

Department of Biological Sciences

SRM University-AP, Andhra Pradesh

Part A — General Aptitude and Research-Related Skills

This section assesses quantitative ability, logical reasoning, interpretation of scientific information and basic analytical skills, with additional emphasis on interpreting research data.

General Aptitude and Research-Related Skills

Unit A1. Numerical Ability and Quantitative Aptitude

- Number systems, simplification, LCM and HCF.
- Fractions, decimals, percentages, ratios, proportions and averages.
- Profit and loss, simple and compound interest, mixtures and alligation.
- Algebra, quadratic equations, logarithms, surds, indices, sequences and series.
- Time and work, time, speed and distance.
- Permutations, combinations and probability.
- Geometry, mensuration and basic trigonometry.

Unit A2. Logical and Analytical Reasoning

- Number and letter series, coding and decoding.
- Classification and analogies.
- Directions, distances, rankings and arrangements.
- Calendar and clock problems.
- Logical deduction, statements and conclusions.
- Puzzles and analytical problem-solving.

Unit A3. Data Interpretation and Graphical Analysis

- Tables, bar graphs, line graphs and pie charts.
- Interpretation and comparison of numerical data.
- Mean, median, mode and measures of dispersion.
- Identification of trends, outliers and relationships in datasets.
- Interpretation of experimental results, including controls and treatment groups.

Unit A4. Scientific and Research Aptitude

- Scientific reasoning and hypothesis-based problem-solving.
- Identification of independent, dependent and controlled variables.
- Fundamentals of experimental design, controls, replicates and sources of error.
- Interpretation of tables, figures and experimental results.

- Basic principles of probability, correlation and scientific evidence.

Unit A5. Research Ethics, Biosafety and Scientific Integrity

- Research ethics and responsible conduct of research.
- Research integrity, plagiarism, fabrication, falsification and publication ethics.
- Intellectual property rights, patents and technology transfer.
- Biosafety principles, biological containment and laboratory safety.
- Animal ethics and ethical considerations in biological experimentation.
- Responsible use of computational tools and artificial intelligence in research.

Part B — Subject Knowledge: Life Sciences and Biotechnology

Unit B1. Biomolecules, Biochemistry and Bioenergetics

- Structure, properties and biological functions of carbohydrates, lipids, proteins, nucleic acids, vitamins and coenzymes.
- Amino acids, peptide bonds, protein structure, folding, stability and misfolding.
- DNA and RNA structure; molecular interactions and forces stabilizing biological macromolecules.
- Enzyme catalysis, enzyme kinetics, enzyme inhibition, regulation and allostery.
- pH, buffers, Henderson–Hasselbalch equation and chemical equilibria.
- Thermodynamics, free energy, entropy, redox reactions and bioenergetics.
- Glycolysis, TCA cycle, pentose phosphate pathway, gluconeogenesis, lipid metabolism and amino acid metabolism.
- Electron transport, oxidative phosphorylation, ATP synthesis and photosynthesis-related energy conversion.

Unit B2. Cell Biology and Cellular Organization

- Prokaryotic and eukaryotic cell structure and organization.
- Biological membranes, membrane lipids, membrane proteins, transport and membrane potential.
- Structure and functions of mitochondria, chloroplasts, nucleus, endoplasmic reticulum, Golgi apparatus, lysosomes and peroxisomes.
- Cytoskeleton, intracellular trafficking, vesicular transport and protein targeting.
- Cell cycle, mitosis, meiosis and cell-cycle regulation.
- Cell death, including apoptosis, necrosis and autophagy.
- Cellular stress responses, organelle dynamics and cellular homeostasis.

Unit B3. Molecular Biology and Gene Regulation

- Genome organization, chromosomes, chromatin and epigenetic regulation.
- DNA replication, DNA damage, repair and recombination.
- Transcription, RNA processing, splicing, RNA editing and non-coding RNAs.
- Translation, ribosome function, post-translational modifications and protein degradation.
- Regulation of gene expression in prokaryotes and eukaryotes.
- Operons, transcription factors, gene silencing and regulatory RNAs.
- Mutations, transposable elements and molecular mechanisms of genome stability.

