Department of Botany
Savitribai Phule Pune University

Format of Question Paper for OEE in Botany - 2024

Section	No. of MCQs	Marks	Total Marks	Duration
Section A	20	20	100	120 minutes
Section B	80	80		

Syllabus for Online Entrance Examination (OEE) in Botany

Section A: This section will consist of 20 MCQs based on the General Aptitude, divided into numerical ability, graphical analysis, quantitative comparison, data interpretation, reasoning, puzzles, general science etc.

Section B: This section will consist of 80 MCQs based on the syllabus of Botany as provided below. The units in the syllabus and marks allocated are provided below

Section B: Syllabus Units (For 80 MCQs)
Unit 1: Algae and Fungi
Unit 2: Archegoniate
Unit 3: Spermatophyta and Paleobotany
Unit 4: Plant Ecology
Unit 5: Cell and Molecular Biology
Unit 6: Genetics
Unit 7: Medicinal Botany
Unit 8: Plant Diversity and Human Health
Unit 9: Plant Physiology
Unit 10: Biochemistry
Unit 11: Plant Pathology
Unit 12: Evolution and Population genetics
Unit 13: Advanced Plant Biotechnology
Unit 14: Plant Breeding and Seed Technology
Unit 15: Nursery/Gardening Management
Unit 16: Biofertilizers

Detailed Syllabus (Based on B.Sc. Botany)

Sr. No.	Algae and Fungi
	Credit-I Algae
1.	Introduction: Cryptogams- meaning. Types- Lower Cryptogams, brief Review with examples
2.	Algae: General characters, distribution, Thallus organization, habit and Habitat reproduction and Classification (G.M.Smith 1955) up to classes.
3.	Study of life cycle of algae with reference to taxonomic position, Occurrence, Thallus structure, and reproduction of *Nostoc*, *Oedogonium Chara*, *Sargassum* and *Batrachospermum*.
4	Economic importance of algae- Role in industry, agriculture, fodder and medicine.
	Credit-II Fungi
5	Fungi: General characters, Habit and habitats, thallus organization, cell wall composition, nutrition and Classification. (Alexopoulos and Mims 1979) up to classes.
6.	Study of life cycle of fungi with reference to taxonomic position, thallus structure, and reproduction of *Mucor (Zygomycotina), Saccharomyces (Ascomycotina), Puccinia (Basidiomycotina), Penecillium and Cercospore (Deuteromycotina) [Two members of Deutero.]*
7.	Symbiotic Associations - Lichens, Mycorrhiza and their significance

Sr. No.	Archegoniate
	Credit-I Bryophytes
1.	Introduction to Archegoniate
2.	Introduction, general characters, distribution of Bryophytes to land habit, classification of Bryophytes according to G.M. Smith (1955) up to classes with reasons
3.	Range of thallus organisation, origin of Bryophytes - Pteridophytes and Algal hypothesis, evolution of sporophyte
4	Study of Life Cycle of Bryophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Gametophytes and sporophytes of *Marchantia, Anthoceros and Funaria*
5	Ecological and economic importance of Bryophyte
	Credit-II Pteridophytes
6	Introduction, Vascular Cryptogams, General characteristics, Classification according to K.R. Sporne (1975) up to classes with reasons, Diversity and Distribution of Pteridophytes.
7.	Resemblances of Pteridophytes with Bryophytes, Differences between Pteridophytes and Bryophytes, Origin of Pteridophytes -Algal and Bryophytes, Evolution of Pteridophytes- Telome Theory and Enation Theory.
8.	Study of Life Cycle of Pteridophytes with respect to Taxonomic position, Morphology, Anatomy, Reproduction, Sporophytes and Gametophytes of *Psilotum, Selaginella* and *Equisetum*
09	Ecological and Economical Importance of Pteridophytes

Sr. No.	Spermatophyta and Paleobotany
	Credit-I ANGIOSPERMS
1.	**Origin of angiosperms:** with reference to time, place and ancestry- 1) Pseudanthial theory 2) Transitional-Combinational Theory

