



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir (SKUAST-K)
OFFICE OF THE CONTROLLER OF EXAMINATIONS

Main Campus, Shalimar, Srinagar – 190025

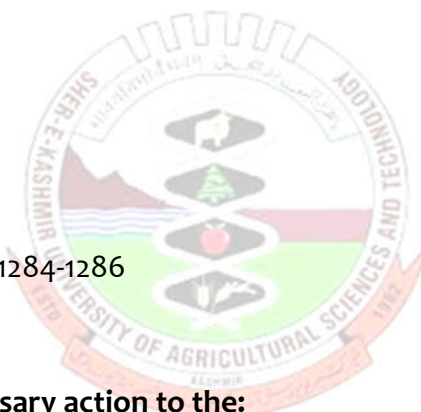
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Notice

Subject: Issuance of Syllabus for Written Examinations for the Posts of Subject Matter Specialists (SMS).

This is for the information of all the concerned candidates that the syllabus for the post/s of **Subject Matter Specialists (SMS)** in various disciplines, advertised vide University advertisement notice No. 06 of 2026 dated: 16.06.2026, is available on the University website <https://www.skuastkashmir.ac.in>.



Prof. (Dr.) K. N. Qaisar
Controller of Examinations

No. AU/CoE/R-5(SMS)/2026/1284-1286

Dated: 13.08.2026

Copy for information/necessary action to the:

- Registrar, SKUAST-K, Shalimar.
- Officer In-Charge ARIS for uploading the syllabus on the University Website.
- Secretary to Vice-Chancellor for information of Hon'ble Vice-Chancellor.

Subject Matter Specialist (SMS) – Agricultural Extension

Fundamentals of Extension Education (15)

Extension Education- meaning, definition, scope, process, objectives and principles of Extension Education. Teaching and learning processes. Extension systems in India: extension efforts in pre-independence era and post-independence era; various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc. Transfer of technology (TOT): concept and models, capacity building of extension personnel. FLD and OFT in relation to TOT programmes.

Communication Methods (10)

Communication: meaning and definition; principles and functions of communication, models, credibility, fidelity, empathy, feedback, problems and barriers in communication. Communication methods: Individual, group and mass approaches in extension. Audio-visual aids- classification, selection, use and production. Traditional media for communication in development programmes. Modularized communication- concept, approach, need, process of designing instruction for transfer of communication.

Diffusion and Adoption of Innovations (10)

Concept and meaning, process and stages of adoption, diffusion process, adoption process, models of diffusion and adoption, adopter categories and their characteristics. Factors influencing adoption and attributes of innovations. Agriculture Journalism: Farm publications – bulletins, folders, leaflets, booklets, newsletters, popular and scientific articles. Selection, planning and use of different extension teaching methods like demonstration, exhibition, farmers fairs, field days, tours, extension literature, etc. Preparation and presentation of different projected and non-projected audio-visual aids.

Information Communication Technologies (ICT) (05)

ICT tools- print and electronic media, e-mail, Internet, use of multimedia, use of mobile phone, video and teleconferencing, computer-assisted instructions, touch screens, micro-computers and web technologies. ICT Applications in TOT.

Rural sociology (05)

Rural Sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Human behaviour: Personality, Learning, Motivation, Intelligence, knowledge, attitude and skill.

Rural development (05)

Concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Development-meaning, definition, concept & principles, Philosophy of community development.

Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions.

Training & Human Resource Development (05)

Concept of human resource management. Identifying training needs and assessment of training impact. Training – principles, importance, methods and factors. Phases of training - pre training and post training. Developing training modules, training requirements, training methods. Evaluation of training - types and techniques of training evaluation.

Programme Planning (05)

Concept, steps, principles and theories of programme planning. Steps in programme planning. Evaluation of development programmes and schemes. Monitoring and evaluation – concept, significance, types, methods and tools. SWOT/TOWS analysis of development programmes.

Entrepreneurial Development (10)

Concept, significance and scope. Government Programmes and institutions for entrepreneurship development. Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill, Developing Managerial skills, Business Leadership, Problem solving skill, Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for entrepreneurship and rural enterprise. SWOT Analysis. Self Help Groups – concepts, organisation, mobilization, micro-finance and functioning of SHG for empowerment and sustainability. Concept and stages of Innovation-decision process, consequences of innovations.

Extension Management (05)

Concept and principles of administration and management. Functions of management – planning, organizing, staffing, directing and leading, controlling, coordinating, reporting and budgeting. Decision-making in organization. Organizational development, job satisfaction, time management, performance appraisal and coordination at different levels of extension management.

Resource management: concept and methods; Team building: process and strategies at organizational and village levels. Mobilization and empowerment skills: concept and strategies in mobilization, concretisation and empowerment of rural people.

Developmental Strategies and Issues in Extension policies (05)

National Agricultural Extension System and Networking of State development Departments, NARS, NGOs, producers' companies, agricultural cooperatives, rural banks, insurance and private sectors. Research-Extension-Farmer-Interface. Identification, characterization, documentation and validation of ITKs. Privatization of extension, market led extension, production to consumption and end to end innovative approaches. Issues related to globalization and IPR.

Gender Sensitization and Empowerment (08)

Gender and empowerment: meaning, definitions and importance; need and focus on gender sensitization, gender in community diversity and its implication for empowerment. Gender perspectives in development of women, social characteristics, roles, responsibilities, resources, constraints, legal issues and opportunities; economical, educational and other parameters. Dimensions and methodologies for empowerment; gender budgeting; gender analysis framework- context, activities, resources and programme action profile; technologies and empowerment - gender specific technologies, household technology interface, socio-cultural interface and women as consumer of technologies. Gender issues and development: health and nutrition, violence, governance, education and media.

Research Methodology in Extension Education (12)

Social research- concept, principles and approach. Selection and identification of research problems, methods of data collection- interview method and mailed questionnaires. Variables -meaning and types, independent, dependent and intervening variables. Hypothesis – concept, characteristics, types and testing. Research design - concept and types, field studies, case studies and survey method. Measurement – meaning and levels. Methods of sampling and statistical tests. Reliability and validity of tests, normal distribution, tests of significance, ANOVA, correlation and regression, scaling techniques. Processing of data, coding - tabulation. Analysis and interpretation. Writing scientific reports, citing references. Participatory approaches, PRA, RRA and PLA.

