Life History of Zygomycetes (Mucor), Ascomycetes (Peziza), Basidiomycetes (Ustilago nuda, Puccinia graminis), and Deuteromycetes (Alternaria solani). Economic Importance of Fungi.

### Unit III

Bryophyta: General Characteristics of Bryophytes. Comparative study of sporophytes of Bryophytes. Life Cycle of Marchantia and Polytrichum.

### Unit IV

Pteridophyta: General Characteristics of Pteridophytes. Stellar organization. Homospory and Heterospory.

Life cycle of Pteris. **Gymnosperms** General Characteristics of Gymnosperms. Resemblances and differences of Gymnosperms with Pteridophytes and Angiosperms, Life Cycle of Pinus.

### Reference Books

Diversity of Cryptogams and Gymnosperms

1. Chapman V.J & Chapman D.J, The Algae, Macmillan India Ltd.
2. Fritsch F. B 1945, Structure and Reproduction of Algae Vol.I & II. Cambridge University Press.
3. Bilgrami, K.S. and Saha, L.C., 2001, A text Book Of Algae, CBS, Publishers, New Delhi.
4. Kamat, N.D. , 1982, Topics in algae, Sai Kripa Prakashan, Aurangabad.
5. Kumar, H.D. 1999, Introductory Phycology, East West Press, New Delhi.
6. Smith G.M 1955, Cryptogamic Botany Vol.I, McGraw Hill.

7. Vashishta B.R 1990, Botany for Degree Students, Algae, S.Chand & Co.
8. Singh V., Pandey P.C and Jain D.K 1998, A Text book of Botany for Undergraduate Students, Rastogi Publications.
9. Alexopoulos C.J & MIMS C.V 1988. Introductory Mycology, John Wiley & Sons.Smith G.M 1955, Cryptogamic Botany, Vol.I McGraw Hill.
10. Vashishta B.R. 1990, Botany for Degree Students, Fungi, S.Chand & Co. Webster J 1970, Introduction to Fungi, Cambridge University Press.
11. Sharma P.D.;The Fungi:Rastogi and company.,Meerut.
12. Parihar N.S 1967, An Introduction to Embryophyta Vol I & II, General Book Depot.
13. Prempuri 1973, Bryophytes - A Broad perspective. Atmaram & Sons.
14. Smith G.M 1955, Cryptogamic Botany Vol.II. McGraw Hill.
15. Sporne K.R 1976, Morphology of Pteridophytes, B1 Publications.
16. Vashista B.R 1978, Bryophytes, S.Chand & Co.
17. Vashista P.C 1976, Botany for Degree Students Vol IV. S.Chand & Co.
18. Vashista P.C, Pteridophyta: S Chand publications.
19. Vashista P.C, Gymnosperms: S Chand publications.
20. Vashista P.C, Bryophyta: S Chand publications.
21. Biodiversity and Quality of Life. Sengupta. Mc Millan India Pvt. Ltd.
22. Lee.R.E.,1999,Phycology,Cambridge University Press, Cambridge.
23. A.J.,Lack and D.E.Evans:Plant Biology:Viva books Pvt.Ltd.
24. Sharma O.P: Text book of Pteridophyta II edition:McMillan India Ltd.

## Algebra and Trigonometry

### Unit-1

Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks. Eigen values, Eigen sectors and the characteristic equation of a matrix Cayley Hamilton theorem and its use in finding inverse of a matrix.

### Unit-2

Applications of matrices to system of linear (both homogenous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equation. Descartes' rule of signs. Solution of cubic equations (Cardano method)

### Unit-3

Definition of a group with example and simple properties. Sub groups. Cyclic groups. Coset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Homomorphism and isomorphism. Normal subgroup. Quotient groups.

### Unit-4

The fundamental theorem of homomorphism. Permutation groups. Even and odd permutations. The alternating groups. Cayley's theorem. Introduction to rings. Sub rings. Integral domains and fields. Characteristics of a ring.

### Unit-5

De Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions. Logarithm of a complex quantity. Expansion of trigonometrically functions.

## **Fundamentals of IT LAB**

1. Text Manipulations
2. Usage of Numbering, Bullets, Tools and Headers
3. Usage of Spell Check and Find and Replace
4. Text Formatting
5. Picture Insertion and Alignment
6. Creation of Documents Using Templates`
7. Creation of Templates
8. Mail Merge Concept
9. Copying Text and Picture From Excel
10. Creation of Tables, Formatting Tables
11. Splitting the Screen
12. Opening Multiple Document, Inserting Symbols in Documents

### **MS-EXCEL**

1. Creation of Worksheet and Entering Information
2. Aligning, Editing Data in Cell
3. Excel Function (Date, Time, Statistical, Mathematical, Financial Functions)
4. Changing of Column Width and Row Height (Column and Range of Column)
5. Moving, copying, Inserting and Deleting Rows and Columns
6. Formatting Numbers and Other Numeric Formats
7. Drawing Borders Around Cells
8. Creation of Charts Raising Moving
9. Changing Chart Type
10. Controlling the Appearance of a Chart

### **MS -POWER POINT**

#### Working With Slides

1. Creating, saving, closing presentation
2. Adding Headers and footers
3. Changing slide layout
4. Working fonts and bullets
5. Inserting Clip art: working with clipart,
6. Applying Transition and animation effects
7. Run and Slide Show

### **DOS**

1. Basics of DOS
2. DOS (Internal & External Commands)
3. Use of Wild Card Character

## Fundamentals of IT

Objectives: **This is a basic paper for Commerce students to familiarize with computer and its applications in the relevant fields and exposes them to other related papers of IT.**

### UNIT – I

#### Introduction to Computers:

The evolution of computers - Computer Generation from First Generation to Fifth Generation, Classifications of Computers - Micro, Mini, Mainframe and Super Computers, Distributed Computer System, Parallel Computers.

