5 Year MSc in Biotechnology Course
Paper I Syllabus (Total marks = 20)

English (MCQs will be based on the below mentioned topics)

Prose & Poetry

- Themes, central idea, tone
- Figures of speech
- Appreciation of poems
- Character analysis

Grammar & Language Study

- Tenses (as per HSC grammar section)
- Voice (Active–Passive)
- Direct–Indirect Speech
- Types of sentences
- Clauses
- Prepositions & Articles

Vocabulary

- Synonyms / Antonyms
- Word formation
- Idioms & phrases

Writing Skills

- Letter writing (formal/informal)
- Report writing
- Precise writing
- Dialogue writing
- Expansion of ideas

Reasoning (MCQs will be based on the below mentioned topics)

Verbal Reasoning

- Analogy (word/number)
- Classification
- Series completion
- Coding-Decoding
- Blood relations
- Direction sense

Logical Reasoning

- Syllogism
- Statement–Conclusion
- Assertion–Reason
- Cause & Effect

Non-Verbal Reasoning

- Mirror & water images
- Paper folding
- Figure completion
- Pattern recognition

Aptitude (MCQs will be based on the below mentioned topics)

Arithmetic

- Percentages
- Ratio & Proportion
- Average
- Profit & Loss
- Simple & Compound Interest
- Time & Work
- Time, Speed & Distance

Number System

- Divisibility rules
- HCF & LCM

Algebra (Basic HSC Level)

- Linear equations
- Simplification

Data Interpretation

- Tables
- Bar graphs
- Pie charts

General Knowledge (MCQs will be based on the below mentioned topics)

- Science-Based General Knowledge
- Static General Knowledge
- Current Affairs

5 Year MSc in Biotechnology Course Paper II syllabus for Online Entrance Exam 2026

Paper II Total Marks : 80

MCQs will be based on the below mentioned topics

Class 11

Physics

1. Physical World and Measurement

- Scope and importance of physics
- Fundamental forces in nature
- Units and measurements:
  - SI units
  - Fundamental and derived units
- Errors in measurement:
  - Absolute, relative, percentage error
- Significant figures
- Dimensional analysis

2. Kinematics

- Motion in one dimension:
  - Distance, displacement
  - Speed and velocity
  - Acceleration
- Equations of motion
  v=u+atv = u + atv=u+at
- Motion in two dimensions:
  - Projectile motion
- Relative velocity

3. Laws of Motion

- Newton's laws of motion
- Inertia and mass
- Force and acceleration
- Friction:
  - Static and kinetic friction
- Circular motion (basic idea)

4. Work, Energy and Power

- Work done by a force
- Kinetic energy
- Potential energy
- Work-energy theorem
- Law of conservation of energy
- Power

5. Rotational Motion

- Angular displacement, velocity, acceleration
- Torque and angular momentum
- Moment of inertia
- Rotational kinetic energy

- Conservation of angular momentum

6. Gravitation

- Universal law of gravitation
  Acceleration due to gravity (g)
- Motion of planets and satellites
- Escape velocity

7. Properties of Bulk Matter

A. Mechanical Properties of Solids

- Stress and strain
- Hooke's law
- Young's modulus

B. Mechanical Properties of Fluids

- Pressure
- Pascal's law
- Archimedes' principle
- Viscosity

C. Thermal Properties

- Temperature and heat
- Thermal expansion
- Specific heat capacity

8. Thermodynamics

- Thermal equilibrium
- Zeroth law of thermodynamics
- First law of thermodynamics
- Heat engines and efficiency
- Reversible and irreversible processes

9. Kinetic Theory

- Kinetic theory of gases
- Assumptions
- Pressure of gas
- Relation between temperature and kinetic energy

10. Oscillations and Waves

A. Oscillations

- Simple harmonic motion (SHM)
- Displacement, velocity, acceleration in SHM
- Time period

B. Waves

- Wave motion
- Types of waves
- Wave parameters:
  - Wavelength
  - Frequency
- Sound waves and their properties

Chemistry

1. Some Basic Concepts of Chemistry

- Nature of matter
- Laws of chemical combination:

    - Law of conservation of mass
    - Law of definite proportions
- Mole concept:
    - Avogadro's number
    - Molar mass
- Stoichiometry:
    - Empirical and molecular formula
    - Limiting reagent