E N D S

Subject Matter Specialist (SMS) – Agronomy

Unit I. Crop Ecology and Geography

Ecosystem concept Principles of crop ecology; Factors affecting productivity of agricultural-ecosystems; Physiological limits of crop yield and variability; Greenhouse gases; Climate change adaptation and mitigation strategies. Geographical distribution of crop spices, medicinal and aromatic plants; Biotic and abiotic factors and their interactions affecting crop production. Physiological stress in crops (temperature and water and excess water); stress detection through remote sensing. (10)

Unit II Weed Management

Scope and principles of weed management; Weeds' classification, biology, ecology and allelopathy; Crop weed competition and critical period; Allelopathy; Herbicide classification, formulations, mode of action, selectivity and persistence of herbicides in soils; herbicide resistance and its management. Cultural, mechanical, biological and chemical weed control, integrated weed management in cropped and non-cropped lands. Bioherbicides; Integrated weed management. Parasitic weeds and their management. Precision weed management. Role of GM crops in weed management. (10)

Unit III Soil Fertility and Fertilizer Use

History of soil fertility and fertilizer use; Concept of essentiality of plant nutrients, Functions of plant nutrients, transformation of major nutrients in soils, nutrient deficiencies and diagnostic techniques; liquid, nano and conventional fertilizer materials. their composition, Slow-release fertilizers, nitrification inhibitors. Nutrient use efficiencies; Methods of fertilizer application; Organic manures, green manures, bio-fertilizers and integrated nutrient management; Site-specific nutrient management. Precision nutrient management and variable rate technology (10)

Unit IV Dryland Agronomy

Concept of dry farming, dryland farming, dryland farming and rainfed farming; History, development, significance and constraints of dryland agriculture in India; Rainfall analysis and length of growing season; Types of drought, drought resistance, drought avoidance, drought management; Plant ideotypes for drylands. Contingency crop planning including and crop diversification. Techniques of moisture conservation, rain water harvesting. Precision, soil seed, fertilizer and weed management, Concept and importance of watershed management in dryland areas. (10)

Unit V Crop Production

Production technologies for cereals, millets, legumes, oilseeds, fiber crops, sugarcane, tobacco, fodder and pasture crops covering origin, climate, soil, varieties, nutrient, weed and water management, harvesting post-harvest technology. (10)

Unit VI Agricultural Statistics

Frequency distribution, descriptive statistics, correlation and regression analyses, co-efficient of variation; Tests of significance-t, F and chi-square (X^2); Data transformation; Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot and simple confounding designs. (8)

Unit VII Sustainable and Alternate Landuse Systems

Concept of sustainability; Sustainability parameters and indicators; Conservation agriculture; Alternate land use systems; Agro forestry systems; Recycling of agricultural and industrial residues. Regenerative Agricultural, Natural and Organic Farming, contract farming; Integrated farming systems. (8)

Unit VIII Basics of Soil and Water plant relationships

Soil and water as vital resources for agricultural production; Hydrological cycle; Soil-plant water relationship; soil infiltration reciprocity, Soil and water conservation; Water harvesting for crop life-saving irrigations; Analysis of hydrologic data and their use. Soil water relations, water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, Soil irritability, classifications, factors affecting profile water storage; soil water potential and its components, hydraulic head; soil water saturated and unsaturated water flow; Field water budget, deep percolation. Evapotranspiration (ET), measures for reducing direct evaporation from soil and crop canopies; Erodibility of soils and their prevention. Concept of plant and cell water potential, plant water potential and its components; Concepts of osmotic adjustment, leaf diffusive resistance, canopy temperature depression (CTD); Water movement through soil - plant atmosphere systems (SPAC), Drought tolerance, mechanisms of drought tolerance. Breeding strategies to improve crop productivity under drought situations. (14)

Irrigation Water Management

History of irrigation in India; Major irrigation projects in India; Water resources development; Crop water requirements; Approaches of irrigation scheduling; Crop modelling; Crop coefficients, water production functions; Methods of irrigation viz. surface methods, overhead methods, micro-irrigation. Measurement of irrigation water, application and distribution efficiencies; Agronomic considerations in tile design and operation of irrigation projects, characteristics of irrigation and family systems affecting irrigation management; irrigation legislation; Design of irrigation canals, design of irrigation structures; Interaction between irrigation and fertilizers. (12)

Crop Production in Problem Soil

Problem soils and their distribution in India, acid, saline, waterlogged; Response of crop to acidity, salinity, sodicity, excess water and nutrient imbalances; Reclamation of problem soils, role of amendments and drainage; Crop production techniques in problem soils and salt tolerant crops. Degraded lands and their rehabilitation. Water quality criteria and conjunctive use of water; Hydrological imbalances and their corrective measures; Management of water logged and flood prone areas Drainage for improving water logged soils for crop production. (8)

Subject Matter Specialist (SMS) – Animal Science

Unit-I: ANIMAL NUTRITION (20 questions)

Animal Nutrition Principles: Nutritional terminology. Importance of nutrients in animal production and health. Role and requirement of water, metabolic water.

Feeds and Fodders: Classification, definitions, availability and importance for livestock production. Forage composition and nutritive values. Factors affecting quality of conserved forages. Formulation and preparation premixes.

Energy and Proteins: Nutritional significance of carbohydrates, lipids and proteins. Partitioning of dietary energy - GE, DE, ME, NE, TDN, SE, etc. Dietary lipids - their digestion, absorption and metabolism. Essential fatty acids. Proteins - digestion, absorption and utilization. Comparative efficiency of amino acids as energy source, Essential and critical amino acids. Protein evaluation - Biological value of protein, protein efficiency ratio, protein equivalent, digestible crude protein. Protein energy inter-relationship.

Minerals, Vitamins and Feed Additives: Minerals: Classification of minerals, Physiological functions, Deficiency symptoms and toxicity - Inter-relationships, Vitamins: Physiological functions and co-enzyme role, Deficiency symptoms, hyper-vitaminosis, Feed Additives and nutraceuticals: Nutritional role of Enzymes, Prebiotics, Probiotics, Phytobiotics, Organic acids and other metabolic modifiers.

Feed Processing and Technology: Methods of processing roughages and concentrates - physical, chemical and biological. Effects of processing on nutritional quality and utilization. Handling, Storage and Quality control of raw feedstuffs and finished feeds. Improvement of the nutritive value of inferior quality roughages. Alternative feed resources. Naturally occurring anti-nutritional factors and common toxins in feeds and forages. Common adulterants of feeds and fodders.

Ruminant Nutrition: Rumen and its environment. Role of rumen microbes. Microbial fermentation in rumen. NPN compounds and their utilization. Manipulation of rumen fermentation. Feeding of ruminants (cattle, buffalo, sheep and goat) during different phases of growth and production. Feeding of high yielding animals. Role of protected/bypass nutrients. Metabolic disorders and nutritional interventions.

Non-ruminant Nutrition: Feeding of poultry for meat and egg production. Nutrient requirements for broilers and layers. Feeding of breeder hens. Feed additives for poultry. Special features of equine, rabbit and companion animals feeding management. Nutrient requirement and feeding of different categories of dogs and cats- peculiarities of feeding cats.

Nutrient Requirements: Feeding standards, their uses and significance, merit and demerits of various feeding standards. Balanced ration and its characteristics. General principles of computation of rations. Least cost rations. Feeding strategies during stress and natural calamities.

