

## Syllabus for the written examination

### **(a) Compulsory subjects**

1. **General English**

This paper will be of 10+2 standard and shall consist of a short essay, comprehension, précis writing, usage and vocabulary.

2. **Essay in English**

One essay to be written on a topic out of given topics in the paper. The essay will be of 10+2 standard.

3. **General Knowledge**

This paper will contain questions on Elementary Science, Geography and Current events etc.

### **Optional Papers/Subjects**

The candidate may choose only one paper from amongst the three optional papers/subjects. The scope of the syllabus will be broadly of bachelor's degree level.

### **(b) SYLLABUS OF OPTIONAL PAPERS/SUBJECTS**

#### **(i) BOTANY**

1. **Microbes and Microbiology.**

1.1 General account of viruses, Mycoplasma and Cynaobacteria.

1.2 Bacteria-Structure, Nutrition and reproduction (A general account with broad classification).

1.3 Economic importance of Bacteria; Bacteria as indicators of pollution; bacteria in industry and agriculture.

1.4 Microbiology of air, water, soil and food materials.

2. **Algae.**

2.1 General characteristics and classification of algae (Fritsch 1935,1945)

2.2 Important features of Chlorophyceae and Xanthophyceae, life histories of Chlamydomonas, Volvox, Oedogonium, Coleochaete, Chara, and Vaucheria.

2.3 Important features of Phaeophyceae and Rhodophyceae, Life histories of Ectocarpus, Sargassum and Polysiphonia.

2.4 Economic importance of algae-algae as food, feed and source of fibre; algae as indicators of pollution; algae blooms; algae toxins; algae in industry.

### **3. Fungi**

- 3.1 General characteristics and classification of fungi (Ainsworth (1971), Economic importance of fungi, General account of Lichens.
- 3.2 Important features of Mastigomycotina; Life histories of Pythium and Allomyces.
- 3.3 Important characteristics of Zygomycotina and Ascomycotina; Life history of Mucor, Saccharomyces, Eurotium and Peziza.
- 3.4 Important characteristics of Basidiomycotina and Deuteromycotina; life histories of Puccinia, Agaricus, Collectotrichum and Cercospora.

### **4. Bryophytes**

- 4.1 General characteristics, classification (Smith, 1955) and Alternation of Generations in Bryophytes.
- 4.2 Structure and reproduction in hepaticae with reference to Marchantia.
- 4.3 Structure and reproduction in Anthocerotales and Musci with reference to Anthoceros and Funaria.
- 4.4 Importance of bryophytes in preventing soil erosion; management of forest floors; monitoring and controlling pollution; geobotanical prospecting; in horticulture and as source of antibiotics.

### **5. Pteridophytes.**

- 5.1 General Characteristics, classification (Sporne 1975) and origin of pteridophytes (the first vascular plants); stelar system and alternation of generations in pteridophytes.
- 5.2 Important characteristics of Psilopsida and Lycopsida; structure and reproduction in Psilotum, Rhynia, Lycopodium and Selaginella.
- 5.3 Important characteristics of sphenopsida, structure and reproduction in Equisetum.
- 5.4 Important characteristics of pteropsida, structure and reproduction in pteris and Marsilea.

### **6. Cell Structure.**

- 6.1 Cell wall; Primary cell wall, its structure, formation and function.
- 6.2 Plasma membrane; The bilayer lipid structure fluid mosaic model, its functions.
- 6.3 Cell organelles: structure and functions of E.R., Golgi bodies, Plastids and mitochondria.
- 6.4 Ultra-structure of nuclear membrane. Nucleolus: Organization and function.

### **7. Chromosome structure and multiplication.**

- 7.1 chromosome structure : physical and chemical structure and importance of centromere and telomere; sex chromosomes.
- 7.2 Organization of DNA in prokaryotica and eukaryotic genomes. Role of proteins; nucleosome model.
- 7.3 Equational division, factors triggering mitosis, various stages of mitosis.
- 7.4 Reductional division, detailed structure of pairing and crossing over.

### **8. Genome organization and function/Gene protein.**

- 8.1 Basic unit: DNA, structure and replication; satellite and repetitive DNA.
- 8.2 Gene function: Genetic Code, transcriptions; Regulation of gene expression in prokaryotes and eukaryotes.
- 8.3 Protein synthesis: Ribosomes and tRNA, structure and function, 1D, 2-D, and 3 D structure of proteins.
- 8.4 Extranuclear genome: structure and functions of mitochondrial and Plastid DNA, Plasmids.

### **9. Alternations on the genome.**

- 9.1 Structural alterations; types, effect and detections of intra chromosomal alterations- deletions, duplications and inversions.