Computer Hardware – Major Components of a Digital Computer, Block Diagram of Computer, Input-Output devices, Description of Computer Input Units, Output Units, CPU

Computer Memory - Memory Cell, Memory Organization, Read Only Memory, Serial Access Memory, Physical Devices Used to construct Memories, Magnetic Hard disk, floppy Disk Drives, Compact Disk Read Only Memory, Magnetic Tape Drives.

### UNIT – II

#### Number System:

Decimal, Binary, Octal, Hexa-decimal. Conversion - Decimal to all other number systems, Binary to octal and Hexa Decimal, Addition of binary numbers, Binary subtraction, Use of complements to represent negative numbers, Conversion of a binary fraction to a decimal fraction and decimal to binary fraction, Binary Coded Decimal(BCD), ASCII Codes, EBCDIC codes, Gray codes, Unicodes.

#### Algorithm and Flowcharts:

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples

Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples

### UNIT – III

#### Computer Software:

System software, assemblers, compilers, interpreters, linkers Elementary , Operating System concepts, different types of operating systems, Application Software.

Introduction to MS Office (MS-Word, MS PowerPoint, MS-Excel)

Computer Programming and Languages: Algorithms, flow chart, decision tables, pseudo code, Low level languages and introduction to high level languages.

### UNIT – IV

#### Data Communication and Computer Networks:

Data Transmission mode, Data transmission media, Digital and Analog Transmission

What is computer Network? Network types, Network Topologies, Communication Protocol, OSI Model

### UNIT - V

#### The Internet:

Definition, Brief History, Network Types (LAN, WAN and MAN), Client and Servers, Intranet, Extranet. Basic Services, Email, File Transfer Protocol, Telnet, Usenet News, Terminologies related to Internet: Protocol, Domain name, IP address, URL, World Wide Web.

Overview of various services on Internet: E-mail, FTP, Telnet, Chat, Instant Messaging

Internet Search Tools: Gopher, Archie, World Wide Web.

WWW Browsers: Line Browsers, Graphical Browsers, Java Enabled Browsers.

Uses of the Internet: Internet Service Providers and Types of Internet Connection: Direct/Leased line Connection, Remote Dial up Connection, SLIP/PPP Connection

**Text Books:**

1. Alex Leon & Mathews Leon, "Fundamentals of Information Technology", LeonTechworld, 1999.
2. Vikas Gupta, "Comdex Computer Kit", Wiley Dreamtech, Delhi, 2004
3. P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications, 1992.

**Reference Books:**

1. V. Raja Raman, "Introduction to Computers", PHI, 1998.
  2. Alex Leon & Mathews Leon, "Introduction to Computers", Vikas Publishing House, 1999.
- Norton Peter, "Introduction to computers", 4<sup>th</sup> Ed., TMH, 2001.

## English-I

**Objective:** The objective of this course is to familiarize students about the dynamics of business language and discourse.

### Unit -I

#### Texts: (Any Five)

1. Nirendranath Chakrabarti, "Amalkanti". (From oxford Anthology of Modern Indian Poetry, eds. Dharwadkar and Ramanujan).
2. Toru Dutt, "Sita"
3. Jawaharlal Nehru, "Tryst with Destiny".
4. Mirza Ghalib, "Delhi in 1857".
5. C. Rajagopalachari, Preface to the Mahabharata.
6. Nibir K. Ghosh, "Spiritual Nationalism of Sri Aurobindo".
7. Madhumalati Adhikari, "The Heritage of Indian Culture".
8. Rabindranath Tagore, "Where the Mind is Without Fear".
9. Kabir, one song translated by Tagore.
10. M.K. Gandhi, extract from "Satyagraha".
11. R.K. Narayan, "Toasted English".
12. Ruskin Bond, "The Old Lama".
13. Khushwant Singh, "The Portrait of a Lady".
14. Ashok Mahadevan and Sushan Shetty, "Discovering Babasaheb", Section on "Clash of Titans" (Reader's Digest, December 2006).

### Unit -II

#### Comprehension of an unseen passage:

Questions should be objective/multiple choice, and should test (a) an understanding of the passage in question, and (b) a grasp of general language skills and issues with reference words and usage within the passage.

### Unit -III Paragraph

#### Writing:

Based on expansion of an idea. Word Limit :100-150 words. Candidates to attempt any one of three alternative topics provided

#### **Unit -IV**

##### **Basic language skills-Vocabulary:**

Synonyms, antonyms, one- word substitution for phrases, prefixes, suffixes and word -derivation. Making sentences with idioms and phrases, corrections of sentences with words likely to be confused. Questions should not repeat examples or exercises given in the textbook.

