

# **DETAILED SYLLABUS FOR THE POST OF AGRICULTURAL OFFICER IN AGRICULTURE DEVELOPMENT AND FARMER'S WELFARE DEPARTMENT (Cat No.31/2022)**

## **PART I -CROP PRODUCTION**

### **Module 1: AGRONOMY**

Agronomy - scope, seeds and sowing, tillage and tilth, crop density and geometry. Classification of crops – agronomic, botanical, ontogenic. Growth and development of crops, factors affecting growth and development, crop rotation and its principles, adaptation and distribution of crops. Crop nutrition-essential nutrients – criteria of essentiality, classification, functions and deficiencies - manures and fertilizers - nutrient use efficiency – fertilizer calculations. Specialty fertilizers – 100 per cent water soluble, fortified, customised, slow release fertilizers, nitrification inhibitors. Biological nitrogen fixation – biofertilizers. Weeds – importance, classification, invasive weeds of Kerala, crop weed competition, allelopathy, concepts of weed management – principles and methods, herbicides – classification, selectivity and resistance, allelopathy. Herbicide calculations, calibration of sprayers and spraying specifications for herbicides. Integrated weed management in rice, banana, coconut. Agriculture –scope- Importance of agriculture and agricultural resources available in India; Farming system components - Cropping system and pattern, multiple cropping system-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. Homestead farming system. Economic importance – soil and climatic requirements – area and production – varieties – seed rate spacing – methods of sowing/planting -manurial schedule- cultural practices and yield of major field crops of Kerala, viz, rice, tuber crops (cassava, sweet potato, yams and aroids), sugarcane, pulses, groundnut, sesamum and fodder crops, viz., guinea and hybrid napier.Irrigation- Water management of principal crops of Kerala.- Water resources and irrigation development in India and Kerala. Soil moisture constants-Evapo-transpiration, potential evapo-transpiration and consumptive use, Reference crop evapo-transpiration (ET<sub>o</sub>)- Crop co-efficient (K<sub>c</sub>)- K<sub>c</sub> values for different crops. Main empirical methods of calculation of ET<sub>o</sub>- Effective rainfall, Water requirement of crops- Scheduling irrigation– Methods of irrigation-.Surface , subsurface, overhead and micro irrigations. Irrigation efficiency- Water productivity and water use efficiency- Agricultural drainage-causes of water logging and types of drainage. Quality of irrigation water. Agro ecology of Kerala – agro ecological zones and agro ecological units, monsoon in Kerala, cropping seasons of Kerala. Rainfed agriculture – dry farming, dryland farming, rainfed farming. Drought – classification, drought adaptation mechanisms in crops, drought management in major crops of Kerala. Watershed – types – characteristics and management.

### **MODULE 2: SOIL SCIENCE & AGRICULTURAL CHEMISTRY**

Soil-Pedological and edaphological concepts. Weathering - soil formation - factors and processes - soil profile. Soil physical properties - soil texture - soil consistency - soil crusting-bulk density and particle density of soils and porosity - their significance and manipulation- Soil compaction - Soil colour. Soils of India - geological processes and formations – characterization of soils of Kerala. Soil colloids – properties – nature - types and significance. Layer silicate clays - their genesis and sources of charges. Adsorption of ions - ion exchange - CEC and AEC - Concept of pH - soil acidity - 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. Soil fertility evaluation – soil testing – rating of soil fertility (organic carbon, major, secondary and micronutrients). Problem soils of Kerala - characteristics, problems and management/reclamation; Salt affected soils- Arid soils -Acid soils- submerged soils-Eroded soils-Acid sulphate soils-Degraded soils. Organic farming and food security- Tools and practices of organic farming. Organic certification – accreditation agencies, certification agencies, NSOP, NPOP. Precision agriculture: Geo-informatics- GIS and Remote sensing concepts application in agriculture-Global positioning system (GPS),components and its functions.Nanotechnology-definition, concepts and techniques, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors

## **PART II- CROP PROTECTION**

### **Module 3 : AGRICULTURAL ENTOMOLOGY**

Categories of pests of agriculture -Economic classification of insects- External Morphology, Anatomy and general Physiology, structure and function of digestive, circulatory, respiratory, excretory, reproductive, endocrine, exocrine, nervous systems and sense organs. Types of metamorphosis- Integrated Pest Management: Principles of IPM, concept of economic threshold and economic injury levels, tools of IPM - Basic concept of host plant resistance. Biocontrol of pests -Microbial control-Regulatory control- plant quarantine and phytosanitary certificate. Pesticides: Insecticide act and rules. Newer trends in insect pest management – pheromones, Insect Growth Regulators, Chitin synthesis Inhibitors, biotechnological methods. Distribution, bioecology, nature and symptoms of damage and management strategies of major insect pests of Field crops: rice, wheat, maize, sorghum, ragi, sugarcane, cotton and oil seeds – groundnut, sesamum, castor, sunflower and mustard, pulses. Vegetable crops: solanaceous ,cruciferous , leafy vegetables polyhouse vegetables; tuber crops , fruit crops,plantation crops,ornamentals,medicinal and aromatic plants and stored products pests. Economically important insects - silkworms, lac insects, pollinators, predators, parasites, weed killers, soil builders, scavengers and insects used for scientific investigation. Damage in major crops and management of nematodes, mites, rodents, birds, molluscs (snail).