UNIT-II: LIVESTOCK PRODUCTION MANAGEMENT (40 questions)

General Livestock Management: Glossary of terms in relation to livestock and poultry production. Present status and future of livestock and poultry development in India. Mixed, integrated and specialized farming systems and their feasibility under Indian climate. Animal production systems in relation to different agro-climatic zones in the country. Methods of identification and age determination in farm animals.

Shelter management: Housing systems of livestock and poultry. Criteria for site selection, design and layout of animal and poultry houses. Environmentally controlled animal/poultry houses. Low-cost houses for livestock and poultry. Automation in livestock/farm houses and precision livestock farming.

Breeding management: Principles of breeding farm animals and poultry. Puberty, sexual maturity and oestrous cycle in farm animals. Body condition scoring and its role in breeding management. Seasonality of breeding in farm animals. Methods of mating, pregnancy diagnosis and heat detection in farm animals. Care and management of breeding, pregnant animals and animals nearing parturition. Transition management in farm animals.

Feeding management: Feeding options for different categories of livestock and poultry. Thumb rules for feeding of different categories of farm animals and poultry. Use of agro-industrial by-products and scarcity fodders. Common property resources for ruminant feeding. Controlled grazing systems and zero grazing systems.

Health management: Farm hygiene and sanitation. Methods of disposal of animal/poultry carcasses. Common disinfectants in farm use. Methods of disinfection. Farm waste management. Deworming and vaccination. Symptoms of ill-health, Segregation, Isolation and Quarantine.

Cattle and buffalo production and management: Prenatal and post-natal care and management of cattle and buffalo. Care and management of young calves. Routine managerial operations like animal identification, weaning, deis-budding, restraint and castration. Concept of service period, dry period and gestation. Selection and judging of dairy cattle. Methods of milking. Clean milk production.

Small ruminant production and management: Housing, feeding and breeding management of sheep and goat. Routine managerial operations like animal identification, shearing and dipping.

Poultry production and management: Production and management of broiler chicken. Brooding of chicks, management of growing, laying and breeding flocks. Shelter, bio-security and light management. Hatchery operations and layer management. Concept of Backyard poultry.

UNIT-3: ANIMAL GENETICS & BREEDING (20 Questions)

Overview and Advances in Animal genetics: History of animal genetics. Exceptions to Mendelian inheritance. Linkage and crossing over. Mosaicism and Chimerism. Different methods of sex determination. Structures and components of genes, genomes, chromosomes and chromatin. Mutation and chromosomal aberrations. Genetics of blood groups. Concept of DNA replication, transcription, protein synthesis and Polymerase Chain Reaction

Principles of Population genetics and Evolution: Quantitative vs Qualitative traits. Population vs Individual. Hardy Weinberg law and its applications. Forces changing gene and genotype frequency. Random genetic drift and effective population size. Natural vs Artificial selection. Concept of Heritability, Repeatability and Genetic correlation. Correlated response and indirect selection. GE interaction vs correlation. Concept of polymorphism and marker-assisted selection

Principles of Breeding in Livestock, Poultry and Lab animals: History of animal breeding. Components of a breeding programme- Breeding objectives, Tools and Strategies. Animal genetic resources of J & K. Conservation & Preservation- insitu and Exsitu conservation. Phenotypic and genotypic characterization. Breed descriptor. Gene bank vs Data bank. Mating systems, Synthetic breeds and heterosis, Natural and Artificial selection. Aids to selection with merits and demerits- Individual, family, within family and pedigree. Progeny testing. Different methods of Sire evaluation. Methods of selection- Tandem, ICL, Selection index. Restriction selection index and Response to selection. Artificial Insemination vs Sexed semen.

Genetic Strategies and Breed Improvement Programmes: Evaluation of past and current genetic improvement programmes for livestock and poultry – Central herd registration scheme, Key village scheme, Intensive cattle development project, Field progeny testing schemes, Network and AICRP projects, Military dairy farms, Nucleus breeding schemes-ONBS, CNBS, MOET, Operation flood, Rashtriya Gokul Mission, National dairy plan, Intensive dairy development programme, National livestock mission, National programme for dairy development etc.

UNIT-IV: VETERINARY MEDICINE (20 questions)

General medicine: Disease epidemiology and definition of diseases (infectious, contagious, sporadic, zoonotic, enzootic, exotic and panzootic) preventive measure to control disease outbreak (quarantine, segregation and isolation), basic understanding about prevalence, incidence, morbidity, mortality, case fatality and odds ratio,

Diagnosis of animal diseases: History taking, general examination, special clinical examination, procedures and protocols for diagnosis. diseases

Gastroenterology: General conditions affecting gastro-intestinal system with special emphasis to simple indigestion, acid/alkaline indigestion, GI ulcer, choke, tympany, Colic, Impaction, traumatic reticulitis, peritonitis, abomasal displacement, ascites, jaundice, hepatitis, enteritis and gastritis.

Diseases of cardiovascular and pulmonary system: Principles of cardiovascular failure, acute heart failure, congestive heart failure, peripheral circulatory failure, myocardial disease, epistaxis, pulmonary congestion and oedema, pneumonia and types of pneumonia.

Diseases of urinary, nervous, musculoskeletal and integumentary system: Nephrosis, nephritis, pyelonephritis, cystitis, urolithiasis, uremia, cerebral anoxia, encephalitis, encephalomalacia, meningitis, encephalomyelitis, paralysis, dermatitis, photosensitisation, alopecia, otitis, kerato-conjunctivitis, corneal ulcer and impetigo.

Common toxicities: Source, pathogenesis, diagnosis, clinical manifestation, treatment and post mortem findings of common toxicities and poisonings with special emphasis to metal toxicities, phytotoxicities, pesticide poisoning, environmental pollution and radiation hazards.

Infectious diseases: Etiologic, epidemiology, pathogenesis, clinical manifestation, post-mortem findings, diagnosis, treatment and control of common livestock diseases with special emphasis to mastitis, strangles, caseous lymphadenitis in sheep and goat, clostridial diseases, ulcerative lymphangitis in equines, listeriosis, leptospirosis, salmonellosis, brucellosis, TB, JD, Actinomycosis, Actinobacillosis, mycoplasmosis, Hog cholera, FMD, PPR, rinderpest, Bovine Malignant Catarrhal Fever, Rinderpest, Mucosal diseases, Bluetongue, rabies, psuedorabies, looping Ill, Scrapie. Sheeppox, Canine Distemper, Infectious Canine Hepatitis, parvo virus enteritis, babesiosis, theileriosis, trypanosomosis and toxoplasmosis.

Parasitic diseases: Etiologic, epidemiology, pathogenesis, clinical manifestation, post-mortem findings, diagnosis, treatment and control of common parasitic diseases with special emphasis to nematode, cestode, and trematode infestations. Major diseases conditions produced by arthropods.

