

Plan of Written Examination
Final Plan of Written Examination

All the aspirants are informed as under with respect to the written test to be conducted for the recruitment of **LABORATORY ATTENDANT (Advt No. 04 of 2023)**:-

1. The Exam will be conducted in MCQ (Multiple Choice Questions) format. OMR sheets will be used for answering the questions.
2. The Exam would be of 2 hours 30 minutes duration.
3. The Exam will consist of two parts (Part A, Part B and Part C) as follows:-

(a) **Part A:-** Qualifying test of Punjabi Language equivalent to Matriculation standard as per Notification No. G.S.R.72 / Const. / Art.309/Amd.(22)/2022, dated:28.10.2022.

Part	Topic	No. of Questions	Marks (Each Question carries 1 mark)	Type of Questions
A	Punjabi (Qualifying Nature) (Annexure-1)	50	50	MCQs (Multiple Choice Questions)

Note:- (i) There will be no negative marking in Part-A.

(b) **Part 'B' and Part 'C' combined will be evaluated only if a candidate scores minimum 50% marks (i.e 25 marks) in Part 'A'.**

Part	Topic	No. of Questions	Marks (Each Question carries 1 mark)	Type of Questions
B	Questions from General Knowledge and Current Affairs, Punjab History and Culture, Logical Reasoning and Mental ability, Punjabi, English, ICT, (Annexure-2)	40	40	MCQs (Multiple Choice Questions)
C	Questions from the Subject (Annexure-3)	60	60	MCQs (Multiple Choice Questions)
Total		100	100	

Note:- (i) There will be negative marking. Each question carries 1 mark. For every wrong answer, 1/4th mark i.e. 0.25 mark would be deducted. The question(s) not attempted will receive no credit or discredit.

(ii) Part C contains questions from the four subjects namely Physics, Chemistry, Mathematics and Biology (20 questions per subject). Candidate will be required to attempt any three subjects mentioned above. In case any candidate attempts more than three subjects, then marks of three subjects in which candidate has scored highest marks will be counted for merit. Extra time will not be given for attempting extra subject.

4. Syllabus for the written examination for the recruitment of **LABORATORY ATTENDANT (Advt No. 04 of 2023)** is annexed at Annexure-1, Annexure-2 and Annexure-3

Annexure-1 (Punjabi Syllabus)
Part-A (Punjabi Qualifying Exam)

1. ਜੀਵਨੀ ਅਤੇ ਰਚਨਾਵਾਂ ਨਾਲ ਸਬੰਧਤ ਪ੍ਰਸ਼ਨ:-
ਸ੍ਰੀ ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਜੀ, ਸ੍ਰੀ ਗੁਰੂ ਅੰਗਦ ਦੇਵ ਜੀ, ਸ੍ਰੀ ਗੁਰੂ ਰਾਮਦਾਸ ਜੀ,
ਸ੍ਰੀ ਗੁਰੂ ਅਰਜਨ ਦੇਵ ਜੀ, ਸ੍ਰੀ ਗੁਰੂ ਤੇਗ ਬਹਾਦਰ ਜੀ, ਸ੍ਰੀ ਗੁਰੂ ਗੋਬਿੰਦ ਸਿੰਘ ਜੀ।
2. ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ, ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ।
3. ਮੁਹਾਵਰੇ।
4. ਅਖਾਣ।
5. ਸ਼ਬਦ ਦੇ ਭੇਦ।
6. ਅਗੇਤਰ/ਪਿਛੇਤਰ।
7. ਵਚਨ ਬਦਲੇ ਤੇ ਲਿੰਗ ਬਦਲੇ।
8. ਵਿਸਰਾਮ ਚਿੰਨ੍ਹ।
9. ਸ਼ਬਦਾਂ / ਵਾਕਾਂ ਨੂੰ ਸੁੱਧ ਕਰਕੇ ਲਿਖੋ।
10. ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਵਿੱਚ ਸੁੱਧ ਰੂਪ।
11. ਅੰਕਾਂ, ਮਹੀਨੇ, ਦਿਨਾਂ ਦਾ ਸੁੱਧ ਪੰਜਾਬੀ ਰੂਪ।
12. ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਨਾਲ ਸਬੰਧਤ ਪ੍ਰਸ਼ਨ।
13. ਪੰਜਾਬ ਦੇ ਇਤਿਹਾਸ ਨਾਲ ਸਬੰਧਤ ਪ੍ਰਸ਼ਨ।
14. ਪੰਜਾਬ ਦੇ ਸਭਿਆਚਾਰ ਨਾਲ ਸਬੰਧਤ ਪ੍ਰਸ਼ਨ।

Annexure-2

Part B - General Knowledge, Punjab History and Culture, Logical Reasoning Mental Ability, Punjabi, English and ICT.