2.	**Speciation & Endemism** Species concept (Biological, Taxonomic & Phylogenetic Species Concept), Speciation (Allopatric, Sympatric & Parapatric), Endemism and its types (Palaeoendemism, Holoendemism and Neoendemism)
3.	**Classification:** Outline, Merit and Demerits of Cronquist's System and APG IV system of classification. Study of following families with reference to systematic position (As per Bentham & Hooker), Diagnostic characters, floral formula, floral diagram and any five examples with their economic importance – Nymphaeaceae, Oleaceae, Amaranthaceae, Cannaceae
4	**Herbaria and Botanical Gardens** Functions of Herbarium, Important herbaria (World: Kew herbarium; India: Central National Herbarium, Kolkata). Botanic gardens of the world (Royal Botanic Garden, Kew) and India
	Credit-II GYMNOSPERMS and PALEOBOTANY
5	Introduction, general characters, economic importance and classification according to Chamberlain (1934).
6	Study of life cycle of Pinus and Gnetum with reference to distribution, morphology, anatomy, reproduction, gametophyte, sporophyte, seed structure and alternation of generations.
7	Fossil- Definition, process of fossil formation, types of fossils -Impression, Compression, Petrifaction, Pith cast and Coal ball.

Sr. No.	**Plant Ecology**
	Credit-I
1.	Introduction, interrelationship between the living world and the environment, levels of organization, components and dynamism of ecosystem, homeostasis, niche concept, concept of limiting factors
2.	**Biogeography:** Floristic realms, speciation and its types, biogeographic regions of India, Plant indicators
3.	**Population ecology:**Definition, characteristics, population growth form, r and k selection
4.	**Community ecology:** Introduction and Definition, community structure, physiognomy, Raunkiaer's life form classification, keystone species, edge and ecotone
5.	**Biogeochemical cycles:** The carbon cycle, Nitrogen cycle, Phosphorus cycle, and Hydrologic cycle

	Credit-II
6.	**Ecological Impact Assessment (EIA)** Introduction, Historical Review of EIA, Objectives of EIA, Stages of EIA process: Screening; Scoping; Baseline study; Impact prediction and assessment; Mitigation; Producing Environmental Impact Statement (EIS); EIS review; Decision making; Monitoring, Compliance and Enforcement; Benefits of EIA.
7.	**Environmental Audit** Meaning and concept, need, objectives, benefits, types, audit protocol, process, certification, personnel environmental audit
8.	**Remote Sensing** Definition, basic principles, process of ecological data acquisition and interpretation, global positioning system,application of remote sensing in ecology.
9.	**Ecological management:** Concepts, sustainable development, sustainability indicators

Sr. No.	Cell and Molecular Biology
	Credit-I Cell Biology
1.	**Introduction to Cell Biology:** Definition, Brief history of Cell Biology, Units of measurement for cell, Interdisciplinary nature of Cell Biology
2	**Cell organelles**: Ultrastructure, components and functions of Cell wall and cell membranes, mitochondria and Chloroplast, endoplasmic Reticulum, Golgi apparatus, Lysosomes, Vacuoles, Peroxisomes & Glyoxysomes
3.	**Nucleus:** Morphology and ultrastructure of nucleus, nucleolus and nucleolar organizer Nuclear envelope – structure of nuclear pore complex, transport of molecules across nuclear envelope.
4.	Chromosomes: Euchromatin and heterochromatin Histones, Packing of DNA into chromosomes in eukaryotes, Karyotype and ideogram, Polytene chromosomes and lampbrush chromosomes.
5	**Cell signaling:** Introduction and definition, Signaling molecules and receptors, Calcium signaling pathway in plants
	Credit-II Molecular Biology
5	**Genetic material** DNA: historical perspective from 1953 to 2020, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment.

6.	**DNA replication (Prokaryotes and Eukaryotes):** Molecular mechanism of DNA replication. Enzymes involved in both prokaryotic and eukaryotic DNA replication and their inhibitors (antibiotics).
7.	**Gene expression:Transcription (Prokaryotes in details and passing remarks on Eukaryotes)** Types of RNA: mRNA, tRNA, rRNA; types of promoters; types of RNA polymerase enzymes in eukaryotes; molecular mechanism of transcription.
8	**Translation (Prokaryotes and Eukaryotes):** Definition, concept and properties of genetic code; molecular mechanism of translation.
9	**Regulation of gene expression:** Concept of operon, *lac* operon and *trp* operon, positive and negative control, one gene one enzyme hypothesis.