E N D S

Subject Matter Specialist (SMS) – Plant Protection

Entomology (50 Questions)

Classification of insects up to order level, habits, habitats and distinguishing features of different Order and important Families. Structure, types and modification of different body appendages both in Pterygota and Apterygota in important insect orders.

Types of metamorphosis, General features and types of larvae and pupae. Structure, function, modification and physiology of various systems. Arthropod population monitoring and forecasting. Diapause and causes of pest out breaks.

History, importance and scope of biological control. Biocontrol agents-parasites, predators and insect pathogens. Important entomophagous insect Orders and Families. Mass multiplication techniques and economics. Formulation of biopesticides. Biocontrol agents of weeds.

Insecticides and their classification based on their mode of action, mode of entry and chemical nature. Formulations of insecticides. Botanical insecticides and their classification. Insecticides and fungicide compatibility. Problems of pesticide hazards and environmental pollution. Safe use of pesticides. Insecticides Act 1968 and insecticide rules 1971. Pesticides residues in the environment and their dynamics of movements. Insecticide resistance; mechanism, genetics and management of insecticide resistance.

Integrated Pest Management; history, concept, components and principles of IPM. Principles of Host plant resistance, Breeding of plants for Insect Resistance. IPM strategies for field and horticultural crops. Biotechnological approaches for insect resistant plants. Innovative pest management approaches and their case histories.

Pesticide Application Equipment's -Types of appliances: sprayers, dusters, fog generators, smoke generators, soil injecting guns, seed treating drums, flame throwers, etc. Power operated sprayers and dusters. Types of nozzles and their uses. Maintenance of appliances. High volume, low volume and ultra-low volume spraying.

Pests of Field Crops, Horticultural crops, oilseeds, fibre, spices, Condiments, pulses, cereals and ornamentals and their Management Distribution, host range, biology and bionomics, nature of damage and management of arthropod pests. Vertebrate and Invertebrate pests of Stored Products and their Management. Storage losses, sources of infestation/infection, Storage structures, bulk storage and bag storage, their relative efficacy and demerits. Grain drying methods and aeration.

Arthropod Vectors of Plant Diseases. Common arthropod vectors and their relationship with the plant pathogenic fungi, bacteria, viruses and mycoplasma. Management of insect vectors Honey Bees and their economic importance. Bee species, their behaviour, habit and habitats. Bee Keeping: bee pasturage, hives and equipment's, seasonal management. Bee enemies including diseases and their control. Insect pollinators and pollination management.

Silkworm species and their rearing techniques. Nutritional requirements of silkworms. Enemies and diseases of silkworms and their management. Sericulture organization in India.

Statistics and Computer Application in agricultural experiments. Correlation and regression: tests of significance; Principles of various experimental designs. Probit analysis. Use of software packages like SPSS, SAS, etc. for the above tests and designs of experiments for analysis.

PLANT PATHOLOGY (50 Questions)

History and Principles of Plant Pathology Milestones in phytopathology with particular reference to India. Major epidemics and their social impacts. Historical developments of chemicals, legislative, cultural and biological protection measures including classification of plant diseases. Physiologic specialization, Koch's postulates. Growth, reproduction, survival and dispersal of plant pathogens. Factors influencing infection, colonization and development of symptoms. Sanitary and phytosanitary issues and post entry quarantine.

Plant disease diagnosis and symptomatology. Molecular detection of pathogens in seeds and other planting materials: Laboratory equipment and their use: autoclave, hot air oven, laminar flow, spectrophotometer, electrophoresis, incubator, ultracentrifuge, ELISA Reader. Physiological and Molecular Plant Pathology Mechanisms of disease resistance in plants. Mycology, Classification of fungi. Economic mycology, edible fungi and entomopathogenic fungi. Mycorrhizal associations.

Plant Bacteriology Identification and classification of bacteria. morphology, ultrastructure and chemical composition of prokaryotic cell. Bacteriophages: lytic and lysogenic cycles. Prokaryotic inhibitors and their mode of action. Economic uses of prokaryotes. Morphology, biochemical characteristics, reproduction and life cycle of phytoplasma and other fastidious prokaryotes.

Plant Virology Nature, composition and architecture of viruses and viroids. Properties of viruses. Conventional and biotechnological techniques used in detection and diagnosis of plant diseases. Behaviour of viruses in plants including infection, replication and movement. Histopathological changes induced by viruses in plants, inclusion bodies. Survey, surveillance and prediction and forecasting of diseases. Epidemic analysis and disease prediction models. Crop loss assessment.

Parasitic and Non-parasitic Diseases Nutritional deficiencies. Fungal, bacterial and viral diseases of Crop Plants like cereals, millets, oilseeds, pulses, fruits, vegetables, plantation, fiber, spices and ornamental crops with special reference to etiologic, disease cycle, perpetuation, epidemiology and management. Post harvest diseases in transit and storage; aflatoxins and their integrated management.

Production of disease free seeds and planting materials. Seed certification. Fungicides and their classification based on their mode of action, mode of entry and chemical nature. Formulations of fungicides; resistance to fungicides/ antibiotics.

E N D S

Subject Matter Specialist (SMS) – **Food Science and Technology/Home Science**

- **Introductory Food Technology.** Introduction to Food Technology, Food Processing Industries of Importance in India (3 Marks)
- **Food Microbiology.** Bacterial growth curve, causes of food spoilage, sources of microbial contamination of foods (dairy, meat, bakery, fruit and vegetables and their products), food-borne illnesses (5 Marks)
- **Processing and Preservation of Foods.** Principles and methods of food preservation, methods of food preservation- pasteurization, sterilization, canning, dehydration, freezing, fermentation, irradiation; Asceptic preservation, Hurdle Technology; Novel methods of processing and preservation- high hydrostatic pressure (HHP), dielectric heating, pulsed electric field (PEF), pulsed x-ray, thermo-sonication, ohmic heating (10 Marks)
- **Technology of foods of plant origin.** Preparation of fruits and vegetables for processing, Zero energy cool chambers (ZECCs), charcoal cool storage rooms (CCSR); Pre-cooling- methods and advantages; canning of fruits and vegetables; Processed products from fruits and vegetables- fermented and non-fermented; role of pectin in gel formation of jellies and marmalades; Tea, cocoa and coffee processing; defects in chocolates- sugar and fat bloom (10 Marks)
- **Food Grain Processing.** Structure, composition and milling of different grains-wheat, rice, barley, oats, maize and millets; rheology of wheat and rice flour, parboiling of paddy, structure and composition of pulses; extruded products from rice and maize (5 Marks)
- **Technology of foods of animal origin.** Dairy plant operations from farm to fork; ultrahigh temperature processed milk; low temperature, long time (LTLT) and high temperature, short time (HTST) processed milk; toned and double-toned milk; single and double stage homogenization; cleaning-in-place (CIP) and cleaning-out-of-place (COP) in dairy industry, Pearson's square method for ingredient calculations in dairy industry; chemistry & microscopic structure of meat; ante- and post-mortem inspection of meat; rigor mortis; curing of meat; Fish processing and spoilage; structure and composition of eggs, preservation of eggs; meat tenderization and role of enzymes (10 Marks)
- **Food Safety & Quality.** FSSAI-an overview; auditing inspections; environmental protection act (EPA-ISO 14000); HACCP, Codex Alimentarius Commission; Common food adulterants and their detection methods; FSMS-ISO-22000-2005; food allergens and FSSAI guidelines (5 Marks)