#### **Unit -V**

##### **Basic language skills - Grammar and Usage:**

Modals, linking device, tenses and prepositions. Verb forms and structures, gerunds, participles and infinitives, verbs followed by a preposition and phrasal verbs, articles and determiners, countable and uncountable nouns, adjectives and articles. Questions should not repeat the examples or exercises given in the textbooks.

**Hindi- I****आधार पाठ्यक्रम**

प्रश्न पत्र - प्रथम

**पाठ्य विषय**

**इकाई-1** पल्लवन, पत्राचार तथा अनुवाद एवं पारिभाषिक शब्दावली ।

**इकाई-2** मुहावरे-लोकोक्तियाँ, शब्दशुद्धि, वाक्य शुद्धि, शब्द ज्ञान-पर्यायवाची, विलोम, अनेकार्थी, समश्रुत (समानोचरित) अनेक शब्दों के लिए एक शब्द ।

**इकाई-3** देवनागरी लिपि की विशेषता, देवनागरी लिपि एवं वर्तनी का मानक रूप ।

**इकाई-4** कम्प्यूटर में हिन्दी का अनुप्रयोग, हिन्दी में पदनाम ।

**इकाई-5** हिन्दी अपठित, संक्षेपण, हिन्दी में संक्षिप्तीकरण ।

**पाठ्य क्रम के लिए पुस्तकें -**

1. भारतीयता के स्वर साधन धनंजय वर्मा - म. प्र. ग्रंथ अकादमी ।
2. नागरी लिपि और हिन्दी - अनंत चौधरी - ग्रंथ अकादमी पटना ।
3. कम्प्यूटर और हिन्दी - हरिमोहन - तक्षशिला प्रकाशन, दिल्ली ।

**YEAR-2**

# Genetics

## Unit -I: Heredity & Variation, Gene Expression

1. Chromosome: The physical basis of heredity and transmitters of heredity.
2. Types of Chromosomes: Lamp brush, Salivary gland and Beta Chromosome.
3. Nucleocytoplasmic interaction
4. Heredity and variation: Sources of variation Genotype, Phenotype and Environmental variation (Elementary idea)
5. Gene Expression: Regulation of protein synthesis, transcriptions in Prokaryotes and Eukaryotes.
6. Gene Expression: Translation, Operon model.

## Unit -II: Linkage and Chromosomal Aberrations

1. Gene linkage: Kinds and Theories of linkage, significance of linkage.
2. Gene linkage: Mechanism of genetic recombination; linkage maps
3. Sex Chromosome System: Sex differentiation. Chromosome theory of sex determination.
4. Sex linked inheritance (Haemophilia, colour blindness)
5. Structural changes in chromosomes.
6. Numerical changes in chromosomes.

## Unit -III: Human Genetics & Genetic Engineering

1. Human chromosomes and maps.
2. Common genetic diseases in man (Sickle cell anaemia, Albinism and Alkaptonuria)
3. Multiple factors and blood groups.
4. Twins, physical traits, mental traits.
5. Techniques used in recombinant DNA technology.
6. Gene cloning and Polymerase chain Reaction (PCR).

## Unit - IV: Cytoplasmic Inheritance, Nature and Functions of Genetic Material

1. Cytoplasmic inheritance: Material effect on Limnea (Shell Coiling), Carbondioxide sensitivity in Drosophilla and Kappa particles in Paramecium.
2. Chemistry of Gene: Nucleic Acids and their structure.
3. Concept of DNA replication.
4. Nucleosome (Solenoid model)
5. Split genes, overlapping gene and Pseudogenes.
6. Genetic Code.

## Unit -V: Mutation and Applied Genetics

1. Types of mutation
2. Causes of mutation
3. Mutagens- Classification, Types and effects
4. Gene Therapy
5. DNA finger printing

## **Practical Exercise**

1. Histological study of various endocrine glands, digestive organs, testis, ovary, kidney, lung, muscles, pancreas & liver.
2. Counting of RBC and WBC in blood sample.
3. Estimation of haematocrit value, bleeding time
4. Study of human salivary activity in relation to pH
6. pH determination by pH meter/pH paper
7. Use of Kymograph
8. Detection of protein, carbohydrate and lipids
9. Human blood groups
10. Detection of nitrogenous waste product in fish tank water, frog tank water, Bird excreta, mammalian kidney
11. Squash preparations of Onion root tip/ Chironomus salivary gland/Grasshopper testis
12. O<sub>2</sub> Consumption in Fish
13. Problems on Genetics

## Animal Physiology

### Unit -I: Nutrition, Metabolism

1. Physiology of Digestion
2. Metabolism of Protein
3. Metabolism of Carbohydrate
4. Metabolism of Fat

### Unit -II: Respiration

1. Kinds of organs of respiration (vertebrates)
2. Mechanism of respiration
3. Physiology of respiration (transport of gases, chloride shift)
4. Properties and function of respiratory pigments

### Unit -III: Regulatory Mechanism and Enzymes

4. Osmoregulation
5. Physiology of Excretion- Urea and Urine formation
6. Thermoregulation
7. Definition and nomenclature of enzymes; classification of enzymes
8. Mechanism of enzyme action

### Unit - IV: Neuromuscular Co- ordination

3. Structure and properties of nervous tissue
4. Physiology of nerve impulse conduction
5. Types of muscles and their properties
6. Ultra structure of muscles
7. Theory of muscle contraction and its biochemistry

### Unit -V: Endocrine and Reproductive System

1. Structure and function of pituitary gland
2. Structure and function of thyroid gland
3. Structure and function of adrenal gland
4. Structure and function of parathyroid, thymus and islets of langerhan's
5. Physiology of reproduction in mammals.