Sr. No.	Indicative Contents of Syllabus	Weightage (Approx.)
1.	<p>General Knowledge and Current affairs of National and International importance including:</p> <p>(i) Polity issues, (ii) Environment issues, (iii) Current Affairs, (iv) Science and Technology, (v) Economic issues, (vi) History of India with special reference to Indian freedom struggle movement. (vii) Sports, (viii) Cinema and Literature. (ix) Geography</p>	10
2.	<p>Punjab History and Culture:- Physical features of Punjab and its ancient history. Social, religious and economic life in Punjab. Development of Language & literature and Arts in Punjab, Social and culture of Punjab during Afgan/Mughal Rule, Bhakti Movement, Sufism, Teachings/History of Sikh Gurus and Saints in Punjab. Adi Granth, Sikh Rulers, Freedom movements of Punjab.</p>	5
3.	<p>Logical Reasoning & Mental Ability:</p> <p>(i) Logical reasoning, analytical and mental ability. (05 Marks) (ii) Basic numerical skills, numbers, magnitudes, percentage, numerical relation appreciation. (03 Marks) (iii) Data analysis, Graphic presentation charts, tables, spreadsheets. (02 Marks)</p>	10
4.	<p>ਪੰਜਾਬੀ:- ਸ਼ੁੱਧ-ਅਸ਼ੁੱਧ, ਸ਼ਬਦਜੋੜ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ, ਸਮਾਨਾਰਥਕ/ਵਿਰੋਧੀਸ਼ਬਦ, ਨਾਂਵ, ਪੜਨਾਂਵ ਅਤੇ ਕਿਰਿਆ ਦੀਆਂ ਕਿਸਮਾਂ ਤੇ ਸਹੀ ਵਰਤੋਂ, ਲਿੰਗ ਅਤੇ ਵਚਨ, ਪੰਜਾਬੀ ਅਖਾਣ ਤੇ ਮੁਹਾਵਰੇ, ਅੰਗਰੇਜ਼ੀ ਤੋਂ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਅਤੇ ਬਹੁਤੇ ਸ਼ਬਦਾਂ ਦੀ ਥਾਂ ਇੱਕ ਸ਼ਬਦ ਆਦਿ।</p>	5
5.	<p>English:- Basic Grammar, Subject and Verb, Adjectives and Adverbs, Synonyms, Antonyms, One Word Substitution, Fill in the Blanks, Correction in Sentences, Idioms and their meanings, Spell Checks, Adjectives, Articles, Prepositions, Direct and Indirect Speech, Active and Passive Voice, Correction in Sentences, etc.</p>	5
6.	<p>ICT:- Basics of computers, Network & Internet, Use of office productivity tools Word, Excel, Spreadsheet & PowerPoint.</p>	5
	Maximum Marks	40

Annexure-3

Part C – Subject Syllabus (Physics, Chemistry, Mathematics and Biology)

Laboratory Attendant

(A) PHYSICS

Unit-1: Electrostatics

Electric Charges; basic properties of electric charge (addition of charges, quantisation of charges and their Conservation)

Coulomb's law-force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electrical field, electric field due to a point charge; electric field due to system of charge, physical significance of electric field, electric-field lines; electric dipole, electric field due to a dipole;(on its axis, on equatorial plane) physical significance of dipoles; torque on a dipole in uniform electric field. Electric field due to continuous charge distribution.

Electric flux, statement of Gauss's theorem proof of Gauss's theorem for a charge enclosed in sphere, and its applications to find electric field due to infinitely long straight wire, uniformly charged infinite thin plane sheet and uniformly charged thin spherical shell (Field inside and outside).

Electric potential, potential difference, electric potential due to a point charge, potential due to an electric dipole with special cases for axial and equatorial plane and system of charges; equipotential surfaces, its properties, relation between field and potential electrical potential energy of a system of two point charges, potential energy in external field and of electric dipole in an electrostatic field.

Conductors and insulators, electrostatics of conductors, free charges and bound charges inside a conductor. Electrostatic shielding its uses, Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric

medium between the plates, energy stored in a capacitor.

Unit-II: Current Electricity

Electric current, flow of electric charges in a metallic conductor, drift velocity, drift of electron mobility and their relation with electric current: Ohm's law, limitations of Ohm's law electrical resistance. V-I characteristics (linear and non linear), electrical energy and power, electrical resistivity and conductivity. temperature dependence of resistance and resistivity. Internal resistance of a cell, potential difference and emf of cell, combination of cells in series and in parallel.

