

KERALA PUBLIC SERVICE COMMISSION

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

Optional subject- Agriculture

MODULE 1- Fundamentals of Agronomy and agriculture heritage (20 marks)

Crops – classification- agronomic, botanical, ontogenic, growth habit – growth – definition and factors affecting growth – methods of sowing/planting- vegetative propagation of crops – setts, slips, tubers, rhizomes, etc. – Tillage and tillage implements-modern concepts of tillage-soil fertility and productivity -Crop nutrition- Mineral nutrition of plants- functions and deficiency symptoms of nutrients– methods of fertilizer application- methods for improving nutrient use efficiency, biological nitrogen fixation and biofertilizers -seed testing- - foliar nutrition and hydroponics-crop rotation-Plant ideotypes- yield contributing characters – harvest index

Agriculture scope- Importance of agriculture and agricultural resources available in India; Origin of agriculture- branches of agriculture- agricultural systems in the world- Green revolution and its impact- National agriculture setup in India; ICAR and SAUsCurrent scenario of Indian agriculture; Indian agricultural concerns and future prospects-CGAIR and international institutions- Introduction of Indian agricultural heritage- Ancient agricultural practices- Relevance of heritage to present day agriculture-Journey of Indian agriculture and its development from past to modern era; Natural calamities and famines- Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Introduction to gender perspectives in agriculture- gender concepts- multiples roles of women Women in agriculture- multifaceted roles and tasks of farm women- gender, poverty and livelihoods -Gender equity and strategies for rural women’s empowerment- self- help groups. Farm mechanization and women- Occupational health hazards- Women friendly agricultural technology-Ergonomical approaches- Technological options

MODULE 2 Fundamentals of Plant breeding and genetics-plant physiology-Seed Technology- Intellectual property rights (15 marks)

Breeding methods in asexually propagated crops, clonal selection and hybridization; Participatory plant breeding; Plant Breeders and & Farmer’s Rights. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Ideotype concept and climate resilient crop varieties for future.

Crop physiology and its importance in agriculture; Crop water relations, water potential and its components, diffusion and osmosis, absorption of water; Transpiration and stomatal physiology,

water use efficiency. Mineral nutrition of plants- functions and deficiency symptoms of nutrients– nutrient uptake mechanisms- foliar nutrition and hydroponics. Photosynthesis - Light and dark reactions C3, C4 and CAM plants, photorespiration: Plant respiration- glycolysis, TCA cycle and Electron transport chain, Alternate respiration in plants; Plant growth regulators – physiological roles and agricultural uses; Physiological aspects of growth and development of major crops; Photoperiodism and vernalisation; Growth analysis, role of physiological growth parameters in crop productivity.

.Procedure for seed certification, field inspection. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed Act and Seed Act enforcement. Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories. Synthetic seeds and terminator gene technology. Detection of genetically modified crops. Transgene contamination in non-GM crops, GM crops and organic seed production. Seed dormancy, internal and external factors affecting dormancy in seeds. Seed drying– seed processing -Seed treatment, Seed storage and seed marketing.

Introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Traditional knowledge-meaning and rights of TK holders. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

MODULE 3-Fundamentals of soil science- soil fertility and problem soil management (15 marks)

Weathering - soil formation - factors and processes - soil profile. Soil physical properties - soil texture - textural classes - particle size analysis.- Soil structure Classification - soil aggregates – significance. Soil consistency - soil crusting. Bulk density and particle density of soils and porosity - their significance and manipulation. Soil compaction - soil Colour- soil classification (elementary). Soils of India - geological formations – characterization of soils of Kerala. Soil water - retention and potentials - soil moisture constants - movement of soil water – infiltration – percolation – permeability – drainage - methods of determination of soil moisture. Thermal properties of soils - soil temperature - soil air - gaseous exchange - influence of soil temperature and air on plant growth. Soil colloids – properties – nature - types and significance. Layer silicate clays - their genesis and sources of charges. Adsorption of ions - ion exchange - CEC and AEC - factors influencing ion exchange and its significance. Concept of pH - soil acidity - overview of saline, sodic and calcareous soils- Soil organic matter – composition – decomposability – humus - fractionation of organic matter- Carbon cycle - C: N ratio. Soil biology – biomass - soil organisms and their beneficial and harmful roles.

Importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, specialty fertilizers –cutomised fertilizers and 100 per cent water soluble fertilizers; Fertilizer Storage, Fertilizer Control Order.History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and

micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

MODULE 4-Environment studies and disaster management

(30 marks)

Environmental studies- nature, definition, scope and importance-type and segments of environment. - Natural Resources: Renewable and non-renewable resources- Forest, water, food, mineral, energy and land resources. Forest resources: Use and over-exploitation, deforestation-Water resources: Use and over-utilization of surface and ground water, - Mineral resources: Use and exploitation. Food resources: World food problems- Energy resources: renewable and non-renewable energy sources, use of alternate energy sources. - Land resources: land degradation, soil erosion and desertification. Ecosystems: Definition, concept, structure and functions, types, energy flow -producers, consumers and decomposers, - Ecological succession, food chains, food webs and ecological pyramids. Characteristic features, structure and functions of forest ,grassland ,desert and aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). -Biodiversity – definition and classification- Biogeographical classification of India -Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels, hot spots of biodiversity-Threats to biodiversity: habitat loss, poaching of wildlife, man -wildlife conflicts - Endangered and endemic species of India . Conservation of biodiversity: In-situ and Ex-situ conservation.

Environmental Pollution- Air pollution -. Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards. Solid Waste Management-Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies.- Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. -Human Population and the Environment: population growth, variation among nations, population explosion, -Environment and human health- Human Rights, Role of Information Technology in Environment and human health.

Disasters -Natural Disasters- nature, types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.- Disaster Management- Effect to mitigate natural disaster at national and global levels. International strategy for disaster reduction. -Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

MODULE 5- Agrometeorology and Climate change, rainfed agriculture and watershed management

(20 marks)

Atmospheric weather variables-atmospheric pressure, wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze, solar radiation, solar constant, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion,

lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification. Agriculture and weather relations - climatic variability, global warming-causes of climate change and its impact on regional and national Agriculture- Climatic change and global warming, Sea level rise, ozone depletion. Weather modifications- Weather forecasting--Climate change-Climate change adaptation-Climate change mitigation

Rainfed agriculture-history of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management

MODULE 6- Agro-forestry -Cropping systems- Farming Systems and sustainable agriculture-organic farming and Field Crop Production (30 marks)

Silviculture-importance and objectives, types of forests-salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations- tree stand management. Agroforestry – definition and concepts-Agroforestry systems and practices- different agroforestry systems prevalent in the country and Kerala, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, plantation crop combinations, home gardens. Multi purpose trees in agroforestry, characteristics- Understorey components and diversification potentials- Component interactions- above ground and below ground interactions. Productive and protective functions- Nitrogen fixation- Soil conservation- Litter dynamics and nutrient cycling – Carbon sequestration and climate change mitigation -carbon neutral farming- Social forestry- concept and importance, practices in Kerala

Farming System- importance, and concept, Types and systems and factors affecting types of farming-Farming system components - Cropping system and pattern, multiple cropping system, Plant Interactions- Efficient cropping systems and their evaluation, allied enterprises and their importance-Cropping systems of Kerala -Rice based, Coconut based systems- - Tools for determining production and efficiencies of cropping systems-; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies, HEIA, LEIA and LEISA, ecological principles of LEISA and promising techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, , Homestead farming systems- Good Agricultural Practices, ITKs and farmer centered techniques and practices

Organic agriculture- - Current status of organic farming in India and Kerala; Tools and practices of organic farming- planned crop rotation, green manures, manuring and composting, multiple cropping, intercropping in relation to maintenance of soil productivity, Biological pest control, biological agents and pheromones, Control of weeds, diseases and insect pests- sanitation, tillage and cultivation, cover cropping, mulching, fire, biorational pesticides, foliar fertilization, buffers and barriers- shelter zones; Impact of organic farming on soil and crop quality- Organic farming

initiatives in India and Kerala- National Programme for Organic Production (NPOP) – Operational structure of NPOP-Accreditation agencies- Certification Agencies – National Standards for Organic Product (NSOP)-inspection and certification procedures- Marketing and export potential.

Rice (including speciality rice) , wheat, maize, millets, tapioca, potato, yams and aroids, sugarcane, groundnut, sesamum, sunflower, safflower, linseed, important pulses, banana, mango, coconut, cashew, spices and condiments – origin, geographic distribution, economic importance, botany and growth phases, varieties, harvesting, processing, conversion ratios (ratio between harvested and economic produce)-Agroclimatic and agroecological classification of India and Kerala-Production technology of cereals, millets, tuber crops, pulses, oil seeds, fodder crops

MODULE 7- Irrigation and Weed management -Precision farming and nano technology (20 marks)

Water requirement and irrigation requirement- Soil moisture constants – Evapotranspiration and consumptive use – potential evapotranspiration and reference crop evapotranspiration – crop coefficient – irrigation water quality criteria and its management-Water management of principal crops, critical stages of crops, depth and schedule of irrigation – rice, wheat, banana, coconut, cowpea, sugarcane and vegetables- Methods of irrigation-Agronomic techniques improve water productivity-

Crop water relations, water potential and its components, diffusion and osmosis, absorption of water; Transpiration and stomatal physiology, water use efficiency.