- 9.2 Mechanism, effect and detection of interchromosomal alterations.
- 9.3 Euploidy-type, origin and effect with suitable examples.
- 9.4 Aneuploidy -types, origin and effect with suitable examples.

**10. Alterations in the basic unit of inheritance and inheritance patterns.**

- 10.1 Gene/Point mutations-spontaneous and induced; mechanism of induction; uses.
- 10.2 Shift of Genes through mobile elements-transposons, mechanism and salient features, DNA damages, causes and repair mechanisms.
- 10.3 Mendelism, laws of segregation and independent assortment, allelic and non-allelic interactions.
- 10.4 Linkage and recombination; linkage in mapping of genes.

**11. Seed Plants-origin evolution and characteristics.**

- 11.1 Characteristics of seed plants; evolution of seed habit seed plants with and without fruit.
- 11.2 Geological time scale; fossilization-process and types; age of fossils and their importance.
- 11.3 General characteristics of gymnosperms; classification of gymnosperms by Coulter and Chamberlain.
- 11.4 Evolution and diversity of gymnosperms.

**12. Morphology and Reproduction in Gymnosperms**

- 12.1 Morphology, anatomy, reproduction and life cycle in Cycas.
- 12.2 Morphology, anatomy, reproduction and life cycle in Cedrus.
- 12.3 Morphology, anatomy, reproduction and life cycle in Ephedra.
- 12.4 Fossil gymnosperms : Bennettiales- History and

**13. Angiosperm origin and nomenclature.**

- 13.1 Origin and evolution of angiosperms, characteristics and examples of some primitive angiosperms (Magnolia). Fossil angiosperms- a general account with reference to angiosperm floras.
- 13.2 History of angiosperm taxonomy; Aims and Fundamental components of taxonomy;- Taxonomy, omega taxonomy and holotaxonomy.
- 13.3 Taxonomic identification; taxonomic keys and literature (Floras, Monographs and reviews).
- 13.4 Botanical nomenclature-principles and rules; taxonomic ranks; type concept and principle of priority.

**14. Classification and tools in angiosperm taxonomy**

- 14.1 Salient features of the classification of Bentham and Hooker, merits and demerits.
- 14.2 Salient features of the classification of Engler and Prantl; merits and demerits.
- 14.3 Contribution of cytology to taxonomy.
- 14.4 Contribution of phytochemistry and taxometrics to taxonomy.

**15. Diversity of angiosperms.**

- 15.1 Morphological diversity of families Ranunculaceae, Brassicaceae, Malvaceae and Rutaceae.
- 15.2 Morphological diversity of families Fabaceae, Rosaceae, Apiaceae and Acanthaceae.
- 15.3 Morphological diversity of families Apocyanaceae, Solanaceae, Lamiaceae and Euphorbiaceae.
- 15.4 Morphological diversity of Families Liliaceae, Amaryllidaceae and Poaceae.

**16. Structure, Development and Reproduction in seed bearing plants.**

- 16.1 Basic body plan of a flowering plants; Modular type of growth.

- 16.2 Diversity in plant form in annuals, biennials and perennials.
- 16.3 Convergence of evolution of tree habit in gymnosperms monocotyledons and dicotyledons.
- 16.4 The largest and oldest trees of the world; canopy architecture.

**17. Root and Shoot.**

- 17.1 Apical meristem of root, its position, structure and derivatives.
- 17.2 Structural modifications of root for storage, respiration, reproduction and for interaction with microbes.
- 17.3 Apical meristem, its organization and role.
- 17.4 Vascularisation of primary shoot in monocotyledons and dicotyledons; formation of internodes; branching pattern; monopodial and sympodial growth.

**18. Secondary and Basic structure.**

- 18.1 Vascular cambium and its derivatives; wood structure in relation to translocation of water and minerals.
- 18.2 Growth rings; heart wood, sapwood, role of woody skeleton; structure and functions of secondary phloem; periderm.
- 18.3 Leaf, Initiation; development, arrangement and diversity in size and shape; senescence and abscission.
- 18.4 Internal structure of leaf in relation to photosynthesis and water loss; adaptation to water stress.

**19. Flower**

- 19.1 Flower: A modified shoot; structure, development, variety and functions of flower.
- 19.2 Structure of anther and Pistil; Male gametophyte and female gametophyte.
- 19.3 Pollination: Type, attractants and rewards for pollination; Pollen-Pistil interaction, self incompatibility.
- 19.4 Double fertilization : Endosperm-typescytology and function; formation of fruit.

**20. Units and mechanisms of multiplication.**

- 20.1 Seed formation and its significance.
- 20.2 Seed dormancy; Genetic recombination and replenishment through seed.
- 20.3 Seed dispersal strategies.
- 20.4 Vegetative propagation-grafting, layering, budding and economic aspects.

