

# KERALA PUBLIC SERVICE COMMISSION

## SYLLABUS FOR THE POST OF RANGE FOREST OFFICER IN KERALA FOREST & WILDLIFE DEPARTMENT

### Optional subject- Botany

Module	Topic	Marks
I	Angiosperm anatomy and Embryology	20
II	Phycology and Mycology	12
III	Microbiology and Plant Pathology	12
IV	Bryology, Pteridology, Gymnosperms and Paleobotany	20
V	Taxonomy and Economic Botany	20
VI	Environmental Studies	16
VII	Cell biology and Genetics	12
VIII	Molecular Biology	12
IX	Plant Physiology and Biochemistry	20
X	Biotechnology	20
XI	Horticulture and Plant breeding	16
XII	Forestry	20
	<b>TOTAL</b>	<b>200</b>

#### **Module I. Angiosperm anatomy and Embryology**

Angiosperm Anatomy: Tissues-Meristems - Classification based on origin, position, growth patterns/. Apical organization of shoot apex, Permanent tissues – Definition, classification – simple, complex and secretory tissues. Tissue systems. Primary structure – Root, stem and leaf (Dicot & Monocot). Secondary growth- Root and stem, annual rings, heart wood and sap wood, periderm formation – phellum, phellogen and phelloderm; lenticels, Bark.

Angiosperm embryology: Microsporogenesis- Structure and functions of wall layers. Male gametophyte- Dehiscence of anther. Megasporogenesis –Female gametophyte – Embryo sac-development and types. Pollination- Germination of pollen grains, Fertilization, double fertilization, Barriers of fertilization. Structure of embryo – Dicot and Monocot. Endosperm. Pollen structure, aperture morphology, pollen allergy. Economic importance of pollen.

## **Module II Phycology and Mycology**

Algae : Structure, reproduction and life cycle of Nostoc, Chlorella, Volvox, Oedogonium, Chara, Vaucheria, Pinnularia, Sargassum and Polysiphonia

Commercial products of algae – Agar, Alginates, Carrageenin, Diatomaceous earth, biofuels. Medicinal aspects, algal blooms and red tide.

Fungi: Structure, reproduction, life cycle, of Rhizopus, Penicillium, Saccharomyces, Agaricus, Puccinia, Xylaria and Cercospora. Economic importance of Fungi.

## **Module III : Microbiology and Plant Pathology**

Microbiology –Ultra structure of bacteria, Reproduction, Economic importance.

Mycoplasma and Actinomycetes. Virus- Structure, Chemical composition, reproduction of bacteriophages. Soil microorganisms, the rhizosphere. Microbiology of sewage. Food spoilage and preservation methods. Role of microbes in soil fertility, Nitrogen fixation, Biofertilizers.

Plant Pathology: Classification of plant diseases on the basis of causative organisms and symptoms. Host-parasite interaction. Phytoalexins. Symptoms, disease cycle and control measures. Brief account of the following fungicides- Bordeaux mixture, Lime sulphur, Tobacco decoction, Neem cake and oil.

## **Module IV: Bryology, Pteridology, Gymnosperms and Paleobotany**

**Bryophytes:** Habit, thallus organization, vegetative and sexual reproduction and alternation of generation of the following types - *Riccia*, *Marchantia*, *Anthoceros*, *Funaria*. Economic importance of Bryophytes.

**Pteridophytes:** General characters. Study of the habitat habit, internal structure, reproduction and life cycle of the following types *Psilotum*, *Selaginella*, *Equisetum* and *Pteris*. Stellar evolution in Pteridophytes - Economic importance of Pteridophytes.

**Gymnosperms :** General characters and classification of Gymnosperms. Study of the habit, anatomy, reproduction and life cycle of *Cycas*, *Pinus* and *Gnetum*. Evolutionary trends in gymnosperms, Economic importance of Gymnosperms.

Palaeobotany: Geological time scale, Fossil formation, types of fossils. Fossil Pteridophytes- *Rhynia*, *Lepidodendron*, *Lepidocarpon*. Fossil gymnosperms- *Lyginopteris*.