- **Food Engineering/Packaging and labeling.** Laws of grinding including their calculations; mass and energy balances in food processing; steady and unsteady state heat transfer, mass transfer- laws governing; momentum transfer; calculations on freezing time; dehydration and rehydration ratios; Dimensionless numbers- Reynold's number, Fourier's Number; Grashoff Number, Prandtl Number; Nusselt Number; Kinetic modelling for microbial inactivation using thermal and non-thermal processes; thermal process calculations- D-value, Z-value and F-value; Spoilage probability, rheology-Newtonian and non-Newtonian fluid behavior and their calculations; shelf-life prediction studies
Food-packaging interactions, nutritional labeling requirements of foods- recent trends as per FSSAI, FSSAI guidelines on nutritional labeling **(10 Marks)**
- **Food biotechnology.** Use of biotechnology in food additives; single cell proteins (SCPs); GM Foods- Regulatory aspects **(3 Marks)**
- **Food and flavour chemistry.** Structure and properties of carbohydrates; proteins and fats. Starches- properties and applications; glycemic index; resistant starches; moisture sorption isotherms (MSIs), enzymatic and non-enzymatic browning; Roul't's law and water activity- calculations; mold-free shelf life (MFSL)
Protein and lipid derived flavors; flavour emulsions; flavour composites; essential oils and oleoresins. **(10 Marks)**
- **Human nutrition.** Balanced diet; food groups, food pyramid; role of micronutrients in human health; phytochemicals; antioxidants, prebiotics, probiotics and postbiotics; nutraceuticals; Food for specific health use (FOSHU), major public health and nutritional problems in India- causes, magnitude and distribution **(6 Marks)**
- **Food Toxicology.** Anti-nutritional factors; toxicants in foods; aflatoxins, patulin in apple industry **(3 Marks)**
- **Textile science.** Natural and man-made fibers- classification and processing **(5 Marks)**
- **Human development.** Role of family, school and peer interaction in the development of child; development programmes for children and women **(5 Marks)**
- **Family Resource Management.** Consumer rights; Consumer protection Act and other laws; Environmental and health hazards due to pollution; environmental education and rain water harvesting **(5 Marks)**
- **Home Science Extension and Communication.** Genesis of rural development in India; gender sensitivity in extension education programmes; Integrated rural development programmes (IRDP); Development of women and children in rural areas (DWCRA); Training of rural youth for self-employment (TRYSEM); KVKs; NGOs. **(5 Marks)**

E N D S

Subject Matter Specialist (SMS) – Floriculture & Landscaping

UNIT 1: Systematics of Ornamental Plants

Nomenclature: History, origin, plant diversity hotspots, plant classification and nomenclature systems, phylocode, International systems: International Code, Treaties, International and National Organizations, Biodiversity Act, Plant identification features, keys and methods; plant descriptors. Red Data Book, Registration authorities (NBPGR, PPVFRA, NBA) Families: Description of families, viz., Rosaceae, Asteraceae, Caryophyllaceae, Orchidaceae, Aracaceae, Liliaceae, Acanthaceae, Palmaceae, Asparagaceae, Malvaceae, Musaceae, Oleaceae, Iridaceae and important genera. Cryopreservation, Role of Molecular Techniques in Modern plant Systematics.

UNIT 2. Breeding of Ornamental Crops

Principles of plant breeding, Evolution, origin, distribution and conservation of ornamental genetic resources, Genetic divergence and varietal wealth, Patents, Intellectual Property Rights (IPR) and Plant Breeders Rights (PBR): Introduction and initiatives in IPR and PBR of ornamental crops and Plant Variety Protection in India. Genetic mechanism and inheritance of flower colour, doubleness, flower size, fragrance, plant architecture, post-harvest life; abiotic and biotic stress tolerance/ resistance. Breeding methods suitable for sexually and asexually propagated, self and cross-pollinated flower crops and ornamental plants-Introduction, selection, domestication, hybridization, pedigree selection, backcross method, clonal selection, heterosis & F1 hybrids, polyploidy and mutation breeding for varietal development. Role of biotechnology in improvement of flower crops including transgenics, somaclonal variation, in-vitro mutagenesis, in-vitro selection, genetic engineering, molecular markers, etc. Role of heterosis, production of hybrids, reproductive barriers-Male sterility, Incompatibility, Breeding objectives, constraints and achievements made in commercial flower crops - rose, jasmine, chrysanthemum, marigold, gaillardia, tuberose, crossandra, carnation, dahlia, gerbera, gladiolus, orchids, anthurium, aster, liliuhibiscus, bougainvillea, nerium, flowering annuals (petunia, zinnia, dianthus, snapdragon, pansy, stock, calendula, balsam, annual dahlia)

UNIT 3. Commercial Production of Cut Flowers

National and International Scenario of cut flower production, Scope and importance of cut flower trade, Cut flower production problems in India (constraints); patent rights, Nursery management-media for nursery raising, special nursery practices; Growing environment- open field and protected cultivation, Soil analysis, soil health card, soil/media requirements, land preparation, planting methods, influence of

environmental parameters (light, temperature, moisture, humidity and CO₂), microclimate management for growth and flowering; Commercial cut flower production

- Commercial varieties, water integrated nutrient management (INM), fertigation, weed management, crop specific practices - ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes; Flower Regulation-Flower forcing and year round/ off-season flowering through physiological, chemical interventions, and environmental manipulation; Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, methods of delaying flower opening, pre-cooling, pulsing, packing, storage & transportation, marketing, export potential of cut flower crops, institutional support, Agri Export Zones; 100% Export Oriented units in India, Crop Insurance, flower auction centre. Flower crops: Rose, chrysanthemum, carnation, gerbera, gladiolus, tuberose, orchids, anthurium, chinaaster, liliun, bird of paradise, heliconia, alstroemeria, dahlia, gypsophilla, solidago, limonium, stock, cut green foliages and fillers.

