



# GATE Syllabus

Part II – LIFE SCIENCE (XL)

Section–XL-R Botany



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# SECTION – XL-R: BOTANY

## Course Syllabus

### Unit 1: Plant Systematics

- Major systems of classification
- Plant groups
- Phylogenetic relationships
- Molecular systematics

### Unit 2: Plant Anatomy

- Plant cell structure and its components:
  - Cell wall and membranes
  - Organization
  - Organelles
  - Cytoskeleton
  - Anatomy of root
  - Stem and leaves
  - Floral parts
  - Embryo and young seedlings
  - Meristems
  - Vascular system
  - Their ontogeny
  - Structure and functions
  - Secondary growth in plants and stellar organization

### Unit 3: Morphogenesis & Development

- Cell cycle: cell division
- Life cycle of an angiosperm
  - Pollination
  - Fertilization
  - Embryogenesis
  - Seed formation
  - Seed storage proteins
  - Seed dormancy and germination
- Concept of cellular totipotency:
  - Clonal propagation
  - Organogenesis and somatic embryogenesis
  - Artificial seed

- Somaclonal variation
- Secondary metabolism in plant cell culture
- Embryo culture
- In vitro fertilization

#### **Unit 4: Physiology and Biochemistry**

- Plant water relations:
  - Transport of minerals and solutes
  - Stress physiology
  - Stomatal physiology
  - Signal transduction
  - N<sub>2</sub> metabolism
- Photosynthesis, photorespiration; respiration
- Flowering:
  - Photoperiodism and vernalization
  - Biochemical mechanisms involved in flowering
- Molecular mechanism of senescence and aging:
  - Biosynthesis
  - Mechanism of action and physiological effects of plant growth regulators
  - Structure and function of biomolecules, (proteins, carbohydrates, lipids, nucleic acid)
  - Enzyme kinetics

#### **Unit 5: Genetics**

- Principles of Mendelian inheritance:
  - Linkage
  - Recombination
  - Genetic mapping
- Extrachromosomal inheritance:
  - Prokaryotic and eukaryotic genome organization
  - Regulation of gene expression
  - Gene mutation and repair
  - Chromosomal aberrations (numerical and structural)
  - Transposons

#### **Unit 6: Plant Breeding and Genetic Modification**

- Principles, methods – selection, hybridization, heterosis, male sterility, genetic maps and molecular markers
- Sporophytic and gametophytic self-incompatibility

- Haploidy
- Triploidy
- Somatic cell hybridization
- Marker-assisted selection
- Gene transfer methods viz.
  - Direct and vector-mediated
  - Plastid transformation
  - Transgenic plants and their application in agriculture, molecular pharming, plantibodies

### **Unit 7: Economic Botany**

- A general account of economically and medicinally important plants:
  - Cereals
  - Pulses
  - Plants yielding fibers
  - Timber
  - Sugar
  - Beverages
  - Oils
  - Rubber
  - Pigments
  - Dyes
  - Gums
  - Drugs
  - Narcotics
- Economic importance of:
  - Algae
  - Fungi
  - Lichen
  - Bacteria

### **Unit 8: Plant Pathology**

- Nature and classification of plant diseases:
  - Diseases of important crops caused by fungi, bacteria, nematodes and viruses, and their control measures, mechanism(s) of pathogenesis and resistance, molecular detection of pathogens
- Plant-microbe beneficial interactions

## Unit 9: Ecology and Environment

- Ecosystems:
  - Types
  - Dynamics
  - Degradation
  - Ecological succession
- Food chains and energy flow
- Vegetation types of the world
- Pollution and global warming
- Speciation and extinction
- Conservation strategies
- Cryopreservation
- Phytoremediation