### List of Recommended Books:

1. Verma, P.S. and V.K. Agrawal, Genetics, S.Chand & Co.
2. Lewis, C.D. and Lewin, R., Biology of Gene, McGraw Hill, Toppan Co. Ltd.
3. Gunther S. Stent, Molecular Genetics, Macmillan Publishing Co. Inc.
4. Goodenough. V., Genetics, New York Holt, Rinehart and Winston.
5. Gardner, Principles of Genetics, Wiley Eastern Pvt. Ltd.
6. Winchester, Genetics, Oxford IBH Publications.
7. Stickberger, Genetics, Macmillan Publications.
8. Pai, A.C., Foundation of Genetics, McGraw Hill Publications.
9. Gupta P.K. Genetics Rastogi Publications.
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# Applied Zoology I

## Unit –I :Biotechniques

- 1.1 **Concepts of sterilization:** Filtration, autoclaving, dry heat sterilization, wet sterilization and radiation
- 1.2 **Separation of biomolecules:** Centrifugation (Sedimentation, density gradient); Chromatography (Elementary idea of thin layer, gel filtration and ion exchange Principles and applications)
- 1.3 **Electrophoresis:** Agarose gel electrophoresis, SDS-PAGE
- 1.4 Principles of colorimeter and spectrophotometers

## Unit-II :Microtechnique

- 2.1 Fixation, dehydration, clearing, embedding & section cutting
- 2.2 Difficulties encountered during section cutting (causes and remedies)
- 2.3 Double staining with Haematoxylin and Eosin
- 2.4 Histochemical staining techniques for carbohydrates (Periodic acid schiff), proteins (Mercury-bromophenol blue) and lipids (Sudan black-B)

## Unit-III : Biotechnology

- 3.1 Basic concepts in recombinant DNA technology, Gene isolation method- Shotgun cloning
- 3.2 Isolation of gene- DNA manipulation enzymes: Nucleases, ligases, polymerases
- 3.3 Basic concepts of cloning vectors and splicing : Insertion of DNA and ligation using blunt ends, cohesive ends, Cloning vectors
- 3.4 Application of biotechnology: Insulin and vaccine production

## Unit-IV : Bioinformatics and Biostatistics

- 4.1 Bioinformatics: Definition, Basic concepts in bioinformatics, importance and role of bioinformatics in life sciences
- 4.2 Bioinformatics databases- introduction, types of databases
- 4.3 Nucleotide sequence databases, Elementary idea of protein databases
- 4.4 Biostatistics – Tabulation of data, presentation of data, sampling errors, mean, mode, median, probability, standard error and standard deviation

## **Unit – I : Enzymes**

- 1.1 Enzymes –Distribution and chemical nature of enzymes
- 1.2 General properties of enzymes
- 1.3 Classification of enzymes
- 1.4 Factors affecting enzyme activity

## **Unit-II :Nutrition and Digestion**

- 2.1 Structure and functions of digestive glands - (Salivary, Gastric, Intestinal, Liver and Pancreas )
- 2.2 Gastrointestinal hormones
- 2.3 Digestion and absorption of proteins, carbohydrates and lipids.
- 2.4 Vitamins- Fat soluble and water soluble vitamins; Sources, deficiency and diseases

## **Unit-III :Respiration**

- 3.1 Respiratory pigments - Types , distribution and properties
- 3.2 Mechanism of Respiration
- 3.3 Transport of O<sub>2</sub> and CO<sub>2</sub>
- 3.4 Respiratory disorders and effects of smoking

## **Unit-IV : Circulation**

- 4.1 Composition and functions of blood
- 4.2 Blood clotting – Intrinsic and extrinsic factors, blood groups and Rh factor
- 4.3 Cardiac cycle 4.4 E.C.G. and Blood pressure

## UNIT I

### Thermodynamics – I

12 Hrs

Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

*First Law of Thermodynamics:* statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law - Joule-Thomson coefficient and inversion temperature. Calculation of  $w$ ,  $q$ ,  $dU$  &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

*Thermochemistry:* standard state, standard enthalpy of formation- Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

## UNIT II

### Thermodynamics -II

13 Hrs

*Second law of thermodynamics:* need for the law, different statements 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  $V$  &  $T$ , entropy as a function of  $P$  &  $T$ , entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

*Third law of thermodynamics:* 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 ( $A$ ) as thermodynamic quantities,  $A$  &  $G$  as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of  $G$  and  $A$  with  $P$ ,  $V$  and  $T$ .

## UNIT III

### Chemical Equilibrium

5 Hrs

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle.

Reaction isotherm and reaction isochore – Clapeyron equation and Clausius -Clapeyron equation, applications.

## Phase Equilibrium

10 Hrs

Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system – water,  $\text{CO}_2$  and S systems.

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

Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ( $\text{NaCl-H}_2\text{O}$ ), ( $\text{FeCl}_3\text{-H}_2\text{O}$ ) and  $\text{CuSO}_4\text{-H}_2\text{O}$  system. Freezing mixtures, acetone-dry ice.