UNIT 4. Commercial Production of Loose Flowers

Scope, scenario and importance of loose flower crops, constraints and opportunities in loose flower production. Growing Environment-nursery management, pro-tray nursery under shadenets, Soil and climate requirements, field preparation, systems of planting, precision farming techniques; Soil analysis, soil health card, Water management, weed management, special horticultural practices such as ratooning, training and pruning, pinching and disbudding, etcrole of growth regulators in growth and flowering, physiological disorders and remedies, INM, IPM and IDM. Crop regulation-Flower forcing and year round/ off-season flowering, production for special occasions, through physiological interventions, chemical regulation; Post harvest management-Harvest indices, harvesting techniques, post-harvest handling and grading, packing and storage, transportation and marketing including important Indian flower markets, export potential, HPMC, APMC and online flower trading, institutional support, Crop Insurance. Flower crops -Jasmine, rose, chrysanthemum, marigold, aster, gaillardia, tuberose, crossandra, Nerium, hibiscus, barleria, celosia, gomphrena, non-traditional flowers- Nyctanthes(Har singar), Tabernaemontana, ixora, lotus, water lily, tecoma, michelia (champaka), spider lily, water lily, gardenia, and balsam.

UNIT 5. Ornamental Gardening and Landscaping

Gardens and components: Historical background of gardening, Importance and scope of ornamental gardening, Styles and types of ornamental gardens, formal, informal and free style gardens, types of gardens-English, Mughal, Japanese, Persian, Spanish, Italian. French, Hindu, Buddhist garden. Garden

components: living components), arboretum, shrubbery, fernery, palmatum, arches and pergolas, edges and hedges, climbers and creepers, trees, shrubs, cacti and succulents, herbs, annuals/seasonals, ornamental grasses, flower borders and beds, ground covers, carpet beds, bamboo groves, bonsai, etc. Production technology for selected ornamental plants; Non-living components-Path, garden gate, fencing, paving and garden features like fountains, garden seating, swings, lanterns, basins, bird baths, sculptures, waterfalls, bridge, steps, ramps, lawn. Specialized gardens: vertical garden, roof garden, terrace garden, water garden, shade garden, , bog garden, sunken garden, rock garden, clock garden, color wheels, temple garden, sacred gardens (emphasis on native plants), Zen garden ; Landscape Planning-Principles and elements of landscaping: Basic drawing skills, use of drawing instruments, garden symbols, steps in preparation of garden design, programmes phase, design phase, etc. . Organization of spaces, visual aspects of plan arrangement- view, vista and axis. Principles of circulation, site analysis and landscape, Water requirement, use of recycled water in landscaping. Landscape for different situations: Urban landscaping, landscaping of institutions, industries, residential areas, hospitals, roadsides, traffic islands, dam sites, IT/ SEZ parks, corporates, farm houses, children parks, public parks airports, railway station and tracks, and river banks. Bio-aesthetic planning, eco-tourism, theme parks, therapeutic gardening, xeriscaping, waterscaping

UNIT 6. Protected Cultivation of Flower Crops

Prospects of protected floriculture in India; Types of protected structures –Greenhouses/ polyhouses, shade houses, mist chambers, lath houses, orchidarium, fernery, rain shelters etc., Principles of designing and erection of protected structures. Low cost/medium cost/high cost structures; Location specific designs; Structural components; Suitable flower crops and foliage plants for protected cultivation; Environment control - Microclimate management and manipulation of temperature, light, humidity, air and CO₂; Heating and cooling systems, ventilation, naturally ventilated greenhouses, fan and pad cooled greenhouses, light regulation; water harvesting, Intercultural Operations and Crop Regulation: Containers and substrates, soil decontamination, layout of drip and fertigation system, water and nutrient management, weed management, physiological disorders, IPM and IDM; Crop regulation by chemical methods, special horticultural practices (pinching, disbudding, deshooting, deblossoming, etc. staking and netting, Photoperiod regulation; Automation and standards: Automation in greenhouses, sensors, solar greenhouses and retractable greenhouses, GAP/ Flower labels, Export standards, EXIM policy, APEDA regulations for export, non-tariff barriers. Flower crops: Rose, Chrysanthemum, Carnation, Gerbera, Orchids, Anthuriums, Lilium, Limonium, Lisianthus, Heliconia, Cala lily, Alstromeria, etc.

UNIT 7. Value Addition in Floriculture

National and global scenario, scope and prospects of value addition, production and exports, Types of value-added products, techniques of value addition including tinting, pulsing., Value addition in loose flowers and product development such as gulkand, floral tea, rose oil, rose water, Pankhuri, floral dyes, rose sherbet, floral ice creams, sweets, garlands, veni, floats, floral decorations, etc., value addition in cut flowers such as fresh floral arrangement: Selection of containers and accessories, Flower arrangement styles, Ikebana schools (Ikenobo, Ohara, Sogetsu, etc.), Moribana, Nagiere, contemporary style /free style, bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands, etc.; Selection of containers and accessories for floral products and decorations; Dry flowers- identification and selection of flowers and plant parts; Raw material procurement, preservation and storage; tips for collecting dry flower making, selection of stages for picking of flowers for drying, Techniques in dry flower making -Drying, glycerising, bleaching, dyeing, embedding, pressing; Accessories; Designing and arrangement -dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths; petal embedded handmade papers, Packing and storage; Post drying management including moisture, pests and moulds in value-added dried products. Concrete and essential oils- Selection of species and varieties (including non-conventional species), extraction methods, packing and storage. Aromatherapy. Types of pigments-carotenoids, anthocyanin, chlorophyll, betalains; Significance of natural pigments as nutraceuticals and pharmaceuticals; Extraction methods; Applications in food, cosmetics, pharmaceutical and poultry industries. Dying: Synthetic and Natural dyes, dying techniques, color retention.

Unit 8. Turf grass Management

History, present status and prospects of turf industry; site selection, basic requirements, site evaluation, concepts of physical, chemical and biological properties of soil pertaining to turf grass establishment; criteria for evaluation of turf quality. Turf grasses -Types, species, varieties, hybrids; identification of turf grasses, selection of turf grasses for different locations; Grouping according to climatic requirement, adaptation, ; Turfing for roof gardens; Preparatory operations; Growing media used for turf grasses, turf establishment methods- seeding, sprigging/dibbling, plugging, sodding/turfing, turf plastering, hydro-seeding, instant turfing (portable), astro-turfing, synthetic turfing; Turf management -Irrigation, drainage, nutrition, special practices such as aerating, rolling, coreaerification, dethatching, verticutting, soil top dressing, etc. Use of turf growth regulators (TGRs) and micronutrients. Turf mowing -mowing equipment, techniques to minimize wear and compaction, weed control, biotic and abiotic stress management in turfs; standards for turf, use of recycled water for turf establishment and maintenance. Selection and

maintenance of turf grasses for playgrounds, residential and public parks, turfing of Govt. and Corporate office gardens, event specific preparation, turf colourants.