Sr. No.	**Genetics**
	Credit-I
1.	**Introduction to Genetics:** History, Definition, Concept, branches and applications of Genetics.
2	**Mendelism:** Genetical terminology, Monohybrid cross, Law of dominance, Incomplete dominance, Law of segregation, Dihybrid cross, Dihybrid ratio, Law of independent assortment, Back cross and Test cross.
3.	**Neo Mendelism (Gene Interaction):** Genetic interaction, Epistatic interactions – supplementary gene (recessive epistasis 9:3:4), Inhibitory genes (13:3), Masking genes (12:3:1), Non- Epistatic inter-allelic genetic interactions-Complementary genes (9:7), Duplicate genes (15:1)
4.	**Multiple alleles:** Definition, Concept, Characters of multiple alleles, Examples of multiple alleles – Blood group in human and self-incompatibility in Nicotiana.
5	**Linkage, Recombination and Crossing Over:** Linkage- Definition and Types, Crossing over: Definition and Types, Construction of a linkage map by two point test cross and three point test cross, Recombination: Concept, definition and types
6	**Mutation:** Concept, definition and types
	Credit-II
5	**Numerical alterations of chromosomes.:** Euploidy, Aneuploidy-Concept and Types, Aneuploidy in Plants and Human, Polyploidy in Plants & Animals, Induced Polyploidy, applications of Polyploidy
6.	**Structural alterations of chromosomes.:**Types, cytology and genetic effects of Deletion, Duplication Inversion and Translocation with examples.
7.	**Cytoplasmic & Quantitative Inheritance:** Concept of quantitative inheritance, Inheritance of quantitative trait in Maize (Cob length), Cytoplasmic inheritance Definition and concept, Chloroplast- Varigation in Four O'clock plants, Mitochondria-Petite mutants in yeast.
8	**Sex Linked Inheritance:** Concept of Sex chromosomes and autosomes, Inheritance of X- linked genes –Inheritance of colour blindness in humans, Inheritance of Y-linked (Holandric genes) in humans, Sex influenced genes, Sex-limited genes.

Sr. No.	Medicinal Botany
	Credit-I
1.	**Medicinal Plants**: History, Scope and Importance
2	**Indigenous Medicinal Sciences**; Definition and Scope
3.	**Ayurveda**: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments
4.	**Siddha**: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.
5	**Unani**: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.
6	**Conservation of endangered and endemic medicinal plants:** Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens.
	Credit-II
5	**Propagation of Medicinal Plants:** Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.
6.	**Ethnobotany and Folk medicines**: Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany.
7.	**Folk medicines** of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

Sr. No.	Plant Diversity and Human Health
	Credit-I
1.	**Plant diversity** and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level,
2	**Agrobiodiversity** and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

3.	**Loss of Biodiversity**: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss
4.	Management of Plant Biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations.
	Credit-II
5	**Conservation of Biodiversity:** Conservation of genetic diversity, species diversity and ecosystem diversity, In situ and ex situ conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.
6.	Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

Sr. No.	**Plant Physiology and Metabolism**
	Credit-I
1.	**Mineral nutrition**: Classification of mineral elements, macro and micronutrients; Role of essential elements; Transport of ions across cell membrane, Ionophores , Carriers and Channels
3.	**Photosynthesis**: Mechanism of photosynthesis- Electromagnetic spectrum Ultra-Structure of Chloroplast, Organization of Light-Absorbing Antenna Systems, Light Reaction: (Cyclic and Non-cyclic photophosphorylation), Dark Reaction: Calvin–Benson Cycle, Photorespiration, C4 cycle and CAM pathway of carbon fixation).
4.	**Respiration:** Types of respiration (Aerobic and anaerobic), Mechanism of aerobic respiration (Glycolysis, TCA cycle, Terminal oxidation and phosphorylation in respiratory chain); Pentose Phosphate Pathway.
	Credit-II
5	**Stomatal Biology:** Light-dependent Stomatal Opening, Mediation of Blue- light Photoreception in Guard Cells by Zeaxanthin, Reversal of Blue Light– Stimulated Opening by Green Light, The Resolving Power of Photophysiology (Overview).
6.	**Translocation in phloem**: Composition of phloem sap, girdling experiment; Pressure flow model.
7.	**Plant growth regulators**: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.
8	**Photomorphogenesis**: Red and far-red light responses on photomorphogenesis; Phytochrome (discovery and mode of action).