Weeds – harmful effects, classification of weeds, crop weed association – crop associated weeds, crop bound weeds and season bound weeds – critical period of crop weed competition – aquatic weeds and parasitic weeds-Weed control methods-Herbicide formulations- Methods of application-Selectivity of herbicides-Concept of Integrated Weed Management

Precision agriculture: concepts and techniques and issues and concerns for Indian agriculture; Geoinformatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nanofertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scalingup farm productivity.

MODULE 8-Soil and water conservation engineering-farm machinery-protected cultivation-secondary agriculture-Renewable energy resources-green technology

(20 marks)

Causes of soil erosion. Definition and agents of soil erosion, water erosion. Forms of water erosion. Gully classification and control measures. Soil loss estimation by Universal Soil Loss Equation. Soil loss measurement techniques. Principles of erosion control. Engineering measures of soil and water conservation - contouring, contour bund , graded bund and bench terracing Water harvesting and its techniques-Irrigation pumps and their selection.

Tractor types, cost analysis of tractor power and attached implements. Primary and secondary

tillage implements, implements for hill agriculture, implements of inter-cultural operations, sowing and planting equipments, plant protection equipments and threshing equipments.

Green house technology- Introduction, types of Green Houses; Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in green houses.

Classification of energy sources, biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, bio-diesel and bio-oil production and their utilization as bio-energy resource, introduction of solar energy, collection and their application, solar energy gadgets: introduction of wind energy and their application.

**MODULE 9-Fundamentals of horticulture and production technology of horticultural crops-
Post harvest management and value addition of horticulture crops- land scaping and
ornamental horticulture (15 marks)**

Horticulture - definition, importance, division and classification of horticultural crops- Importance of horticulture in India and Kerala.- Commercial orchards, garden and plantations - selection of site for perennial horticultural crops - climate, soil, socio economic factors-Orchard planting-training and pruning in horticultural crops-fruit set and development- Seedlessness in horticultural crops; significance and induction-Bioregulators- Natural and synthetic regulators - Role of bioregulators in horticultural crops - preparation and methods of application.-Nursery management-layout, planting, aftercare-irrigation, manuring -stage of harvest, harvesting, yield, on farm processing and uses of coconut, arecanut, oil palm, rubber, cashew, tea, coffee and cocoa.

Indian fruit and vegetable processing industry- Importance, problems & prospects- Physiology of maturity, ripening and senescence in fruits and vegetables and their chemical composition, - Post harvest losses - Pre and postharvest factors causing loss and spoilage- Post harvest management techniques - Packaging technology-Government policies, regulations and specifications- Principles and methods of preservation- drying and dehydration - Thermal processing- Preservation by ionizing radiations, chemical methods and fermentation- Recent advances in food preservation techniques- Post harvest technology of coconut, Arecanut, Oil palm, Rubber, Tea, Coffee, Cocoa & cashew, pepper, cardamom, ginger, turmeric, chillies, Tree spices, essential oil yielding crops and cut flowers- Industrial waste utilization.

Landscaping, gardening and commercial Floriculture.–Principles of landscaping. - Lawn making- Annuals and herbaceous perennials - Specialized gardening techniques Roof garden, terrace garden, sunken garden, water garden, rock garden etc. Indoor gardening of plants Bonsai, vertical garden, tray garden, terrarium etc. Introduction to commercial Horticulture -Present status of the cut flower industry in India and abroad – Problems and prospects of commercial floriculture in India and Kerala- classification, varieties grown, identification, environmental requirements, propagation, media and containers, planting, care and management, nutrition, plant protection, harvesting and marketing of flower crops

MODULE 10- Agricultural Marketing, Entrepreneurship Development and Agricultural Extension Management (15 marks)

Agricultural Marketing – concepts and definitions – scope – Market and Marketing-meaning-definition-elements of a market-Classification of market-Agricultural Marketing-approaches-functional (Exchange function, physical marketing function, facilitating functions)-institutional (agencies, channels)-commodity- Producer’s surplus-meaning-types-marketable and marketed surplus importance- factors affecting-Marketing efficiency-meaning-definition-estimation of marketing costs/margins for farm commodities-measures to improve marketing efficiency and tools for risk management-co-operative marketing futures trading-contract farming-International trade-Domestic Vs International trade-theories of international trade-theory of absolute advantage-Globalization and Liberalization-WTO-AOA (market access, domestic support, export subsidies)-Agricultural price policy in India-objectives-role of CACP in agricultural price policy-Administered prices (support price, procurement price, levy price, statutory minimum price, issue price)

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.