Liquid – liquid mixtures - Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes –  $\text{HCl-H}_2\text{O}$  and ethanol – water systems.

Partially miscible liquids – Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature.

Immiscible liquids, steam distillation.

Nernst distribution law – thermodynamic derivation, applications.

## UNITIV

### Electrochemistry – I

10 Hrs

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of  $K_a$  of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

## UNITV

### Electrochemistry - II

10 Hrs

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

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$  and  $K$ ), polarization, over potential and hydrogen overvoltage.

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

Definition of pH and  $pK_a$  determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods.

Buffers – mechanism of buffer action, Henderson-Hassel equation. Hydrolysis of salts.

Corrosion – types, theories and methods of combating it.

## Inorganic Chemistry-II

### Unit I: Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of  $\psi$  and  $\psi^2$ , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rules, Electronic configurations of the elements, effective nuclear charge, Atomic and ionic radii, ionization energy, electron Affinity and electronegativity: definition, method of determination, trends in periodic table and applications.

### Unit II : Chemical Bonding

Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond, Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_4^-$  and  $\text{H}_2\text{O}$  Molecular Orbital theory for homonuclear and heteronuclear ( $\text{CO}$  and  $\text{NO}$ ) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. Weak interactions, hydrogen bonding, van der Waals forces.

### Unit III Ionic Solids

Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond free electron, Valence bond and Band theories Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

### Unit IV p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16 Hydrides of boron-diborane and higher boranes. Borazine, borohydrides

### Unit V p-Block elements

Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens. Chemical properties gases, chemistry of xenon, structure and bonding in xenon compounds.

## Organic Chemistry-II

### Unit I Structure and Bonding

Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clathrates, charge transfer complex, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding, **Mechanism of Organic reactions** : Curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.

### Unit II Stereochemistry

Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, distereoisomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configurations, sequence rules, D & L , R & S systems of nomenclature, Nomenclature E and Z system, geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Saw horse formulae, Fischer and Flying wedge formulae.

### Unit III Alkanes, Cycloalkanes and Aromaticity

IUPAC nomenclature, classification, isomerism in alkanes, sources, and methods of preparation (with special reference to Wurtz, Kolbe., Corey.House, reactions and decarboxylation of carboxylic acids), Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes, Cycloalkanes : nomenclature, methods of preparations, chemical reactions. Bayer's strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of strain rings, Nomenclature of benzene derivatives. The aryl group Aromatic nucleus and side chain Structure of benzene molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution general pattern of the mechanism, role of (a and n complexes) Mechanism of nitration, halogenation. sulphonation. mercuration and Friedel-Crafts reaction Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/pararatio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl

### Unit-IV Alkenes Cycloalkanes, Dienes and alkynes

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration the Saytzeff rule,

Hoffmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ , polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, industrial applications of ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes nomenclature and classification of dienes: isolated conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation and polymerization

### **Unit-V Alkyl and Aryl Halides**

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions mechanisms of nucleophilic substitution reaction of alkyl halides,  $\text{S}_\text{N}2$  and  $\text{S}_\text{N}1$  reactions,

with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides, Synthesis and uses of DDT and BHC, Freon.

## **General Microbiology & Biochemistry**

### **Unit- I**

#### **History of Microbiology and Microscopy**

Meaning, definition and history of Microbiology.

Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky and Alexander Fleming.

Importance and applications of Microbiology.

Principles of microscopy – bright field, dark field, phase-contrast, fluorescent and electron microscopy (SEM and TEM). Ocular and stage micrometers. Size determination of microorganisms.

Principles and types of stains - Simple stain, differential stain, negative stain, structural stains - spore, capsule, flagella. Hanging-drop method.

### **Unit-II**

#### **Microbiological Techniques**

Sterilization and disinfection techniques

Principles and methods of sterilization.

Physical methods - autoclave, hot-air oven, pressure cooker, laminar air flow, filter sterilization.

Radiation methods - UV rays, gamma rays, ultrasonic methods.

Chemical methods - Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient.

Isolation of pure culture techniques - Enrichment culturing, dilution-plating, streak-plate, spread-plate and micromanipulator.

Preservation of microbial cultures - subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

### **Unit-III**

#### **Introductory Biochemistry**

Water- as universal solvent, Weak interaction in aqueous system, Ionization of water.

Buffer- Introduction to buffer concept, Relation of pH, pK and buffer concentration.

Carbohydrates - Classification, Structure and Function. Protein- Classification, Structure and Function.

### **Unit-IV**

Lipid- Structure and Function. Nucleic Acid- Structure and Function. Vitamins- Structure and Function. Enzymes- Major Groups and Nomenclature of Enzymes. Coenzymes and Prosthetic Group. Factors affecting Enzyme activity. Michaelis Menton Equation

## Reference Books

1. Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology**. Scientific Publishers India, Jodhpur.
2. Reddy, S.M. (2003). **University Microbiology –I** . Galgotia Publications Pvt Ltd., New Delhi.
3. Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand ,New Delhi.
4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). **Microbiology**. 5<sup>th</sup> Edition, WCB Mc GrawHill, New York.
5. Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). **Brock Biology of Microorganisms**, 9<sup>th</sup> Edition, MacMillan Press, England.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
7. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology**. 5<sup>th</sup> Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
8. Principles of Biochemistry. Albert L. Lehninger. CBS Publishers and Distributors.
9. Biochemistry- Lubert Stryer Freeman International Edition.
10. Biochemistry- Keshav Trehan. Wiley Eastern Publications.
11. Fundamentals of Biochemistry- J. L. Jain, S .Chand & Company.
12. Biochemistry- Prasarnaga, Bangalore University.
13. Fundamentals of Biochemistry- Dr. A.C. Deb.
14. Essentials of Biophysics. Narayana, P. (2000) .New Age International Publisher
15. New Delhi.
16. A text book of Biophysics. Roy, R.N. (1999). New Central Book Agency.

