

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Ph. D/M. Phil Entrance Examination

BIOSCIENCE

Total Marks 100

(Part I 50 Marks + Part II 50 Marks)

PART - I GENERAL BIOLOGICAL SCIENCE

50 Marks

1. CELL & CELLULAR ORGANIZATION
2. MOLECULES & BIOMOLECULES
3. INHERITANCE BIOLOGY
4. DIVERSITY OF LIFE FORMS
5. ECOLOGICAL PRINCIPLES

Note: Equal waitage should be given to each unit.

PART – II: (A) ANIMAL SCIENCE

50 Marks

Note: Equal waitage should be given to each unit/part.

OR

PART – II: (B) BOTANY

50 Marks

Note: Equal waitage should be given to each unit/part.

OR

PART – II: (C) MICROBIOLOGY/ BIOTECHNOLOGY

50 Marks

Note: Equal waitage should be given to each unit/part.

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Ph. D/M. Phil Entrance Examination

BIOSCIENCE

PART - I GENERAL BIOLOGICAL SCIENCE

1. CELL & CELLULAR ORGANIZATION

- A. Membrane structure and function:** Structure of model membrane, lipid bilayer
And membrane protein, membrane transport.
- B. Structural organization and function of intracellular organelles:** Cell wall,
nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum,
peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton.
- C. Cell division and cell cycle:** Mitosis and meiosis, their regulation, steps in cell
cycle, and control of cell cycle.
- D. Levels of structural organization:** Unicellular, colonial and multicellular forms;
levels of organization of tissues, organs and systems.

2. MOLECULES & BIOMOLECULES

- A. Molecule & Biomolecules:** Structure of atoms, molecules and chemical bonds.
Composition, structure and function of biomolecules (carbohydrates, lipids,
proteins, nucleic acids and vitamins).
- B. Enzymes:** Principles of catalysis, enzymes and enzyme kinetics, enzyme
regulation, Mechanism of enzyme catalysis, isozymes.
- C. Principles of biophysical chemistry:** pH, buffer, reaction kinetics,
Thermodynamics, Bioenergetics, Glycolysis, oxidative phosphorylation, coupled
reaction, group transfer, biological energy transducers.
- D. Metabolism :** Metabolism of carbohydrates, lipids, proteins. Intermetabolic
Pathway.

3. INHERITANCE BIOLOGY

A. Mendelian principles: Dominance, segregation, independent assortment,

Deviation from Mendelian inheritance, co dominance, incomplete dominance,

Gene interactions, linkage and crossing over, sex linked inheritances.

B. Chromosome & chromosomal abnormalities: Structure of chromatin and

Chromosomes, Structural and numerical alterations of chromosomes: Deletion,

Duplication, inversion, translocation, ploidy and their genetic implications.

C. Concept of gene: Classical & modern concept of gene, structure & organization of

gene, Allele, multiple alleles, pseudo allele.

D. Mutation: Types, causes and detection, mutant types – lethal, conditional,

biochemical, loss of function, gain of function, germinal verses somatic mutants,

insertion mutagenesis.

4. DIVERSITY OF LIFE FORMS

A. Principles and methods of taxonomy: Concepts of species and hierarchical taxa,

biological nomenclature, classical and quantitative methods of taxonomy of

plants, animals and microorganisms.

B. Outline classification of plants, animals and microorganisms: Important criteria

used for classification in each taxon; classification of plants, animals and

microorganisms; evolutionary relationships among taxa.

C. Advanced taxonomy: Numerical & molecular taxonomy, Woese classification and

domain system, phylogenetic hierarchy

D. Statistical Methods: Data, tabulation, graphical representation, Measures of

central tendency and dispersal; probability distributions (Binomial, Poisson and

normal); sampling distribution and errors; chi-square.

5. ECOLOGICAL PRINCIPLES

A. The Environment & Habitat: Physical environment; biotic environment; biotic

and abiotic interactions. Concept of habitat and niche

B. Ecosystem: Structure and function; energy flow and mineral cycling (CNP);

Primary production and decomposition; structure and function of some Indian

ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine,

estuarine).

C. Biodiversity: Biodiversity status, Types of biodiversity, monitoring and documentation; major drivers of biodiversity change; biodiversity conservation and management strategy

D. Applied ecology: Environmental pollution: Air, water; global environmental change; management approaches. Principles of conservation, Conservation management,

PART – II: (A) ANIMAL SCIENCE

1. **Animal Kingdom :** General classification of animal kingdom, General characteristics & members of each animal phylum.
2. **Anatomy and Histology :** General anatomy & physiology of alimentary tract- esophagus, stomach, intestine. Histology & anatomy of pancreas, liver and kidney. Gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system. Skin & sensory organ.
3. **Animal physiology:** Digestion, absorption, energy balance, BMR. Blood physiology, excretion of waste, regulation of water balance blood volume, blood pressure, electrolyte balance, acid-base balance. Transport of gases, exchange of gases, thermoregulation, Comparison of respiration in different species. Endocrine gland : hormones-types & characteristics, neurohormone & hypothalamus, pituitary gland, thyroid gland, adrenal gland, gonads-testis & ovaries. Muscle physiology.
4. **Animal reproduction :** Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.
5. **Applied zoology:** Poultry, fishery & aqua culture, animal husbandry, animal products. Tissue culture , animal biotechnology and transgenic animal