2. Structure of Atom

- Discovery of electron, proton, neutron
- Atomic models:
    - Thomson model
    - Rutherford model
    - Bohr's model
- Quantum mechanical model (basic idea)
- Quantum numbers
- Electronic configuration

3. Classification of Elements and Periodicity

- Modern periodic law
- Periodic table trends:
    - Atomic size
    - Ionization energy
    - Electron affinity
    - Electronegativity
- Periodic classification of elements

4. Chemical Bonding and Molecular Structure

- Ionic bond and covalent bond
- Lewis structures
- VSEPR theory
- Hybridization:
    - sp, sp^2, sp^3
- Molecular geometry
- Hydrogen bonding

5. States of Matter

- Solid, liquid, gas
- Gas laws:
    - Boyle's law
    - Charles law
- Ideal gas equation
- Kinetic theory of gases
- Liquids and intermolecular forces

6. Thermodynamics

- System and surroundings
- Types of processes:
    - Isothermal, adiabatic
- First law of thermodynamics
- Enthalpy and heat changes
- Hess's law

7. Equilibrium

- Chemical equilibrium
- Law of mass action
- Equilibrium constant (Kc, Kp)
- Le Chatelier's principle
- Ionic equilibrium:
    - pH and pOH
    - Buffer solutions

8. Redox Reactions

- Oxidation and reduction concepts
- Oxidation number
- Balancing redox equations
- Types of redox reactions

9. Hydrogen

- Position of hydrogen in periodic table
- Isotopes of hydrogen
- Hydrides:
    - Ionic, covalent, metallic
- Water:
    - Hardness and softening

10. s-Block Elements

- Group 1 (alkali metals)
- Group 2 (alkaline earth metals)
- Properties:
    - Physical and chemical
- Compounds:
    - NaOH, Na_2CO_3, CaO, $CaCO_3$

11. p-Block Elements (Group 13 & 14)

- Electronic configuration
- Trends in properties
- Important compounds:
    - Boron compounds
    - Carbon compounds

12. Organic Chemistry – Basic Principles

- Classification and nomenclature
- Isomerism:
    - Structural and stereoisomerism
- Electronic effects:
    - Inductive effect
    - Resonance
- Reaction mechanisms (basic idea)

13. Hydrocarbons

- Alkanes, alkenes, alkynes
- Aromatic hydrocarbons
- Preparation methods
- Chemical reactions:
    - Substitution
    - Addition

- Uses of hydrocarbons

14. Environmental Chemistry

- Environmental pollution:
  - Air, water, soil
- Greenhouse effect
- Ozone depletion
- Waste management
- Green chemistry basics

Mathematics

Sets and Functions

- Sets:
  - Definition and representation
  - Types of sets (finite, infinite, null, subset)
  - Venn diagrams
- Operations on sets:
  - Union, intersection, complement
- Relations:
  - Types: reflexive, symmetric, transitive
- Functions:
  - Domain, codomain, range
  - Types: one-one, onto

2. Trigonometric Functions

- Angles and their measurement (degrees & radians)
- Trigonometric ratios
- Unit circle approach
- Trigonometric identities
- Graphs of sin, cos, tan functions
- Trigonometric equations

3. Complex Numbers

- Definition and representation (Argand plane)
- Algebra of complex numbers
- Conjugate and modulus
- Polar form of complex numbers

4. Quadratic Equations

- Standard form of quadratic equation
- Discriminant and nature of roots
  $D=b^2-4ac$ D
- Solution using formula
- Relationship between roots and coefficients

5. Sequences and Series

- Arithmetic progression (AP):
  - nth term
  - Sum of n terms
- Geometric progression (GP):
  - nth term
  - Sum of GP
- Special series

6. Straight Lines

- Cartesian coordinate system
- Slope of a line
- Equation of line:
  - Slope form
  - Point-slope form
  - Intercept form
- Distance formula
- Angle between two lines

7. Conic Sections

- Circle:
  - Standard equation
- Parabola:
  - Standard equation and properties
- Ellipse and hyperbola (basic idea)

8. Limits and Derivatives

- Concept of limit
- Basic limit formulas
- Introduction to derivatives
- Derivative of simple functions