**21. Physiology, Biochemistry and biotechnology.**

- 21.1 Discovery and nomenclature of enzymes, characteristics of enzymes, concept of holoenzymes, apoenzyme, co-enzyme and co-factors.
- 21.2 Regulation of enzyme activity, mechanism of enzyme action.
- 21.3 Importance of water to plant life; physical properties of water .
- 21.4 Diffusion of water, Osmosis, absorption, transport of water through xylem & transpiration; physiology of opening and closing of stomata.
- 21.5 Macro and Micro elements, importance of mineral nutrients to the plant and their role, mineral uptake, deficiency and toxicity symptoms.
- 21.2 Mechanism of transport of organic substance in phloem, source sink relationship, factors affecting translocation.
- 21.7 Significances and historical aspects of photosynthesis, photosynthetic pigments, action spectra and enhancement, effect.

- 21.8 Concept of two photo systems in photosynthesis, Z- scheme, photophosphorylation, calvin cycle: C4 pathway, CAM plants, photorespiration.
- 21.9 ATP- the biological energy, currency, aerobic and anaerobic respiration, krebs cycle, electron transport mechanism (Chemi-osmotic theory).
- 21.10 Redox potential, oxididative phosphorylation, pentose phosphate pathway.
- 21.11 Biology of nitrogen fixation, importance of nitrate reductase and its requiation. ammonium assimilation.
- 21.12 Structure and function of Lipids, fatty acid and biosynthesis B- Oxidation, saturated and unsaturated fatty acides, storage and mobilization of fatty acids.
- 21.13 Definition and phases of growth, development and kinetics of growth, seed germination and factors of their regulation.
- 21.14 Plant movements- the concept of photoperiodism, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening.
- 21.15 Histroy and discovery of plant hormones, auxins, gibberellins, cytokinins, absoisic acid and ethylene, biosynthesis and mechanism of action.
- 21.16 Photomorphogenesis: phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.
- 21.17 Tool and techniques of recombinant DNA Technology, cloning vectors: genomic and DNA library.
- 21.18 Transposable elements, techniques of gene mapping and chromosome walking.
- 21.19 Functional definition of biotechnology, basic concepts for plant tissue culture, cellular totipotency, differentiation and morphogenesis.
- 21.20 Biology of Agrobacterium, vectors for gene delivery and market genes, salient achievements in crop biotechnology.

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## 22. Plant and Environment

- 22.1 Atmosphere-gaseous composition: water-water cycle, and its significance, global radiation, photosynthetically active radiation, temperature.
- 22.2 Soil structure; soil profiles and development, physico-chemical properties of soil and biotic components.
- 22.3 Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes) and salinity.
- 22.4 Morphological, anatomical and physiological responses of plants to light (potoperiodism, heliophytes, sciophytes) and temp. (thermoperiodically and vernalization).
- 22.5 Population ecology, growth curves: Ecotypes and ecads.
- 22.6 Community ecology: Community characteristics; frequency, density, cover, life forms, biological spectrum, ecological sucession.
- 22.7 Ecosystem: structure, abiotic and biotic components, food chain, food web, ecological pyramids and energy flow.
- 22.8 Biogeochemical cycles of carbon, nitrogen and phosphorus.

## 23. Natural Resources and Management

- 23.1 Biogeographical regions of India.
- 23.2 Vegetation types of India; Forests and grasslands.
- 23.3 Strategies for environmental Management.'
- 23.4 Conservation of Natural resources.

## 24. Utilization of plants.

- 24.1 Food Plants: origin of wheat, maize and potato and their cultivation in India.

- 24.2 Fibres : cultivation and processing of cotton and jute.
- 24.3 Beverages: Botony and processing of tea and coffee.
- 24.4 Spices: history and the parts used of Asafoetida. Cumin, Fennel, Goriander, Cloves, Cinnamomum and Cardamon..

**25. Utilization of Plants.**

- 25.1 Veg. oils: Source of vegetable oils: Botany, Cultivation and utilization of Groundnut, mustard and coconut.
- 25.2 A general account of firewood and timber sources of J&K State and utilization of Bamboos.
- 25.3 Medicinal plants of J&K State: a general account.
- 25.4 Rubber: sources of rubber, extraction and processing of commercial rubber.

**(II) SILVICULTURE**

**1. Principles of Silviculture**

Definition of Forestry:- Stages of forestry development and its influence on forestry today. Definition of silvics and silviculture role of silviculture. Major forest types, distribution and composition in India and J&K.