Kirchhoff's laws and simple applications of Wheatstone bridge,

meter bridge.

Unit-III: Magnetic Effects of Current and Magnetism

Concept of magnetic field. Oersted's experiment;

Biot-savart law and its application to find magnetic field on the axis of a current carrying circular loop, Ampere's circuital law (no proof) and its applications to infinitely long straight wire, straight solenoids.

Force on a moving charge in uniform magnetic and electric fields, motion in a magnetic field.

Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors, definition of ampere. Torque experienced by a current loop in uniform magnetic field; moving coil galvanometers- its current sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic field intensity due to a magnetic dipole (Bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; magnetism and Gauss's law; Earth's magnetisation and magnetic intensity, magnetic properties of materials, Para-, dia- and ferro- magnetic substances with examples,

Unit-IV: Electromagnetic Induction and Alternating Currents

Electromagnetic induction, Faraday's and Henry experiments, magnetic flux, Faraday laws, induced emf and current, Lenz's Law and conservation of energy, motional emf, Self and mutual inductance.

Alternating current, phasors, ac applied across resistance, ac applied across inductor, ac applied across capacitor, ac applied across LCR, (qualitative treatment only), LCR series circuit resonance; power in AC circuit, wattless current.

AC generator and transformer.

Unit-V: Electromagnetic Waves

Need for displacement current, Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

Electromagnetic spectrum (Radio waves, Radio-microwaves, infrared, visible, ultraviolet, X-rays, gamma rays) including elementary facts about their uses.

Unit-VI: Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, optical fibers, refraction at spherical surfaces, refraction by lens, lenses, thin lens formula/equation, lens- maker's formula. Magnification, power of a lens, combination of thin lenses in contact, combination of lens and Refraction through a prism.

Optical instruments:

Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.

Waves optics :

wave front and Huygens' Principle, reflection and refraction of plane wave at a plane surface using Huygens' Principle, wave fronts. Proof of laws of reflection and refraction using Huygens' Principle. Interference Young's double slit experiment and expression for fringe width, coherent sources and incoherent addition of waves Diffraction due to a single slit; width of central maximum.. Polarisation, uses of plane polarised light and Polaroids.

Unit-VII: Dual nature of Matter and Radiation

Electron emission, Photoelectric effect, Hertz and Lenard's observations'; experimental study of photoelectric effect, and wave theory of light; Einstein's photoelectric equation, particle nature of light, the photon, Matter waves-wave nature of particles, de Broglie relation.

Unit-VIII: Atoms & Nuclei

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model of hydrogen atom, expression for radius, velocity and energy of electron in orbit, energy levels, line spectrum of hydrogen atom, atomic spectra, de- Broglie's explanation of Bohr's second postulate of quantization.

Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity- alpha, beta and gamma particles/rays. Mass-energy relation, mass-defect; binding energy per nucleon and its variation with mass number; nuclear fission, nuclear force, Nuclear energy, Nuclear Fusion.

Unit-IX: Electronic Devices

Classification of metal insulator and semiconductor, Energy bands in solids (qualitative idea only) conductor, insulators and Semiconductors; intrinsic and extrinsic semiconductors, p-n junction, semiconductor Diode- I-V characteristics in forward and reverse bias, diode as a rectifier,

(B) CHEMISTRY

Unit I: Solutions

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoult's Law, elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass. Vant Hoff factor.

Unit II: Electrochemistry

Redox reactions; conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and laws of electrolysis (elementary idea) dry cell- electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, fuel cells; corrosion. Relation between Gibbs Energy change and EMF of cell.

Unit III: Chemical Kinetics

Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction: rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation Energy, Arrhenius equation.

Unit-IV: d and f Block Elements

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals-metallic character, ionization, enthalpy, oxidation states, ionic radii, colour, electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and consequences.

Actinoids-Electronic configuration, oxidation states.

Unit-V: Coordination Compounds

Coordination compounds - introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding; Werner's theory VBT, CFT, Isomerism (structure and stereo) importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

Unit-VI: Haloalkanes and Haloarenes.

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation.

Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only)
Uses and environmental effects of dichloromethane, t

Unit-VII: Alcohols, Phenols and Ethers

Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to - methanol and ethanol.

Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.