Unit B4. Genetics, Genomics and Evolution

- Mendelian and non-Mendelian inheritance.
- Linkage, recombination, genetic mapping and chromosome abnormalities.
- Quantitative genetics, population genetics and Hardy–Weinberg equilibrium.
- Gene interactions, sex-linked inheritance, organellar inheritance and genetic disorders.
- Genetic variation, mutation, natural selection, genetic drift and speciation.

- Genome organization, comparative genomics and functional genomics.
- Model organisms and their applications in biological research.

Unit B5. Microbiology, Immunology and Host–Pathogen Interactions

- Diversity, classification and structure of bacteria, archaea, fungi, viruses and protozoa.
- Microbial growth, nutrition, metabolism, culture methods and microbial genetics.
- Microbial ecology, biofilms, quorum sensing and antimicrobial resistance.
- Innate and adaptive immunity, immune cells, antibodies, antigens and complement.
- Antigen presentation, B-cell and T-cell responses, inflammation and immune regulation.
- Vaccines, immunological techniques and diagnostic methods.
- Host–pathogen interactions, infectious diseases, parasitology and mechanisms of pathogenicity.

Unit B6. Plant Biology and Physiology

- Plant anatomy, morphology, taxonomy and diversity.
- Plant cell organization, tissue differentiation and developmental processes.
- Photosynthesis, photorespiration, respiration and plant bioenergetics.
- Water relations, mineral nutrition, transport and translocation.
- Plant hormones, photobiology, flowering, seed development and germination.
- Plant responses to biotic and abiotic stresses.
- Plant genetics, breeding, tissue culture, genetic modification and genome editing.

Unit B7. Animal Biology, Physiology and Development

- Animal diversity, taxonomy and evolutionary relationships.
- Blood, circulation, respiration, excretion and osmoregulation.
- Nervous system, sensory physiology, muscle function and endocrinology.
- Digestion, metabolism, reproduction and physiological homeostasis.
- Gametogenesis, fertilization, embryogenesis, morphogenesis and organogenesis.
- Stem cells, differentiation, regeneration, ageing and programmed cell death.
- Animal behaviour, adaptation and interactions with the environment.

Unit B8. Ecology, Biodiversity and Environmental Biology

- Organismal, population, community and ecosystem ecology.
- Population growth, species interactions, food webs and ecological succession.
- Energy flow, productivity and biogeochemical cycles.
- Evolutionary diversity, systematics and phylogenetic relationships.
- Biodiversity, conservation biology and environmental change.
- Pollution, climate change, ecological stress and ecosystem degradation.
- Microbial ecology, environmental microbiology and biological approaches to remediation.

Unit B9. Biotechnology and Applied Biological Sciences

- Recombinant DNA technology, molecular cloning and recombinant protein expression.
- PCR, DNA sequencing, gene expression analysis and molecular diagnostics.

- Genome editing, CRISPR-based methods, transgenic organisms and gene silencing.
- Plant, animal, microbial, medical and environmental biotechnology.
- Cell and tissue culture, stem-cell technology and organoid-based models.
- Vaccines, immunotechnology, biosensors and biotechnology-based diagnostics.
- Fermentation, bioprocess engineering, bioreactors and downstream processing.
- Industrial enzymes, biofuels, bioremediation and other microbial applications.

Unit B10. Bioinformatics, Computational Biology and Systems Biology

- Biological databases and retrieval of molecular information.
- Sequence alignment, BLAST, sequence similarity and homology.
- Phylogenetic analysis, gene annotation and comparative genomics.
- Protein structure, molecular modelling and molecular dynamics: basic principles.
- Genomics, transcriptomics, proteomics and metabolomics.
- Biological networks, systems biology and mathematical modelling of biological processes.
- Computational approaches to drug discovery and biological data analysis.

Unit B11. Analytical Techniques

- Chromatography, electrophoresis, centrifugation and spectroscopic methods.
- PCR, quantitative PCR, sequencing, immunoblotting, ELISA and immunoprecipitation.
- Microscopy, fluorescence imaging, flow cytometry and cell-based assays.
- X-ray crystallography, NMR, cryo-electron microscopy and mass spectrometry: principles and applications.
- Basic principles of statistical analysis, hypothesis testing, confidence intervals, correlation, regression, t-tests, ANOVA and chi-square tests.
- Interpretation of experimental datasets, figures, controls and statistical results.