UNIT 9: Indoor Plants and Interiorscaping

Importance and scope: Importance and scope of indoor plants and interiorscaping, Indoor plants and indoor air quality. Factors affecting growth, development and flowering of indoor plants. Classification and principles: Classification of indoor plants based on light, temperature, humidity and pollution tolerance. Description and cultivation of various indoor plants. Principles of interior-scaping, Role in pollution mitigation. Cultural operations: Containers and substrates, preparation of growing media, propagation, training, grooming, nutrition, management of disease, pests and weeds. Maintenance of plants including repotting, foliar nutrition, light exposure and plant rotation. Media standards, Nursery and Export standards for potted plants. Special gardens including miniature gardens and plant stand. Presentations like dish garden, terrarium, bottle gardens, hanging baskets, window boxes and bonsai. Vertical gardens- history, planting material, structures, containers, substrate, water and nutrient management, supplemental lighting. Marketing channels, Business models including plant rentals.

UNIT 10: Seed Production in Flower Crops

International and national scenario of flower seed production, scope, and importance of seed production in flower crops. Constraints in flower seed production. Methods of seed production, agro-techniques for production of nucleus, breeder and certified seeds. Harvesting, seed processing, seed priming, seed chain, packaging and storage; Mass selection, progeny selection, use of incompatibility and male sterility, maintenance of variety and seed production in flower crops; F1 hybrid seed production advantages, steps involved in hybrid seed production, pollination behaviour and isolation, pollination management methods in production of F1/ hybrids in different flower crops; Seed certification, Seed standards, seed act, plant breeders rights and farmers' rights, Bio safety, handling of transgenic seed crops, importing of seeds and OGL, trade barriers in seed business, sanitary and phytosanitary issues, custom clearance and quarantine. Marketing and economics of flower seeds; Flower crops: Marigold, petunia, antirrhinum, zinnia, pansy, lupin, calendula, phlox, vinca, dianthus, sunflower, annual chrysanthemum, poppy, corn flower, rice flower, aster, annual dahlia, crossandra and gaillardia.

Unit 11. Computer Aided Design (CAD) for Landscaping

Principles of integrating the architecture and landscaping, Exposure to CAD (Computer Aided Design) - Applications of CAD in landscape garden designing, 2D drawing by AUTOCAD, 3D drawing by ARCHICAD, 3D drawing by 3D MAX software. Creating legends for plant and non-plant components. Basics of Photoshop software in garden designing; 2D drawing methods AUTOCAD Basics, Coordinate

systems in AUTOCAD LT 2007, Point picking methods, Toolbars and Icons, File handling functions, Modifying tools, Modifying comments, Isometric drawings, Drafting objects; Using patterns in AUTOCAD drawing, Dimension concepts, Hyperlinking Script making, Using productivity tools, e- transmit file, Making layout; 3D drawing methods, ARCHICAD file system, Tools and Infobox, modification tools, structural elements, GDL objects (Grid Dimensional Linking), Creation of garden components through ARCHICAD; ARCHICAD organization tools, Dimensioning and detailing of designs, Landscape designing softwares and CD ROM for ornamental plant material (TRES, HIMFLORA, CAPSSA, etc), Attribute settings of components, Visualization tools for landscape preview, Inserting picture using Photoshop.

E N D S

Subject Matter Specialist (SMS) – Fruit Science

Unit 1. Tropical Fruit Production

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, rootstocks, stionic influence, planting systems, cropping systems, root zone and canopy management, nutrient and water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination, fruit set and development, honeybees/pollinators in cross pollination, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques, processing and value addition, industrial and export potential, Agri Export Zones (AEZ) and industrial supports, Canopy management through plant growth inhibitors, training and pruning and management practices in relation to growth, flowering, fruiting and fruit quality, insect and disease management, Integrated Nutrient Management (INM), bio- fertilizers and fertigation in tropical fruit crops, organic fruit production, pre-harvest and post-harvest factors affecting shelf-life of fruits. Crops: mango, banana, citrus, papaya, guava, sapota, jackfruit, pineapple, Annona, avocado, aonla, pomegranate and ber.

Unit 2. Subtropical and Temperate Fruit Production

Commercial varieties of regional, national and international importance, eco-physiological requirements, recent trends in propagation, rootstocks, stionic influences, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bioregulation, abiotic factors limiting fruit production, physiology of flowering, pollinizers, pollinators, fruit set and development, abiotic factors limiting production, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, precooling, storage, transportation and ripening techniques; processing and value addition, industrial and export potential, Agri Export Zones (AEZs) and industrial support, Canopy management through plant growth inhibitors, training and pruning and management practices in relation to growth, flowering, fruiting and fruit quality, insect and disease management, pre harvest and post-harvest factors affecting shelf life. Crops: apple, pear, quince, grapes, plums, peach, apricot, cherries, litchi, loquat, persimmon, kiwifruit. strawberry, nuts (walnut, almond, pecan).

Unit 3. Breeding of Fruit Crops

Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems – spontaneous mutations, polyploidy, incompatibility, sterility, parthenocarpy, apomixis, breeding objectives, ideotypes, approaches for crop improvement — introduction, selection, hybridization, mutation breeding, polyploid breeding, rootstock breeding, improvement of quality traits, breeding for biotic and abiotic stresses, biotechnological interventions and achievements. Intellectual Property Rights (IPR) and Plant Breeders Rights (PBR): Introduction and initiatives in fruit crops.

Crops: mango, banana, pineapple, citrus, grapes, guava, sapota, jackfruit, papaya, custard apple, aonla, avocado, ber, mangosteen, litchi, jamun, phalsa, mulberry, raspberry, kokam, apple, pear, plums, peach, apricot, cherries, strawberry and nuts, pomegranate and kiwi fruit.

Unit 4. Growth and Development of Fruit Crops

Growth and development- definition, parameters of growth and development, growth dynamics, morphogenesis; annual, semi-perennial and perennial horticultural crops, environmental impact on growth and development, effect of light, photosynthesis and photoperiodism, vernalisation, effect of temperature, heat units, thermoperiodism; Assimilate partitioning during growth and development, influence of water and mineral nutrition during growth and development, biosynthesis of auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, morphactins, role of plant growth promoters and inhibitors; Developmental physiology and biochemistry during dormancy, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization, fruit set, fruit drop, fruit growth, ripening and seed development; Growth and developmental process during stress - manipulation of growth and development, impact of pruning and training, chemical manipulations in horticultural crops, molecular and genetic approaches in plant growth development, global warming, effect of climate change on spatio-temporal patterns of temperature and rainfall, concentrations of greenhouse gasses in atmosphere. Climate mitigation measures through crop management- use of tolerant rootstocks and varieties, mulching, use of plastic, windbreak, spectral changes, protection from frost and heat waves. Climate management in greenhouse: heating vents, CO₂ injection, screens and artificial light. Impact of climate changes on invasive insects, diseases, weeds, fruit yield, quality and sustainability.