9. Statistics

- Measures of central tendency:
  - Mean
  - Median
  - Mode
- Measures of dispersion:
  - Range
  - Variance
  - Standard deviation

10. Probability

- Random experiments and events
- Sample space
- Types of events
- Probability of an event

Biology

1. Diversity in Living World

A. Living World

- Characteristics of living organisms
- Diversity in living organisms
- Taxonomy and systematics
- Binomial nomenclature

B. Biological Classification

- Five kingdom classification
- Kingdoms:
  - Monera
  - Protista
  - Fungi

    - Plantae
    - Animalia

C. Plant Kingdom

- Algae, Bryophytes, Pteridophytes
- Gymnosperms and Angiosperms
- Life cycles

D. Animal Kingdom

- Classification based on:
    - Symmetry
    - Coelom
    - Segmentation
- Phylum-wise classification (Porifera → Chordata)

2. Structural Organization in Plants and Animals

A. Morphology of Flowering Plants

- Root, stem, leaf
- Inflorescence
- Flower structure
- Fruit and seed

B. Anatomy of Flowering Plants

- Tissue systems:
    - Epidermal
    - Ground
    - Vascular
- Secondary growth

C. Structural Organization in Animals

- Animal tissues:
    - Epithelial
    - Connective
    - Muscular
    - Nervous
- Cockroach morphology (important for exams)

3. Cell Structure and Function

A. Cell Theory

- Cell as basic unit of life
- Prokaryotic vs eukaryotic cells

B. Cell Organelles

- Nucleus, mitochondria, ribosomes
- Endoplasmic reticulum, Golgi apparatus
- Lysosomes, plastids

C. Cell Cycle and Division

- Mitosis
- Meiosis (very important)

4. Plant Physiology

A. Transport in Plants

- Diffusion, osmosis
- Xylem and phloem transport

B. Mineral Nutrition

- Essential elements
- Deficiency symptoms

C. Photosynthesis
- Light and dark reactions
- C3 and C4 pathways

D. Respiration in Plants
- Glycolysis
- Krebs cycle
- Electron transport chain

E. Plant Growth and Development
- Plant hormones:
    - Auxins
    - Gibberellins
    - Cytokinins
    - Ethylene
    - ABA

5. Human Physiology

A. Digestion and Absorption
- Human digestive system
- Enzymes and digestion process

B. Breathing and Exchange of Gases
- Respiratory system
- Mechanism of breathing

C. Body Fluids and Circulation
- Blood and its components
- Heart structure and function
- Cardiac cycle

D. Excretory Products and Elimination
- Kidney structure
- Urine formation

E. Locomotion and Movement
- Muscles and bones
- Types of joints

F. Neural Control and Coordination
- Nervous system
- Reflex action

G. Chemical Coordination and Integration
- Endocrine glands
- Hormones and functions

Class 12

Physics

1. Electrostatics

- Electric charges and their properties
- Coulomb's law
- Electric field and field lines
- Electric dipole and dipole moment
- Electric potential and potential difference
- Equipotential surfaces
- Capacitance:
    - Parallel plate capacitor
    - Series and parallel combinations
- Energy stored in a capacitor

2. Current Electricity

- Electric current and drift velocity
- Ohm's law
- Resistance and resistivity
- Series and parallel combinations of resistors
- Kirchhoff's laws
- Wheatstone bridge
- Potentiometer and its applications

3. Magnetism

- Magnetic field and field lines
- Biot–Savart law
- Ampere's circuital law
- Force on moving charge and current-carrying conductor
- Motion of charged particle in magnetic field
- Magnetic properties of materials

4. Electromagnetic Induction

- Faraday's laws of electromagnetic induction
- Lenz's law
- Self and mutual inductance
- Eddy currents

5. Alternating Current

- AC voltage and current
- RMS and peak values
- Reactance and impedance
- LC, LR, LCR circuits
- Resonance
- Power in AC circuits (power factor)

6. Electromagnetic Waves

- Displacement current
- Nature of EM waves
- Electromagnetic spectrum
- Properties and applications of EM waves

7. Optics

A. Ray Optics

- Reflection and refraction
- Mirror formula
- Refraction through lenses
- Lens maker's formula
- Total internal reflection
- Optical instruments (microscope, telescope)

