**SVKM's NMIMS University**

**Mukesh Patel School of Technology Management & Engineering, Mumbai**

**Department of Basic Science and Humanities**

**Syllabus for PhD Entrance Test**

**Biology – Green Technology**

**Effective from May, 2026**

## SECTION- A

Section A will include 25 compulsory objective-type questions, each carrying 2 marks. It will be focused on research aptitude. The section will be general in nature and aims to evaluate the candidate's research aptitude, with emphasis on reasoning ability, data interpretation, and quantitative skills.

## SECTION-B

Section B will comprise 25 compulsory objective-type questions, each carrying 2 marks, based on the following syllabus:

### UNIT I- Environmental Biology & Green Technology

Principles of ecology and environmental biology. Biogeochemical cycles: carbon, nitrogen, phosphorus, and sulfur. Climate change: greenhouse gases, carbon sequestration, and biological mitigation strategies. Ecosystem services and biodiversity conservation. Bioremediation and phytoremediation. Waste-to-energy concepts. Sustainable development goals (SDGs) in the context of biology.

### UNIT II- Microbiology & Microbial Ecology

Classification and diversity of microorganisms: bacteria, archaea, fungi, and algae. Microbial growth kinetics: batch, fed-batch, and continuous culture. Extremophiles and their biotechnological relevance. Microbial communities, biofilms, and quorum sensing. Soil and aquatic microbiology. Role of microorganisms in nutrient cycling and bioenergy production. Microbial ecology tools: metagenomics and 16S rRNA profiling.

### UNIT III- Enzymology & Biocatalysis

Enzyme structure, classification, and nomenclature. Enzyme kinetics: Michaelis-Menten model and catalytic efficiency. Enzyme inhibition: competitive, non-competitive, and uncompetitive. Allosteric regulation and multi-enzyme complexes. Immobilized enzymes: methods, supports, and industrial applications. Extremozymes and engineered enzymes for green chemistry. Biocatalysis in sustainable synthesis and biodegradation. Enzyme screening and directed evolution.

### UNIT IV- Fermentation Technology & Bioprocess Engineering

Types of fermentation: aerobic, anaerobic, solid-state, and submerged. Design and operation of bioreactors: stirred tank, airlift, and packed-bed. Upstream and downstream processing: media formulation, sterilization, centrifugation, filtration, and chromatography. Metabolic flux analysis

and process optimization. Scale-up principles. Production of biofuels (bioethanol, biobutanol, biogas), biopolymers, and biosurfactants.

**UNIT V- Nanobiotechnology & Biomaterials**

Fundamentals of nanotechnology: nanoparticles, nanomaterials, and surface chemistry. Green synthesis of nanoparticles using biological systems (plants, fungi, bacteria). Characterization techniques: TEM, SEM, DLS, XRD, and FTIR. Biopolymers and biodegradable materials: cellulose, chitosan, PHA, and PLA. Biosensors for environmental monitoring. Nanotoxicology and safety considerations. Applications in water purification and green catalysis.

**UNIT VI- Molecular Biology & Genomics for Sustainability**

Central dogma: DNA replication, transcription, and translation. Recombinant DNA technology: cloning, expression systems, and gene editing. Metabolic engineering for overproduction of value-added compounds. Synthetic biology: design principles and applications in bioenergy and bioremediation. Omics approaches: genomics, transcriptomics, proteomics, and metabolomics. Biosafety, bioethics, and regulatory frameworks for genetically engineered organisms.