Sr. No.	Biochemistry
	Credit-I
1.	**Foundation of Biochemistry:** From molecules to the first cell (origin of a cell), Miller and Urey experiment. Biomolecules of a cell, functional groups in biomolecules, conformations and configurations of biomolecules.
2	**Water: The solvent of life:** Physical properties of water, structure of water molecule, polarity of water molecule, weak interactions in aqueous solutions.
3.	**Amino acids and proteins:** Structure, classification, properties and functions of amino acids. Structure (primary, secondary, tertiary and quaternary), properties and functions of proteins. Biological disorders of amino acid metabolism. Commercial applications.
4.	**Enzymes:** Definition, nature of enzymes and co-factors, classification and properties of enzymes, active site. Mechanism of enzyme action: free energy, activation energy, binding energy, transition state, lock and key hypothesis, induced fit theory. Factors affecting enzyme activity: pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibition: Competitive, uncompetitive, non-competitive.Reversible and irreversible inhibition, feedback inhibition.
	Credit-II
5	Carbohydrates: Definition, classification of carbohydrates- Monosaccharides: aldoses and ketoses, configurations, linear to ring structure; Oligosaccharides: glycosidic bond, reducing and non-reducing sugars; Polysaccharides: homopolysaccharides, heteropolysaccharides, examples, their structures, locations and role. Properties and functions of carbohydrates. Commercial applications.
6.	**Lipids:** Definition, classification of lipids: simple, conjugate and derived lipids, properties and functions of lipids. Biological disorders of lipid metabolism. Commercial applications.
7.	**Vitamins:** Definition, classification of vitamins. source and functions of vitamins.

Sr. No.	Plant Pathology
	Credit-I

	Fundamentals of Plant Pathology: Introduction, Important terminology- Incitants, Host, Symptoms, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease. Economic importance of plant diseases, History of plant pathology, Introduction to Indian Agriculture Research Institute (IARI),International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Contribution of Anton De Bary and Prof. B.B. Mundkur.
2	Disease Development: Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics-Forms, Decline, Exponential model.
3.	**Defense Mechanisms**: Concept and Definition, Types-Preexisting- Structural and chemical, Induced- Structural and Biochemical.
4.	**Methods of Studying Plant Diseases.** Macroscopic study, Microscopic study, Koch"s postulates. Types of culture Media, Pure culture methods- Streak plate, Pour plate, Spread plate.
5	**Fungal Plant Diseases** Introduction to fungi as plant pathogens. Study of Diseases- Downy mildew of Grapes, Head smut of Jowar, Tikka diseases of Groundnut with reference to causal organism, symptoms and disease management.
6	**Bacterial Plant Diseases** Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker, Black arm of Cotton with reference to causal organism, symptoms and disease management.
	Credit-II
5	**Mycoplasma Plant Diseases:** Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassy shoot disease of sugarcane, Little leaf of brinjal with reference to causal organism,symptoms and disease management.
6.	**Nematodal Plant Diseases:** Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot diseases of vegetables, Soybean cyst Nematodes with reference to causal organisms, symptoms, Integrated management of Nematodal diseases.
7.	**Viral Plant Diseases**: Introduction of Virus as plant pathogens. Study of Diseases- Papaya Mosaic Disease, Bunchy top of Banana with reference to causal organism, symptoms and causal organism
8	**Non-Parasitic Diseases.** The impact and abiotic causes- Temperature, Soil moisture and relative humidity, Poor oxygen, Poor light, Air pollutants, mineral deficiencies. Herbicidal injury, Study of Mango necrosis, Black Heart of Potato.
9	**Principles of plant diseases control:** General account, Quarantine, Eradication, cultural control practices, Biological control. Curative measures, chemical control, Use of Effective Microorganism solution (EMS), Microbial Pesticides.