Unit-VIII: Aldehydes, Ketones and Carboxylic Acids
Aldehydes and Ketones: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

Unit-IX: Organic compounds containing Nitrogen Amines:

Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

Cyanides and Isocyanides - will be mentioned at relevant places in context.

Diazonium Salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

Unit-X: Biomolecules

Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); importance

Proteins - Elementary idea of amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.

Vitamins: Classification and functions.

Hormones: Elementary idea (excluding structure)

Nucleic Acids: DNA & RNA

(C) MATHEMATICS

UNIT I: RELATIONS & FUNCTIONS

1 Relations and Functions:

Types of relations: Reflexive, symmetric, transitive and equivalence relations. Types of functions: One to one and onto functions, composition of functions and invertible functions.

2 Inverse Trigonometric Functions:

Definition, Range, Domain, Principal value branches. Graphs of inverse trigonometric functions. Properties of inverse trigonometric functions.

UNIT II: ALGEBRA

3 Matrices:

Concept, notation, order, equality, types of matrices, zero and identity matrix, transpose of a matrix, symmetric and skew symmetric matrices. Operation of matrices. Addition and multiplication and multiplication with a scalar. Simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2). Invertible matrices and proof of the uniqueness of inverse, if it exists; (Here all matrices will have real entries).

4 Determinants:

Determinant of a square matrix (up to 3×3 matrices), minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equation by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT III: Calculus

5 Continuity and Differentiability:

Continuity and Differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit function. Concepts of exponential and logarithmic functions.

Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives.

6 Applications of Derivatives

Applications of derivatives: rate of change, increasing/decreasing functions, maxima and minima (first derivative test motivated geometrically and second derivative test given as a

provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real life situations).

7 Integrals:

Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, Evaluation of simple integrals of the

following types and problems based on them:

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int \frac{dx}{ax^2 + bx + c}$$
$$\int \frac{(px + q)}{ax^2 + bx + c} dx, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} dx \text{ and } \int \sqrt{x^2 - a^2} dx$$
$$\int \sqrt{ax^2 + bx + c} dx$$

Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

8 Applications of the Integrals:

Applications in finding the area under simple curves, especially lines, circles/parabolas/ellipses (in standard form only).

9 Differential Equations:

Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables, solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:

$$\frac{dy}{dx} + py = q \text{ where } p \text{ and } q \text{ are functions of } x \text{ or constant}$$

$$\frac{dx}{dy} + px = q \text{ where } p \text{ and } q \text{ are functions of } y \text{ or constant}$$

UNIT IV: VECTORS AND THREE DIMENSIONAL GEOMETRY

10 Vectors:

Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Definition, Geometrical interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors.

11 Three-dimensional Geometry:

Direction cosines and direction ratios of a line joining two points. Cartesian

equations and vector equation of a line, skew lines, shortest distance between two lines. Angle between two lines.

UNIT V: LINEAR PROGRAMMING

12 Linear Programming:

Introduction related terminology such as constraints, objectives function, optimization, Graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded) feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints)

UNIT VI: PROBABILITY

13 Probability:

Conditional probability, multiplication theorem on probability, independent events; total probability, Baye's theorem.

(D) BIOLOGY

Unit-I Reproduction

Chapter-1: Sexual Reproduction in Flowering Plants

Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; out breeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Chapter-2: Human Reproduction

Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis -spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development up to blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Chapter-3: Reproductive Health

Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

Unit-II Genetics and Evolution

Chapter-4: Principles of Inheritance and Variation

Heredity and variation: Mendelian inheritance; deviations from Mendelism - incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes; Sex determination - in humans, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colourblindness;

Mendelian disorders in humans - thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-5: Molecular Basis of Inheritance

Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; Genome, Human and rice genome projects; DNA fingerprinting.

Chapter-6: Evolution

Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; Gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; human evolution.

Unit-III Biology and Human Welfare

Chapter-7: Human Health and Diseases

Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Chapter-8: Microbes in Human Welfare

Microbes in food processing, industrial production, sewage treatment, energy generation and microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicious use.

Unit-IV Biotechnology and its Applications

Chapter-9: Biotechnology - Principles and Processes

Genetic Engineering (Recombinant DNA Technology).

Chapter-10: Biotechnology and its Applications

Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

Unit-V Ecology and Environment

Chapter-11: Organisms and Populations

Population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution. (Topics excluded: Organism and its Environment, Major Abiotic Factors, Responses to Abiotic Factors, Adaptations)

Chapter-12: Ecosystem

Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy (Topics excluded: Ecological Succession and Nutrient Cycles).

Chapter-13: Biodiversity and its Conservation

Biodiversity-Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.