## **Module V: Taxonomy and Economic Botany**

**Taxonomy:** Types of inflorescence. Flower -symmetry of flower, aestivation types, placentation types. Fruit types: simple, aggregate and multiple. Seeds: albuminous and exalbuminous

Systems of classification - Artificial- Linnaeus, Natural - Bentham and Hooker, Phylogenetic- Engler and Prantl. Basic rules of Binomial Nomenclature and International Code of Nomenclature for algae, fungi, and plants (ICN); Importance of herbarium, Herbarium techniques and Botanical gardens.

Morphological peculiarities and economic importance of the members of the families Annonaceae, Nymphaeaceae, Malvaceae, Rutaceae, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Sapotaceae Solanaceae, Acanthaceae, Euphorbiaceae, Orchidaceae, Poaceae

**Economic Botany:** Cereals–Millets, Pulses, Spices, Beverages, Fibre yielding plants, Dye Yielding plants; Resins, Oil yielding plants; Latex yielding plants; Medicinal plants.

## **Module VI: Environmental Studies**

Natural resources - Renewable and Non-renewable. Degradation of natural resources - Causes. Conservation of Natural resources - Renewable resources. Reforestation. Ecosystems - components- biotic and abiotic; Energy flow. Food chains - Food web and ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle. Ecological succession. Adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites. Characteristic features of different ecosystems. Biodiversity and its conservation - Genetic, species and ecosystem diversity; Hot-spots of biodiversity; Threats to biodiversity: Red data Book; Extinct and Threatened species-endangered & Rare; Endemic species of Western Ghats. Conservation of biodiversity: In-situ and Ex-situ conservation. Global initiatives in biodiversity conservation.

Environmental pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution. Solid Waste Management. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board. Global warming and sea level rise, Acid rain, Ozone layer depletion.

Disaster management - Natural and Environmental disasters- Earth quake, flood, coastal disasters, landslides, tsunami, cyclone, dam collapse, nuclear disaster, chemical disaster, biological disaster. Disaster management –mitigation, preparedness, responses, recovery. Emergency procedures and warning systems, application of GIS.

## **Module VII. Cell biology and Genetics**

**Cell biology:** Ultra structure and functions of the cell components and organelles. The chromosomes- Chromatin -Nucleosome model of DNA organization. Special types of chromosomes- Salivary gland, Lamp brush and B chromosomes. Variation in Chromosome number (Numerical aberrations). Variation in Chromosome structure (Structural aberrations) - Mitosis and Meiosis. cell cycle : Significance of mitosis and meiosis

**Genetics:** Mendelian principles, monohybrid and dihybrid crosses, back cross and testcross. Incomplete dominance; Interaction of genes- Comb pattern in poultry. Recessive and Dominant epistasis. Complementary genes. Duplicate gene with cumulative effect. Duplicate dominant genes; Inhibitory factor. Multiple alleles- ABO blood group in man. Rh factor. Quantitative characters- polygenic inheritance. Linkage and crossing over.

### **Module VIII Molecular Biology:**

DNA as genetic material- experimental evidence. DNA- Chemical Composition. Watson & Crick's Double Helical Model of DNA. A, B and Z forms. Satellite and repetitive DNA. Replication of DNA in prokaryotes. Semiconservative model- Meselson and Stahl experiment; DNA repairing mechanism. Replication of DNA in eukaryotes. RNA structure and types. Genetic code. Synthesis of protein. Transcription and Post transcriptional modification of mRNA. Translation in Eukaryotes; Modern concept of gene. Regulation of gene expression in prokaryotes and eukaryotes- lac operon; transcriptional gene regulation in eukaryotes-promoters, enhancers, transcription factors; RNA interference. Transposable genetic elements.