Sr. No.	Evolution and Population Genetics
	Credit-I
1	**Organic Evolution**: Distinction between Origin of life and Organic Evolution, Historical account of Origin of life, Origin of Earth Vs Origin of life: Gaia Hypothesis, Earliest Fossils, Prebiotic Evolution, Abiotic synthesis of organic matter, Primordial soup, origin of membranes, Oparin's Coacervate model, Theory of Panspermia, Early life and RNA and Origin of genetic code
2	**Organic Evolution:** The concept of organic evolution, Theories of Evolution, Pre-Darwinian period, Theory of Inheritance of acquired characters (Lamark's), Darwinism- Theory of Natural Selection, Post- Darwinian period- Modern synthetic theory
2	**Evidences of Evolution:** Direct evidences and conclusions from fossil records, Indirect evidences, Evidences from Genetics, Evidences from bio-geographical relations
	Credit-II
4	Fossilization, Conditions of fossilization, Dating of fossils: Uranium Lead method, Radio-carbon method, U-series and ESR method, Geological Time scale: Eras, Periods, epochs, and duration in millions of years and plant life.

5.	**Population Genetics and Evolution**: Concept of Mendelian population, Gene Pool and its models, Hardy-Weinberg law of gene frequencies, Factors affecting allelic frequency, Genetic polymorphism
5.	**Speciation and Isolating Mechanisms:** Introduction, Morphological Criteria for Species and Races, Allopatric and Sympatric Populations, Isolating Mechanisms: Pre zygotic Isolation mechanisms: Concept, Spatial & Ecological;, Seasonal Isolation, Ethological Isolation, Mechanical Isolation, Post zygotic Isolation mechanisms: Concept, Hybrid in viability, Hybrid sterility & Hybrid breakdown.

Sr. No.	Advanced Plant Biotechnology
	Credit-I
1	**Biotechnology:** Introduction, Traditional and modern Biotechnology. Impact of Biotechnology on Health care, Agriculture, and Environment
2	**Plant Tissue Culture:** Concepts of Cell theory & Cellular totipotency, Landmarks in plant tissue culture. Pluripotency, Differentiation, dedifferentiation, redifferentiation, Hormones used in PTC, 'Explant' for plant tissue culture and Response of explants in vitro– callus formation, organogenesis (direct and indirect) and embryogenesis (direct and indirect)**.** Micro propagation of Banana (in detail from Selection of explant to hardening and marketing)

3.	**Techniques of Genetic Engineering and Methods of gene transfer in Plants-** Introduction to Molecular tools: Definition and role of Nucleases, Polymerases, Ligases, Polynucleotide kinases, Alkaline Phosphatases. Types of vectors- Definition and characters (2-4) of Plasmids, Phages, Cosmids, BAC, YAC, Plant viruses, Animal viruses. Methods of gene transfer in Plants –Direct gene transfer – Definition and concept of Electroporation, Microinjection, and Gene gun, Indirect gene transfer- Agrobacterium mediated gene transfer method, Ti- plasmid: structure and functions, T-DNA, Gene amplification technique -Polymerase chain reaction DNA finger printing
	Credit-II
4	**Cryopreservation and Germplasm Conservation** Definition and concept, techniques of cryopreservation, cold storage, long term and short term storage, applications, Preservation of Cell, tissue, organ, whole organism. Concept of Gene Bank, DNA Bank, Seed Bank, Pollen Bank etc.
5.	**Biotechnology and Society:** Biotechnology- Benefits, GM foods and its safety, Recombinant foods and religious beliefs, Recombinant therapeutic product for human health care. Patenting of biotechnological inventions and Intellectual property rights.
6.	**Microbial Biotechnology:** Biochemistry of fermentation, Microorganism used in fermentation, fermentable substrate, Ethanol fermentation methods, Distilleries producing alcohols. Commercial production: Alcoholic beverages, organic acids, citric acids. Advantages of fermentation. **Transgenic Plants as Bioreactors:** Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics, Genetically engineered plants as protein factories, Production of therapeutic proteins from plants.
7	**Nano-biotechnology:** Definition and concept, Applications of nanotechnology in agriculture (fertilizers and pesticides).