B. Wave Optics

- Huygens' principle
- Interference (Young's double slit experiment)
- Diffraction
- Polarization

8. Dual Nature of Radiation and Matter

- Photoelectric effect
- Einstein's photoelectric equation
- Wave-particle duality
- de Broglie wavelength

9. Atoms and Nuclei

- Rutherford's model
- Bohr's atomic model
- Energy levels and spectra
- Radioactivity (α, β, γ decay)
- Nuclear reactions
- Mass-energy relation

10. Semiconductors

- Types: intrinsic and extrinsic
- p-n junction diode
- Diode as rectifier
- Transistors (basic idea)
- Logic gates (AND, OR, NOT)

11. Communication Systems

- Elements of communication system
- Analog and digital communication
- Modulation (amplitude modulation)
- Transmission and reception

Chemistry

1. Solid State

- Types of solids: crystalline & amorphous
- Crystal lattice and unit cell
- Types of unit cells (primitive, body-centered, face-centered)
- Packing efficiency
- Density of unit cell
- Imperfections in solids (defects)
- Electrical and magnetic properties

2. Solutions

- Types of solutions

- Concentration terms: molarity, molality, mole fraction
- Solubility and factors affecting solubility
- Vapour pressure and Raoult's law
- Ideal and non-ideal solutions
- Colligative properties:
    - Relative lowering of vapour pressure
    - Elevation of boiling point
    - Depression of freezing point
    - Osmotic pressure

3. Electrochemistry

- Electrochemical cells (galvanic & electrolytic)
- Electrode potential and EMF
- Nernst equation (very important)
- Conductance:
    - Specific conductance
    - Molar conductance
- Kohlrausch's law
- Batteries and fuel cells
- Corrosion and prevention

4. Chemical Kinetics

- Rate of reaction
- Rate law and rate constant
- Order and molecularity
- Integrated rate equations (0, 1, 2 order)
- Half-life of reactions
- Effect of temperature (Arrhenius equation)
- Activation energy

5. Surface Chemistry

- Adsorption:
    - Physisorption vs chemisorption
- Factors affecting adsorption
- Catalysis:
    - Homogeneous & heterogeneous
- Colloids:
    - Types and properties
    - Tyndall effect
    - Emulsions

6. Metallurgy

- Occurrence of metals
- Concentration of ores
- Extraction methods:
    - Roasting
    - Calcination
    - Reduction
- Refining of metals:
    - Electrolytic refining
- Important ores and processes

7. Haloalkanes and Haloarenes

- Classification and nomenclature

- Preparation methods
- Physical and chemical properties
- Reactions:
  - Nucleophilic substitution (SN1, SN2)
  - Elimination reactions
- Uses and environmental effects (CFCs)

8. Alcohols, Phenols and Ethers

- Classification and nomenclature
- Preparation of alcohols and phenols
- Physical properties (H-bonding – important)
- Chemical reactions:
  - Oxidation
  - Dehydration
  - Esterification
- Distinction between alcohols, phenols, ethers

9. Aldehydes, Ketones and Carboxylic Acids

- Structure and nomenclature
- Preparation methods
- Chemical reactions:
  - Nucleophilic addition
  - Oxidation and reduction
- Tests:
  - Tollens' test
  - Fehling's test
- Properties of carboxylic acids

10. Amines

- Classification (primary, secondary, tertiary)
- Nomenclature
- Preparation methods
- Chemical properties:
  - Basic nature
  - Reactions (diazotization – important)
- Uses of amines

11. Biomolecules

- Carbohydrates:
  - Glucose, fructose
- Proteins:
  - Structure and functions
- Enzymes
- Vitamins
- Nucleic acids (DNA, RNA – basics)

12. Polymers

- Classification of polymers
- Types:
  - Addition polymers
  - Condensation polymers
- Important polymers:
  - Nylon
  - Bakelite

    - PVC
- Biodegradable polymers
- Chemistry in Everyday Life

Mathematics

1. Relations and Functions

- Types of relations: reflexive, symmetric, transitive, equivalence
- Functions: domain, codomain, range
- Types of functions: one-one, onto, bijective
- Composition of functions
- Invertible functions

2. Inverse Trigonometric Functions

- Definition and principal value branches
- Domain and range
- Graphs of inverse trigonometric functions
- Properties and identities
- Solving equations using inverse trigonometric functions