## **Advanced-Calculus**

### **Unit-I**

Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequence. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests. Cauchy's integral tests. Ratio tests, Raabe's, logarithmic, de Morgan and Bertrand's tests.(without proofs) Alternating series, Leibnitz's theorem . Absolute and conditional convergence.

### **Unit-II**

Continuity of single variables 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-III**

Limit and continuity of functions of two variables. Partial differentiation. Change of variables. Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables Jacobians.

### **Unit-IV**

Envelopes, Evolutes, Maxima, Minima and saddle point of functions of two variables. Lagrange multiplier method. Indeterminate forms.

### **Unit-V**

Beta and Gamma functions. Double and triple integrals. Dirichlet's integrals, change of order of integration in double integrals.

## **Environmental Science**

### **Unit-1**

Diversities of lifeforms- Concept of taxonomy, systematic and classification with respect to plant kingdom, animal kingdom and microbial world.

### **Unit-2**

Fundamental of chemical equilibrium and reaction kinetics -Stoichiometry, chemical equilibrium, thermodynamics application in reaction process (both chemical and biological process), acid base reaction, solubility products, bioinorganic complexes and their importance.

### **Unit-3**

Radiation Physics-Electromagnetic radiation characteristics and its biological effects, radioactivity-source, characteristics, and impacts, radiation in diagnosis and therapy of diseases, radioisotopes and radionuclide in biological systems

### **Unit-4**

Tropical monsoon-causes, and impacts, impacts of climate change on tropical monsoon

### **Unit-5**

Noise Pollution- source of noise, distinction between sound and noise, noise impacts, noise monitoring and control strategies

## English -II

### Unit-I (Any Five)

1. Walt Whitman – O Captain! My Captain!
2. George Orwell – What is Science
3. J. Bronowski - The Dilemma of The Scientist
4. Will Durant – The Origin of Science
5. Somerset Maugham – The Luncheon
  - Henry The Last Leaf
6. Major Ancient Indian Scientist Adopted
7. C.P Snow- Ramanujan
8. Aldous Huxley – J.C.Bose
9. Human Rights
10. R.K Narayan – The Axe
11. Dr. C.V Raman - Water
12. Robert Frost – stopping by Woods on a Snow evening
13. Dr. Yashodhara Mishra – Understanding Gender issues.

### Unit-II

Comprehension of an unseen passage question should be objective/Multiple - choice and should test (a) an understanding of the passage in question, and (b) a group of general language skills and issues with Reference Word and usage Within the passage.

### Unit-III

Paragraph Writing: - Based on expansion word limit 100-150 words. Candidates to attempt any one of three alternative topics provided.

### Unit-IV

Basic language Skill-Vocabulary Synonyms Antonyms one word Substitution of Phrases, Prefixes, Suffixes and word Derivation making Sentence With Idioms and Phrases Corrections of Sentence With Words Likely to be Confused Question Should not repeat the Examples Or exercises given in the text book

### Unit-V

Basic language Skill- Grammar and Usage modals linking devices, tenses, and preposition verb forms Structures Gerunds Participles and infinitive, verbs followed by a preposition and phrasal verbs, articles and determines Countable and uncountable nouns adjectives, and adverbs. Questions Should not repeat the example exercise given in the text book

## Hindi -II

### भाग - दो, आधार पाठ्यक्रम ( हिन्दी भाषा )

**खण्ड-क** निम्नलिखित 5 लेखकों के एक-एक निबंध पाठ्यक्रम में सम्मिलित होंगे -

- |                        |                            |
|------------------------|----------------------------|
| 1. महात्मा गांधी       | - सत्य और अहिंसा           |
| 2. विनोबा भावे         | - ग्राम सेवा               |
| 3. आचार्य नरेन्द्र देव | - युवकों का समाज में स्थान |
| 4. वासुदेव शरण अग्रवाल | - मातृ-भूमि                |
| 5. भगवतशरण उपाध्याय    | - हिमालय की व्युत्पत्ति    |
| 6. हरि ठाकुर           | - डॉ. खूबचंद बघेल          |

**खण्ड-ख** हिन्दी भाषा और उसके विविध रूप

- कार्यालयीन भाषा
- मीडिया की भाषा
- वित्त एवं वाणिज्य की भाषा
- मशीनी भाषा

**खण्ड-ग** अनुवाद व्यवहार : अंग्रेजी से हिन्दी में अनुवाद

हिन्दी की व्यवहारिक कोटियाँ-

रचनागत प्रयोगगत उदाहरण, संज्ञा, सर्वनाम, विशेषण, क्रिया विशेषण, समास, संधि एवं संक्षिप्तियाँ, रचना एवं प्रयोगगत विवेचन ।

**Year-3**

## Applied Zoology II

### Unit -I Aqua Culture:

1. Definition, scope and significance of aquaculture.
2. Prawn culture.
3. Pearl culture.
4. Edible Oyster culture.
5. Frog culture.