Sr. No.	**Plant Breeding and Seed Technology**
	Credit-I –Plant Breeding
1	**Introduction:** Definition, Scope and objectives and History of Plant breeding in India

2	**Techniques and practices of plant breeding** **A. Plant Introduction** • Definition • Types (Primary and Secondary) • Procedure • Merits and Demerits • Important Achievements
	B. Selection methods • Concept, • Types of selections –mass selection, pure line selection and clonal selection. • Advantage and disadvantages of selection • Achievements of selection breeding
	C. Hybridization • Definition, Concept and Objectives • Precaution to be taken during hybridization • Types: Intervarietal and Distant • General procedure of hybridization • Methods of hybridization: Pdigree and bulk • Hybrid vigour and heterosis
3	**Advanced techniques in Plant breeding** **A. Mutation breeding**
	• Definition and concept • Mutagens (Physical and Chemical) • Mutants • Types of mutation (Spontaneous and Induced) • Application of mutation breeding • Limitations of mutation breeding
	B. Tissue Culture • Definition and concept • Totipotency • Application of tissue, embryo and anther culture in seed production
	Credit-II - SEED TECHNOLOGY
4	**Introduction to Seed Technology** • Seed as a basic input in agriculture • Classes of seed 1. Nucleus 2. Breeder 3. Foundation 4. Certified Role of seed technology
5.	**Seed legislation** • Introduction • Seed legislation in India (Seed Act)

6	**Seed Production**
	• Introduction
	• National Seed Corporation (NSC) and its objectives
	• State Seed Corporation (SSC) and its objectives
	• General procedure for Seed Production
	  ○ Location and Season
	  ○ Land requirement
	  ○ Importance of soil and water testing
	  ○ Cultural practices
	  ○ Isolation distance
	  ○ Plant protection
	  ○ Weed Control
	  ○ Rouging
	  ○ Harvesting
	  ○ Threshing
	  ○ Seed Processing

7	**Seed Certification** • Definition, Objectives and Concept • Phases of Seed Certification • General procedure of seed certification • Field inspection • Duties of seed inspector
8	**Seed Testing**
	A. **Physical Purity Analysis** • Definition of purity components • Physical Purity Work Board • Procedure B. **Moisture Testing** • Concept • Air oven method • Digital Moisture Meter C. **Germination testing** • Definition and objectives • Procedure and methods for germination testing (Paper, Sand and Soil) • Seedling evaluation (Normal Seedlings, Abnormal Seedlings, Multigerm Seed Units and Non-germinated Seeds)

9	**Seed Pathology and Entomology**
	• Definition
	• Seed Borne pathogens
	  ○ Fungi
	  ○ Bacteria
	  ○ Viruses
	• Influence of seed borne pathogens on seed production
	• Common insect pest and its impact on seed production

10	**Seed Storage**
	• Definition and Concept
	• Seed treatment
	• Management of seed storage structures
	  o Sanitization
	  o Dehumidification
	  o Fumigation

Sr. No.	**Nursery and Gardening Management**
	Credit-I Nursery Management
1	**Nursery:** definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.
2	**Seed:** Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion –Seed production technology - seed testing and certification.
3.	**Vegetative propagation**: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants– greenhouse - mist chamber, shed root, shade house and glass house.
	Credit-II Gardening Management
4	Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design -computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.
5.	Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Sr. No.	**Biofertilizers**
	Credit-I
1	**Introduction**: 1.1 Introduction, Scope and importance of Biofertilizers 1.2 General account of the microbes used as Biofertilizers
2	**Bacterial Biofertilizers** 2.1. Isolation of Rhizobium, Identification, Mass multiplication, Carrier based inoculants. 2.2. Azospirillum isolation and mass multiplication, carrier based

	inoculants and associative effect of different organisms 2.3. Azotobacter, classification and characteristics 2.4. Crop response to Azotobacter inoculums, Mass multiplication of Azotobacter 2.5. Applications of Azospirillum 2.6. Phosphate solubilizing Bacteria
3.	**Algal Biofertilizers** 3:1. Cyanobacteria (Blue Green Algae): Isolation of Anabaena from Azolla, Mass Multiplication of Anabaena 3.2. Azolla - Anabaena relationship 3.3. Biological Nitrogen fixation 3.4. Blue Green algae in a rice cultivation. 3.5. Applications of BGA
	Credit-II
4	**Fungal Biofertilizers** 4.1. Introduction, Occurrence and Distribution of Mycorrhizal association. 4:2. Types of Mycorrhizal association, growth and yield - colonization of VAM - Vesicular Arbuscular Mycorrhiza 4.3. Mycorrhizal applications in agriculture
5.	**Compost and Manure** 5.1. Organic Farming, green manuring, organic manures and their uses 5.2. Recycling by composting method of biodegradable, municipal, agricultural and industrial wastes 5.3. Biocompost making methods, Types and methods of vermicomposting 5.4. Benefits of vermicompost, field applications