### **Module IX: Plant Physiology and Biochemistry**

#### **Physiology**

Water relations: Absorption and translocation of water. Loss of water from plants. Significance of transpiration - guttation, anti-transpirants. Mineral nutrition: Macro and micro elements, role of essential elements and their deficiency symptoms. Culture methods - hydroponics and aeroponics. Mechanism of mineral absorption. Photosynthesis: Photosynthetic apparatus, structure and function of chloroplast, Fluorescence and phosphorescence; Red drop, Emerson effect; Light reaction - cyclic and non cyclic photophosphorylation; Hill reaction - Calvin cycle; C4 and CAM plants; Photorespiration. Respiration: Respiratory substrate, types of respiration- aerobic and anaerobic. Glycolysis, Krebs's cycle, terminal oxidation. Anaerobic respiration - fermentation. Translocation of solutes: Path way of movement, phloem transport, mechanism of transport - Munch hypothesis. Nitrogen metabolism: Biological nitrogen fixation - symbiotic and asymbiotic. Nif genes -Leghaemoglobin. Growth: Plant growth regulators. Senescence and abscission, Photoperiodism, Photoreceptors - Phytochrome and Cryptochrome. Vernalization - Physiology of bud and seed dormancy, germination. Plant movements: Tropic and nastic movements. Circadian rhythm and biological clock. Stress physiology: water stress, salt stress.

#### **Biochemistry**

Carbohydrates, Amino acids, Proteins - Structure, classification, properties and function. Lipids- fats & oils, waxes; phospholipids, sphingolipids and glycolipids; Cholesterol and terpenes; Fatty acids -Alpha- oxidation and Beta-oxidation; Enzymes - structure, classification and nomenclature; Mechanism of enzyme action - coenzymes and cofactors.

Secondary Plant Products -- Alkaloids, terpenoids, phenolics, flavonoids

### **Module X: Biotechnology**

Plant Tissue culture - Totipotency- dedifferentiation, redifferentiation and Cytodifferentiation. Culture media. Micropropagation, Callus and suspension culture, Somaclonal variation- Somatic embryogenesis and organogenesis. Production of haploids, Protoplast culture - somatic hybrids - cybrids - Synthetic seeds

Recombinant DNA technology: Cloning vectors, Restriction endonucleases, ligases - Gene library. Gene transfer methods - *Agrobacterium* mediated, electroporation- Biolistics.

Isolation of DNA. Agarose gel electrophoresis. PCR, DNA sequencing-Sanger's method, Southern blotting, ELISA. Molecular markers – RAPD, RFLP. Genetically modified crops . Microbial and Industrial Biotechnology - Microbes in Biotechnology. Bioreactor – Chemostat and Turbidostat. Industrial microbiology: Production of alcohol, vinegar, bread, dairy products & single cell protein.

### **Module XI: Horticulture and Plant breeding**

Principles of garden making. Potting media, Soil types, Soil preparation. Irrigation methods. Vegetative propagation methods. Manures and fertilizers- Foliar sprays. Irrigation Methods– Components of Garden- Landscaping principles; Bonsai. Flower Arrangement- Free style, Shallow and Mass arrangement- Japanese- Ikebana. Dry flower arrangement. Objectives in plant breeding- - Important national and international plant breeding Institutes. Plant introduction. Selection - Genetic basis of selection and methods. Hybridization. Composite and synthetic varieties. Heterosis and inbreeding depression. Male sterility. Mutation breeding. Polyploidy breeding.

### **Module XII: Forestry**

Silviculture- concept and scope of study of natural and artificial regeneration of forests. Clear felling, uniform shelter, wood selection, coppice and conservation systems. Silviculture of some of the economically important species in India such as *Azadirachta indica*, *Tectona grandis*, *Eucalyptus indica*, *Swietenia mahagoni*, *Dalbergia sisso* and *Santalum album*, *Artocarpus heterophyllus*, *Hevea brasiliensis*.

Social and agro forestry. Selection of species and role of multipurpose trees. Food, fodder and energy. Social forest- Avenue plantation. Sacred plants- definition, importance of sacred trees like *Ficus religiosa*, *Emblica officinalis*, *Aegle marmelos*. Principles of forest management. Sustained yield principle and its limitations. Rotation - factors influencing length of rotations. Normal forest, regular and irregular forests. Working plans. Joint forest management. Forest policies in India, Forest Laws and Acts, The Wildlife (Protection) Act 1972, Forest (Conservation) Act 1980, Environment (Protection) Act 1986. International Treaties like CITES, CBD, RAMSAR. The Biological Diversity Act, 2002. Forest resources and utilization. Plantation forestry in India. Choice of species. Fertilization in plantations. Clonal plantations. Forest products- timber, pulp wood, secondary timbers, non timber forest products (NTFPs). Definition and scope (brief outline) - Gums, resins, fibers, oil seeds, nuts, rubber, canes and bamboos, medicinal plants, charcoal. Lac collection and marketing.

**NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.**