PART – II: (B) BOTANY

- 1. Diversity of plant world:** Classification of plants, Bentham & Hooker classification system, general characteristics & members of thallophytes, bryophytes, pteridophytes, gymnosperms & angiosperms. Diversity of flowering plants
- 2. Plant morphology and anatomy:** General morphology of flowering plants – Root and shoot system, plant adaptation-storage, support, climbing, protection, photosynthesis, vegetative reproduction etc. General characteristics & types of plant tissue, plant tissue system, General anatomy of stem, root and leaf of monocot & dicot, secondary growth.
- 3. Plant physiology:** Uptake, transport and translocation of water, ions, solutes and macromolecules, transpiration-stomatal, epidermal, lenticular . Light harvesting complexes; mechanisms of electron transport; photo protective mechanisms; CO₂ fixation, C₃, C₄ and CAM pathways. Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photo respiratory pathway. Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action of plant hormone Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.
- 4. Plant reproduction :** Pollination, production of gametes, fertilization in plants; zygote formation, embryogenesis, establishment of symmetry in plants, seed formation and germination. Organization of shoot and root apical meristems; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development
- 5. Economic Botany :** Horticulture, forestry, agriculture, ethanobotany-medicinal plants and plant products. Tissue culture , plant biotechnology and transgenic plant

PART – II: (C) MICROBIOLOGY/BIOTECHNOLOGY

1. **Elementary microbiology** : Introduction to microbes, Microscopy, Electron microscopy, Dyes & stains, staining method, Bacterial cell structure & function: Cell wall, flagella, spore, cell wall free state, cell wall synthesis, Sporulation & germination, Nutrition requirement, Culture media & isolation method, preservation technique, Type culture, Microbial growth, generation time, growth curve. Continuous growth, growth measurement, Control of microbes-physical & chemical agent, filtration, radiation, sterilization, antiseptics, disinfections.
2. **Microbial World** : System of classification: Bergey's manual of systematic bacteriology, proteobacter & non proteobacter – gram negative & gram positive bacteria, archeobacteria, General characteristics outline classification of protists: algae and protozoa, their importance. The world of fungi: General characteristics outline classification and importance of yeast and moulds. General characteristics and classification of viruses, multiplication of viruses, virus purification, viroids & prions
3. **Medical Microbiology** :Host microbe's interaction: infection & its types, concept of disease, types of disease, pathogenesis & pathological condition. Immunity & immune response: innate & adaptive immunity, immune response – humoral & cellular response, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors immune prophylaxis. Antigen & immunoglobulin: antigen properties & types, immunoglobulin basic structure & types, antigen-antibody reaction & their practical applications, hypersensitivity & AID, Hybridoma technique, ELISA & RIA, IFT, Immunochromatographic technique. Microbial diseases: air borne, water borne, soil borne, direct contact diseases, venereal diseases, viral diseases, fungal infection, clinical microbiology, and antibacterial sensitivity testing.
4. **Applied Microbiology**: Sanitary microbiology: microbiology of water & waste water, sewage treatment, disposal of solid waste. Dairy & food microbiology: microbiology of milk, pasteurization, milk products, food spoilage, food intoxication. Industrial microbiology: fermenter design, fermentation process, strain improvement, scale-up technique, industrial production of acids, enzymes, etc. Environmental microbiology: bio-geo chemical cycle- C, N, S, P, etc. biofertilizers, bio pesticides, environmental pollution & bioremediation.

5. **Biotechnology:** Microbial genetics: gene expression – transcription, translation, mutation, gene transfer & recombination- conjugation, transformation & transduction
Recombinant DNA Technology: restriction enzymes, cloning vectors, gene library, basic procedure, insertion & screening method. Application of recombinant DNA technology: medical, agriculture, pharmaceutical, industrial, environmental etc.
Advanced technique: amplification of DNA (PCR) & its application, DNA hybridization- blot technique. Nucleic acid sequences, protein sequencing methods, genome sequencing

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Biotechnology Syllabus for Ph. D. Entrance Test (PET)

Part-I: DNA as genetic material in bacteria, plants and animal cells, Semi-conservative replication of DNA, Hybridization of Nucleic acids, Structure of DNA and RNA, DNA replication and transcription in prokaryotes and eukaryotes, Translation process, Restriction endonucleases, vectors used in rDNA technology, Introduction of genes in prokaryotes and eukaryotes.

Part-II: (a) Bioethics and its need, Stem cell research, Human genome project, Biosafety guidelines and regulations, Drug discovery and development,

(b) Bioremediation: Principles and factors responsible, *In situ* and *Ex situ* bioremediation strategies, Metal and organic phytoremediation; Waste management: Activated sludge, Oxidation ponds, Composting, Vermicomposting.

Part-III: Microscopy: TEM, SEM, Phase Contrast, Dark Field, Florescence, Inverted microscope; Centrifugation; Spectrophotometry; Electrophoretic techniques; Chromatography; PCR.

Part-IV: Large scale/industrial uses of enzymes, Recent advances and future prospects of enzyme technology; Fermentation of Wine, Beer, Vinegar, Penicillin, Citric acid, Ethanol, L-lysine, Human Recombinant Insulin; Animal cell culture and Plant cell culture, Aquaculture Biotechnology, Algal Biotechnology, Tissue culture and transgenic technologies, Plant secondary metabolites isolation and identification.