### **Module 4: PLANT PATHOLOGY**

Importance of plant diseases-. Important plant pathogenic organisms- Fungi, bacteria, fastidious vascular bacteria, virus, viroids, phytoplasma, spiroplasma, algae, protozoa, nematodes, phanerogamic parasites. Diseases due to abiotic /biotic causes: Causes/ factors affecting disease development-disease triangle and tetrahedron.Fungi-Bacteria-Viruses and mollicutes-Morphology, classification, reproduction, transmission, dispersal and survival. Categories of diseases-IDM; Epidemiology: Factors affecting disease development. Principles and methods of plant disease management-symptoms, etiology, disease cycle and management of diseases of rice, wheat, sugarcane, groundnut, pulses, vegetables, tubers, citrus, mango, banana, grapevine, pineapple, papaya, guava, sapota, cashew, apple, coconut, arecanut, cocoa, black pepper, ginger, cardamom, tree spices, oil palm, betelvine, coffee, tea, rubber and ornamentals.Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Survey, surveillance and forecasting of diseases.Development and validation of IDM module- IDM programmes in cereals, vegetables, pulses, tuber crops,spices and plantation crops and ornamentals.

### **Part III: CROP IMPROVEMENT**

#### **Module 5: PLANT BREEDING AND GENETICS**

Heredity, Mendelian principles of heredity, Cell division –Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Domestication, Acclimatization, Multiline concept. Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Major breeding objectives for crop improvement 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. Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future. Germplasm – Methods of conservation and utilization in crop improvement. Micropropagation -organogenesis and embryogenesis-different stages of micropropagation - commercial micropropagation, quality assurance of tissue culture plants. Plant tissue culture for crop improvement. Intellectual Property Rights – meaning, GATT, WTO, TRIPs, WIPO, patents, copyrights, trademark, industrial design, geographical indications, integrated circuits, trade secrets. Patent Act 1970 and patent system in India.

#### **MODULE 6: SEED AND SEED TECHNOLOGY**

Seed certification, field inspection- Foundation and certified seed production of important cereals (Rice, wheat and maize), pulses (Cowpea, mung, urd, pigeonpea, field bean and soyabean), oilseeds (Sesame, coconut, sunflower, groundnut), fodder (Guinea grass, napier grass and lucern), and vegetables (Bhindi, tomato, brinjal, chillies and cucurbitaceous vegetables). Seed Act and Seed Act enforcement- Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories. Seeds Control Order 1983 and Seed Bill 2004, IPR- Intellectual Property Rights

## **PART –III OTHERS**

### **Module 7: HORTICULTURE**

Horticulture - area, production, productivity of horticultural crops in India and Kerala – branches of horticulture – major fruit crops (Pomology) – importance, nutritional value, production technologies. Commercial orchards, gardens and plantations – selection of site for crops - climate, soil, socio-economic factors; Techniques of training and pruning , problems of unfruitfulness - internal factors, external factors. Plant growth regulators in horticulture -.Plant propagation techniques - definition and basic concepts, type-structures - commercial propagation of horticultural crops; Micro propagation of horticultural plants .Important seed and herbal classification ,medicinal plants -different methods of classification, active principles, aromatic plants- Botany, varieties, production technology, active principles and uses, plantation crops of Kerala – commercially cultivated varieties,production technologies – improved propagation methods..Ornamental and flowering plants (Floriculture) — cultivation of commercial ornamental and flower crops. Gardening and landscaping-scope and methods. Post harvest management of major horticultural crops of Kerala

### **MODULE 8: OLERICULTURE**

Importance and scope of vegetable crops in India with special reference to Kerala-Production and management of warm season and cool vegetables of Kerala. Types of vegetable farming-Systems of vegetable cultivation- traditional and specialized systems; Factors affecting vegetable production- Basic principles in vegetable production- nursery, sowing and transplanting, care and management. Plant protection special precautions in vegetables- Seed production in cool season vegetables, post harvest handling- losses; causes and measures to reduce losses; Packing and transport, marketing of vegetables.

### **MODULE 9: AGRICULTURAL ECONOMICS**

.Agricultural economics- Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, tax, capital, income and welfare. Theories- Utility theory; law of diminishing marginal utility, equi-marginal utility principle. Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets- demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus.

### **Module 10: AGRICULTURAL EXTENSION**

Extension Education-Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). New trends in agricultural extension-Variou rural development programmes launched by Govt. of India. Community development-Rural Leadership: concept and definition, types of leaders in rural context; extension administration. Extension teaching methods- Sociology and Rural sociology. Management in extension, participatory approaches, entrepreneurship in agriculture, communication and transfer of technology in agriculture.

**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**