### Unit -II Pisciculture

1. General account of freshwater edible fishes.
2. Carp culture.
3. Maintenance of aquarium.
4. Plankton and their role in fisheries.
5. Elementary knowledge of poly-culture.

### Unit -III Economic

General account of:-

1. Sericulture
2. Piculture
3. Lac culture
4. Common pests of oil seeds, vegetables and stored grains.
5. Biological control of insect-pests.

### Unit -IV Toxicology

1. Toxicology: Basic concept.
2. Toxicity testing LC50, LD50 acute and chronic toxicity.
3. Heavy metal toxicity (mercury, cadmium and lead).
4. Pesticides and their toxicological effects.
5. Occupational health hazards and their control.

### Unit -V Lab Techniques

1. Study of pH meter and chromatography.
2. Microtomy.
3. Preparation of fixatives, stains and regents.
4. Museum keeping - Preservation and skeleton preparation, taxidermy.

## Environmental Biology and Evolution

### Unit -I Basic concept of ecology

1. Concept of Ecosystem- Biotic and Abiotic factors, energy flow in ecosystem -food chain and food web.
2. Biogeochemical cycles of CO<sub>2</sub>, N and P.
3. Population concept -characteristics of population.
4. Community concept - Succession, periodicities, indicators.

### Unit -II Habitat Ecology

Characteristics of the following habitats-

1. Fresh water
2. Terrestrial
3. Marine
4. Ecological divisions of India
5. Natural resources and their conservation.

### Unit -III Man and Environment

1. Wild life conservation and sanctuaries of Madhya Pradesh.
2. Environmental degradation and pollution.
3. Pesticide, metal, thermal and noise pollution.
4. Global warming, green house effect and radiation ecology.
5. Urbanization and effects of human population on environment.

### Unit -IV Origin of life and Evolution

1. Origin and life- Theories and concepts.
2. History of evolutionary thought.
3. Lamarckism and Darwinism, Neo-Darwinism.
4. Natural selection -Basic concept of variation, mutation, isolation and speciation.
5. Adaptations and mimicry.
6. Concept of micro, macro and mega evolution.

### Unit -V Palaeontology and Distribution of Animals

1. Palaeontology:-Formation of fossils.
2. Determination of age of fossils.
3. Study of extinct forms: - Dinosaurs and Archaeopteryx.
4. Evolution of man.
5. Zoogeographical distribution of animals.

### Exercises for Practical:

1. Collection and study of Local Insects, Molluses, Fresh water fishes.
2. Study of life history of Silk worm, Honey bee & Lac Insect.
3. Study of Pests- Vegetable and fruit pest, stored grain pest and crop pest.
4. Study of animal adaptations-Aquatic, Desert, Cave, Volant etc. Mounting of unio gills, Fish scales & gills, sting apparatus of honey bee and mouth parts of Insects.
5. Study of pond Ecosystem.
6. Water analysis -O<sub>2</sub>, Chloride, Co<sub>2</sub>, alkalinity, Soil pH.
7. Components and working of Instruments -Microtome, Microscope, pH meter.
8. Spectrometer and centrifuge.

### Scheme of Practical Examination

S.No.	Titles	Marks
1	Spotting (Insects, Fishes Moll uses) <i>any five</i>	10
2	Study of animals for adaptation <i>any three</i>	6
3	Mounting	5
4	Water analysis (any one parameter)	5
5	Comments on Instruments	5
6	Exercise on wild life	5
7	Project/collection	4
8	Viva	5
9	Practical Record	5
	<b>Total</b>	<b>50</b>

**Recommended Books:-**

- Jhingram V.G.                   -Hindustan Publishing Corp, India.
- S.S. Khanna                    -Central Book Depot, Allahabad
- M.S. Reddy & Rao -Discovery Publishing House, New Delhi.
- Nayar B.V.                    -Namrata Publications, Madras.
- Odum E.P.                    -Amerind

## **General Mammalian Physiology – II**

### **Unit –I : Nerve and Muscle Physiology**

- 1.1 Types of neurons, E.M. structure of neuron
- 1.2 Conduction of nerve impulse
- 1.3 Ultrastructure of striated muscle, Sliding filament theory of muscle contraction
- 1.4 Properties of muscles (Twitch, Tetanus, Tonus, Summation, All or None Principle, Muscle fatigue)

### **Unit-II : Excretion**

- 2.1 Structure of uriniferous tubule
- 2.2 Mechanism of urine formation
- 2.3 Counter – current mechanism
- 2.4 Normal and abnormal constituents of urine; Elementary idea of dialysis

### **Unit-III : Endocrinology**

- 3.1 Structure and functions of pituitary gland
- 3.2 Structure and functions of thyroid and parathyroid gland
- 3.3 Structure and functions of adrenal gland
- 3.4 Structure and functions of pineal gland

### **Unit-IV : Reproduction**

- 4.1 Oestrous and menstrual cycle
- 4.2 Male and female sex hormones
- 4.3 Causes of infertility in male and female
- 4.4 Contraceptives– Mechanical and hormonal ;In-vitro fertilization