Study of site factors like climatic, edaphic, physiographic and biotic in relation to forest.'

Classification of climatic factors, the role played by light, temperature, rainfall, snow, wind, humidity and evaporation in relation to forest vegetation.

Edaphic factors of biological agencies parent rock topography etc. on the soil formation. Soil profiles-physical and chemical properties, mineral nutrients, nutrient cycling, soil moisture and their influences on forest production.

Tree growth photosynthesis biotic factor-influence of plants, insects, wild animals man and domestic animals on vegetation.

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Tree growth photosynthesis, respiration, translocation and transpiration. Cambial development, growth rings, effects on environment on cambial development. Shoot and drown development. Flowering, fruiting and seed production.

Root growth-distribution and biomass. Environmental effects on development silvicultural manipulation of root growth.

Stand dynamics- Plant succession, competition and tolerance stand development- basal area and yield table.

**2. Practices of Silviculture**

Classification of forests. Forest regeneration, natural, artificial (Plantation forests) and mixed regeneration. Natural forest types and their management. Plantation forests: planting survey, planting plan, plantation records, maps, ecological aspects for the choice of tree species, site preparation, planting tools and planting, direct seeding gap filling, afforestation of dryland, wetland and adverse sites and taungya. Enrichment planting; fertilizer, application, nursery crops, cover crops. Tending; control of climbers and undesirable trees. Weed Management. Pruning and

lopping. Thinning- thinning of irregular crops, increment felling, improvement felling. Fire prescribed burning. Conflicts between afforestation and cattle ranching.

### **3. Silviculture of trees and shrubs (Soft wood)**

The origin, distribution, general description, economic value, Phenology, siculture characters, regeneration methods, management of soft woods such as Cedrus deodara, cupressus torulosa, pinus wallichiana; P. roxiburghii, P. helpensis, P. gerardiana, Abies Pindrow, Picca Smethana and Tropical Pines like P. oocarpa, P. petula, P. inesia Rhododendrons, Pyrus passia, and indigofera species, Juniperus, aqathis robusta.

### **4. Silvicultural Systems**

Silvicultural system:- definition modern silviculture, classical silviculture, classification and detailed study of the following systems.

Clear felling, system ( Including clear strip and alternate strip system); shelter wood system; uniform system, the group system the ship shelter wood system; the wedge system; the irregular shelter wood system; the coppice of two rotation system; the shelter wood coppice system; coppice selection system; coppice with standard system; coppice with reserve system; pollard system and culm selection system in bamboo.

### **5. Silviculture of Indian trees-II**

General description, growth and silviculture characters and regeneration methods of following species:-

Quercus species, Alus nitida, Acer Spp. Acacia nilotica, A catechu, Dalbergia Sisso, Juglans regia. Toona Ciliata Bauhinia Variegata, Fraxinus spp. Celtis australis, Grewia optiva, morus species, platinus orientalis, Eucalyptus spp, populus spp. salix species, Robinea pseudoacacia, ulmus wallichiana, catalpa bigninoides, Albizzia spp Dondonaea viscoso, parrotia spp. viburnum, olea cuspidate, Aesculus indica, Ailanthus excelsa; Tectona grandis, shorea robusta Berberis spp. prosopis spp Leucaena leucocephala, Hippophae rhamanoidls.

## **(III) FIELD CROPS**

### **1. Cereals, Millets and Pulses**

Economic importance-origin and distribution, soil climatic requirement land preparation, varieties, seed-rate/seed treatment, sowing time density growth stages, water management nutrient and weed management after cultivation, harvest and processing.

Cereals:- Rice, maize, wheat, oats, barley.

Millets:- Sorghum pearl - millet; finger millet and small millets.

Pulses:- Beans, blackgram, greengram. cowpea, soyabean, lentil and peas.

### **2. Oil seeds and commercial crops.**

Economic importance-origin and distribution-soil and climatic requirement, land preparation varieties, seed rate, seed treatment, sowing density crop growth stages, integrated nutrient management- irrigation, weed management, harvest and processing cropping system and yield constraints together utilization.

Oil seeds:- Groundnut Sesamum, Sunflower, Castor, Safflower, rapeseed, mustard, niger and linseed.

Commercial Crops:- Tobacco , cotton, sugarcane, sugarbeet, saffron, zeera, potato, onion and garlic.

3. **Forages and Grasses**

Forage crops:- definition, classification of forage crops (annual and perennial): leguminous and cereal forages crops with their characteristics Quality- characteristics of forages crops: storage and preservation of forages (hay and silage) making Grassland improvement problems and prospects. Renovations of degraded grasslands; Role of grasses and legumes in soil fertility.

Brief description about the cultivation of important grasses and legumes.

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