3. Matrices

- Types: row, column, square, zero, identity
- Matrix operations: addition, multiplication
- Transpose of a matrix
- Symmetric and skew-symmetric matrices

4. Determinants

- Determinant of a matrix (up to 3×3)
- Properties of determinants
- Minors and cofactors
- Adjoint and inverse of a matrix
- Solving linear equations using matrices (Cramer's rule)

5. Continuity and Differentiability

- Continuity of functions
- Differentiability
- Derivatives of:
    - Trigonometric functions
    - Inverse trigonometric functions
    - Exponential and logarithmic functions
- Chain rule, product rule, quotient rule

6. Applications of Derivatives

- Rate of change
- Increasing and decreasing functions
- Maxima and minima (very important)
- Tangents and normals

7. Integrals

- Integration as inverse of differentiation
- Standard integrals
- Methods:
    - Substitution
    - Integration by parts
    - Partial fractions

8. Applications of Integrals

- Area under curves
- Area between two curves

9. Differential Equations

- Definition and order/degree
- Formation of differential equations
- Solution of:
    - Variable separable equations
    - Homogeneous equations
    - Linear differential equations

10. Vectors

- Vector algebra (addition, scalar multiplication)
- Dot product (scalar product)
- Angle between vectors

11. 3D Geometry

- Direction cosines and ratios
- Equation of line in space
- Angle between lines
- Shortest distance between lines

12. Linear Programming

- Linear inequalities
- Objective function
- Graphical method of solution
- Feasible region and optimal solution

13. Probability

- Conditional probability
- Multiplication theorem
- Independent events
- Bayes' theorem (basic idea)

Biology

1. Reproduction

A. Reproduction in Organisms

- Asexual reproduction (binary fission, budding, fragmentation)
- Sexual reproduction (gamete formation, fertilization)
- Life cycles and lifespan

B. Reproduction in Plants

- Structure of flower (anther, ovule)
- Microsporogenesis & megasporogenesis
- Pollination (types, agents)
- Fertilization (double fertilization – very important)
- Seed and fruit formation

C. Human Reproduction

- Male and female reproductive systems
- Gametogenesis (spermatogenesis, oogenesis)
- Menstrual cycle

- Fertilization, implantation, pregnancy
- Parturition and lactation

D. Reproductive Health

- Contraceptive methods
- Sexually transmitted diseases (STDs)
- Infertility and assisted reproductive technologies (IVF, etc.)

2. Genetics and Evolution

A. Principles of Inheritance

- Mendel's laws (law of dominance, segregation, independent assortment)
- Monohybrid and dihybrid crosses
- Test cross

B. Molecular Basis of Inheritance

- DNA structure and replication
- RNA types and functions
- Genetic code
- Protein synthesis (transcription & translation)

C. Evolution

- Theories of evolution (Lamarckism, Darwinism)
- Evidence of evolution (fossils, homologous organs)
- Hardy–Weinberg principle
- Human evolution

3. Biotechnology

A. Principles and Processes

- Genetic engineering
- Recombinant DNA technology
- Tools:
    - Restriction enzymes
    - Vectors (plasmids)
    - Host cells

B. Applications

- Medical (insulin production, vaccines)
- Agriculture (GM crops)
- Environmental (bioremediation)

C. Ethical Issues

- Biosafety
- Bioethics
- Genetically modified organisms (GMOs)

4. Ecology

A. Organisms and Environment

- Abiotic factors (temperature, water, light)
- Adaptations

B. Ecosystem

- Structure and function
- Food chain and food web
- Ecological pyramids

C. Biodiversity and Conservation

- Levels of biodiversity
- Hotspots
- Conservation methods (in-situ, ex-situ)

D. Environmental Issues

- Pollution (air, water, soil)
- Global warming
- Ozone depletion

5. Human Health and Disease

A. Pathogens and Diseases

- Bacterial, viral, protozoan diseases
- Examples: malaria, tuberculosis

B. Immunity

- Innate and acquired immunity
- Antigen–antibody interaction
- Vaccination

C. Health and Lifestyle

- Balanced diet
- Exercise
- Mental health

D. Drugs and Alcohol Abuse

- Effects on body
- Prevention and control