## **Life and Diversity of Animals - Chordates (Protochordata to Amphibia)**

### **Unit – I**

- 1.1 **Protochordata** : General characters and classification up to order
- 1.2 **Herdmania** : Structure, digestive system, ascidian tadpole and retrogressive metamorphosis
- 1.3 **Amphioxus** : Structure, digestive system, circulatory system, sense organs and protonephridia
- 1.4 **Agnatha** : General characters of Cyclostomata (Petromyzon and Myxine)

### **Unit – II**

- 2.1 **Pisces** : Salient features of Chondrichthyes and Osteichthyes, Origin of paired fins in fishes
- 2.2 Migration and Accessory respiratory organs in fishes
- 2.3 **Amphibia** : General characters and classification up to order
- 2.4 Parental care and Neotony in Amphibia

### **Unit – III**

- 3.1 Gametogenesis and type of eggs
- 3.2 Fertilization of egg
- 3.3 Post fertilization development of fish
- 3.4 Types of scales of fishes, Development of placoid scales

### **Unit – IV**

- 4.1 Frog Embryology - Cleavage ,blastulation and gastrulation
- 4.2 Fate map, Morphogenetic movements in gastrula of frog
- 4.3 Development of respiratory organs in frog
- 4.4 Development of Aortic arches of frog

## **Cell Biology**

### **Unit – I**

- 1.1 Ultrastructure of prokaryotic and eukaryotic cell
- 1.2 Plasma membrane: Structure- Fluid Mosaic Model and functions
- 1.3 Endoplasmic reticulum: Types, ultrastructure and functions
- 1.4 Golgi complex: Ultrastructure and functions

### **Unit – II**

- 2.1 Ultrastructure of mitochondria
- 2.2 Oxidative phosphorylation – Glycolysis and Krebs' cycle
- 2.3 Electron Transport Chain and terminal oxidation
- 2.4 Lysosome: Structure, polymorphism and functions

### **Unit – III**

- 3.1 Nucleus: Ultrastructure of nuclear membrane
- 3.2 Structure and functions of nucleolus
- 3.3 Chromosome: Structure and types, structure of nucleosome
- 3.4 Giant chromosomes: Lamp-brush and polytene chromosome

### **Unit - IV**

- 4.1 Ribosome: Structure, types, Lake's model and functions
- 4.2 Somatic cell division: Cell cycle and Mitosis
- 4.3 Meiosis (different phases and significance), synaptonemal complex
- 4.4 Cellular ageing and cell death, Elementary idea of cancer and its causative agents

## Molecular Biology and Immunology

### Unit - I

- 1.1 **DNA:** Structure of DNA, forms of DNA, properties of DNA, DNA as a genetic material
- 1.2 **RNA:** Structure of RNA, types of RNA, RNA as a genetic material
- 1.3 Prokaryotic and eukaryotic gene structure
- 1.4 **Recombination in Bacteria:** Bacterial transformation – Griffith's experiment, Conjugation in bacteria, transduction

### Unit - II

- 2.1 **DNA replication:** Semiconservative model, MeselsonStahl experiments. Process of replication – origin of replication, concept of replication, directionality of replication
- 2.2 **Genetic code:** Characteristics of genetic code, Wobble hypothesis
- 2.3 **Protein synthesis:** Transcription mechanism – Initiation, elongation and termination of transcription. Translation – activation of amino acids, transfer of activated amino acids to tRNA, Initiation, elongation and termination of polypeptide chain; inhibitors of protein synthesis
- 2.4 **Gene regulation models** - Lac operon and tryptophan operon

### Unit - III

- 3.1 **Concepts of immunity** – Innate and acquired immunity, organs of the immune system
- 3.2 **Antigen** - Structure, diversity, functions and types of antigen
- 3.3 **Antibody** - Structure, types and functions
- 3.4 **Antigen-antibody interaction** – Precipitation and agglutination

### Unit – IV

- 4.1 **Types of immune response:** B cell response (antibody mediated), T cell response (cell mediated)
- 4.2 **Complement system:** Basic concepts of complement cascades, classical, alternative and MBL pathways, implications of complement system in immune defense
- 4.3 **Cytokines**- General account on cytokines, Cytokine related diseases
- 4.4 **Autoimmunity and immunodeficiencies**- Autoimmune diseases and their treatment, AIDS and other immunodeficiencies

## English -III

**Unit-1** Essay type answers in about 200 words. Four essay types question to be asked and two be attempted.

**Unit-2** Writing skills for composition- Essay writing.

**Unit-3** Précis writing.

**Unit-4** (a) reading comprehension of an unseen passages.

(b) Vocabulary based on text.

**Unit-5** Grammar: Advanced Exercises.

Note- Question on unit I and IV (b) shall be asked from the prescribed text. Which will comprise of popular creative writings and the following items.

Minimum needs: Housing and transport, Geo-economic profile of C.G. of education and culture, Women empowerment , Management of change (Physical quality of life) . War and human survival. The question of human social value, new Economic philosophy recent liberalization methods democratic decentralization (with reference to 73, 74 constitutional amendment.)

BZL308

External Marks: 70  
Internal Marks: 30

## **Hindi -III**