Unit 5. Biotechnology of Fruit Crops

Harnessing biotechnology in horticultural crops; introduction and significance, history and basic principles, influence of plant materials, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture; callus culture - types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis; use of bioreactors and in-vitro methods - for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues, acclimatization of tissue culture plants; Physiology of hardening - hardening and field transfer, organ culture - meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture and fusion; Somatic cell hybridization-construction and identification of somatic hybrids and cybrids, wide hybridization, invitro pollination and fertilization, haploids, in- vitro mutation, artificial seeds, cryopreservation, rapid clonal propagation, genetic engineering- principles and methods, and transformation in horticulture crops, use of molecular markers and genomics. Gene silencing, gene tagging, gene editing in fruit crops. In-vitro selection for biotic and abiotic stress, achievements of biotechnology in horticultural crops.

Unit 6. Propagation and Nursery Management in Fruit Crops

General concepts and phenomena: Introduction, understanding cellular basis for propagation, sexual and asexual propagation, apomixis, polyembryony, chimeras. Factors influencing seed germination of fruit crops, dormancy, hormonal regulation of seed germination and seedling growth. Seed quality, treatment, packing, storage, certification and testing. Conventional asexual propagation: Cutting– methods, rooting of soft, semi-hard and hardwood cuttings under mist and hotbeds. Use of PGR in propagation, physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods. Budding and grafting – principles and methods, graft union formation, establishment and management of scion/bud wood bank. Stock, scion and inter stock relationship– graft incompatibility, physiology of rootstock and top working. Micro-propagation – principles and concepts, commercial exploitation in horticultural crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micro-grafting, meristem culture, genetic fidelity testing. Hardening, packaging and transport of micro-propagules. Management Practices and Regulation, Nursery – types, structures, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, nursery accreditation, import and export of seeds and planting material, quarantine, role of Post-Entry Quarantine (PEQ), and Clean Plant Programme (CPP).

Unit 7. Systematics of Fruit Crops

Nomenclature and classification: Biosystematics – introduction and significance; history of nomenclature of cultivated plants, classification and nomenclature systems; International code of nomenclature for cultivated plants. Identification and description: methods of identification and description of cultivated fruit and nut species and their wild relative; development of plant keys for systematic identification and classification. Development of fruit crop descriptors- based upon Biodiversity International Descriptors and UPOV/ DUS test guidelines, botanical and pomological description of major cultivars and rootstocks of tropical, subtropical and temperate fruits and nut crops. Registration and modern systematics: GI and Farmers variety Registration, Use of chemotaxonomy, biochemical and molecular markers in modern systematics.

Unit 8. Export Oriented Fruit Production

Statistics and World Trade: National and international fruit export and import scenario and trends; statistics and India's position and potentiality in world trade; export promotion zones in India. Government policies, norms and standards: Scope, produce specifications, quality and safety standards for export of fruits, viz., mango, banana, grape, litchi, pomegranate, walnut, apple and other important fruits. Processed and value-added products, post-harvest management for export including packaging and cool chain; HACCP, Codex alimentarius, ISO certification; FPO license, role of APEDA, FSSAI, BIS, WTO and its implications, sanitary and phyto-sanitary measures, MRLs. Infrastructure and plant material; quality fruit production under protected environment; different types of structures – automated greenhouses, glasshouse, shade net, poly tunnels – design and development of low-cost greenhouse structures. Seed and planting material; meeting export standards, implications of plant variety protection – patent regimes.

Unit 9. Minor Fruit Production

Occurrence, Adoption and General Account: Importance – occurrence and distribution, climate adaptation in fragile ecosystem and wastelands. Propagation and cultural practices: traditional cultural practices and recent development in agro-techniques; propagation, botany-floral biology, growth patterns, mode of pollination, fruit set, ripening, fruit quality. Post-harvest management, marketing; minor fruit crops in terms of nutritional and pharmaceutical values; their uses for edible purpose and in processing industry

Crops: Bael, chironji, fig, passion fruit, jamun, phalsa, karonda, wood apple, cactus pear, khejri, kair, pilu, lasoda, loquat, tamarind, dragon fruit, monkey jack, mahua, khirni, amra, kokum, cape gooseberry, kaphal, persimmon, pistachio, sea buckthorn, hazel nut and other minor fruits of regional importance.

Unit 10. Post-Harvest Management of Fruit Crops

Post-harvest management scenario of India and world, fruit maturity indices, harvesting practices in tropical, sub-tropical and temperate fruits, influence of pre-harvest practices, Climacteric and non-climacteric fruits, enzymatic and textural changes, respiration, transpiration during fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest losses, pre-cooling; Treatments prior to shipment, viz., pre-cooling, chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage-ventilated, refrigerated, MAS, CA storage, physical injuries and post-harvest and storage disorders; fruit ripening chambers, Packing methods and transport, principles and methods of preservation, Principles of food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies; Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology of value-added products, processing waste management, food safety standards.

E N D S

Subject Matter Specialist (SMS) – Soil Science

➤ Soil Pedology (20 marks)

Soil Pedology concept of land soils Soil Sciences, weather in of rocks & minerals, factors of soil formation, pedogenic processes. Soil development, soil profile, soil taxonomy, soil moisture, temperature regime. Interpretation of soil survey data for land capability classifications. Study of base maps, topo sheets and aerial photographs.

➤ Soil Physics (15 marks)

Soil texture- classes, soil structure, classification, bulk density and particle diversity of soil, porosity, Soil water infiltration. Thermal properties of soils. Soil air composition, soil erosion by water. Soil erosion measures, land degradation. Land use planning, concept of watershed management.

➤ Soil Chemistry (15 marks)

Soil colloid, structure, constitution of clay minerals, charge development on clays & organic matter. Buffer capacity of soils. Electro chemistry of soils. Diffuse double layers. Soil organic matter fractionation, clay organic interactions. Thermodynamics, hysteresis in sorption desorption of oxyanions and anions. N, P, and K fixation in soils. Chemistry of acid, salt affected and submerged soils.

➤ Soil fertility (25 marks)

Essential elements in plant nutrition, transformation & transport of nutrients. Manures & fertilizers, manufacture of different fertilizers. Quality control of fertilizers, soil fertility evaluation. Common text method for fertilizer recommendations. Integrated nutrient management. Lime & gypsum requirement. Irrigation water quality. Pollution & its types. Radioactive contamination of soils.

➤ Soil microbiology (15 marks)

Soil microbiology, soil biota, soil microbial ecology. Microbiology & biochemistry of root soil interface. Phyllosphere soil enzymes, importance. Soil characteristics influencing growth activity of micro flora, humus formation, cycles of important organic nutrients. Biodegradation of pesticides, organic wastes, Biofertilizers, definition & classification, role in crop production, Methods of soil, plant & fertilizer analysis. Spectrophotometry, inductively coupled plasma optical emission spectroscopy, AAS (Atomic absorption spectrophotometer).

➤ Statistical use in soil science (10 marks)

Statistical experimental designs for field and pot experiments. Statistical measures of central tendency and dispersion: Correlation & regression, tests of significance, t & F tests. Computer use in soil research.

E N D S