



## **Syllabus for Recruitment Test**

**Name of the post: Subject Matter Specialist(T-6)**



**Directorate of Rapeseed-Mustard Research**

**Sewar, Bharatpur-321303 (Rajasthan)**

## **Syllabus- AGRICULTURE EXTENSION**

Objectives, philosophy and principles of extension education; extension role of agricultural universities; comparative studies of extension education system in selected developed and developing countries; different models of organizing agricultural extension, particularly tools and methodology; agricultural information (knowledge) system; teaching and learning processes; principles of adult learning; audio-visual aids and their classification; modern communication and information technology; application of PERT/CPM principles of programme planning process; agricultural and rural development programmes in India.

Principles of extension management, different theories of management processes and functions of management organizational set-up for extension services in India including the T & V system; types of training programmes for extension personnel and farmers; model of modern training, modern technologies, experimental learning methods, entrepreneurial development process; factors affecting extension training.

Scope and importance of psychology in extension education, concept of human society; characteristics of rural people; socio-psychological basis of human behaviour, socio-psychological factors in transfer of technology; social structure; social interactions and processes; values and norms of rural social systems; rural institutions; role of leadership; process of diffusion and adoption; consequences of adoption of innovations; communication process and elements of communication; theories of communication, fundamentals of farm journalism; role of mass media; modern electronic media.

Process of scientific research; validity and reliability of measuring devices; methods of observation and data collection; techniques of tabulation; analysis of data and report writing; methods of statistical analysis; statistical designs.

## **Syllabus- HORTICULTURE**

### **Floriculture**

General principles of Floriculture. Importance and scope of floriculture, garden designs and styles, lawns and their management; origin, classification and description of commercially important floricultural crops; factors affecting growth and flowering of ornamental plants; methods of propagation including tissue culture; growing of cut flower crops under protected conditions; pre-and post-harvest care of cut flowers; recent advances in production technology for rose, chrysanthemum, gladiolus, carnation, orchids, jasmines, tuberose, marigold and anthurium.

Role of male-sterility, self-incompatibility, polyploidy and mutations in the evolution of new varieties of flowers; heterosis breeding; male-sterility and its use in the production of F1 hybrids; breeding for disease resistance; use of anti-transpirants in increasing shelf-life of plants and flowers; role of growth regulators in ornamental plants.

Major methods of preservation and processing of horticultural and ornamental crops.

### **Pomology**

General principles of Pomology. Area and production of fruits, climatic and soil requirement, cultivation practices of major fruit crops like mango, citrus, banana, grape, papaya, guava, pineapple, loquat, phalsa, jackfruit, mangosteen, sapota, cashewnut, ber, pomegranate, date palm, aonla and temperate fruits like apple, pear, peach, almond, plum, apricot and cherry.

Principles of pruning and training, weed control; modern methods of propagation including micro-propagation and use of growth regulators in fruit crops; water management; classification of fruit crops; use of biofertilizers; rootstocks and high density orcharding.

Improvement of plant types of important fruit crops; physiological manipulations for overcoming problems like biennial bearing, spongy tissue, malformation, necrosis and black tip in mango; delayed maturity and uneven ripening in grapes and granulation in citrus.

### **Vegetable Science**

General principles of vegetable production. Area and production of vegetable crops in India, climatic and soil requirements, seed production techniques in vegetable crops and related problems. Origin, classification, cytogenetics, floral biology and breeding behaviour of different vegetables; methodology for the improvement of different self-and cross-pollinated vegetable crops including breeding for disease and insect resistance; Mendel's laws of inheritance.

Role of different nutrients, their deficiency symptoms and remedial measures; improved vegetable production technology.

Important statistical designs and methods of statistical analysis

## Syllabus- HOME SCIENCE

**Human Nutrition, Health and Interventions:** Balanced diet-Food groups, Food pyramid. Macro and micro nutrients in human nutrition- Carbohydrates, proteins, lipids, vitamins, minerals and water-requirement. Inborn errors of metabolism. Functional foods and nutraceuticals. Diet & nutritional therapy in common disorders. Food allergies and intolerances. Major Public Health and Nutritional problems in India-Causes, magnitude and distribution. Assessment of Community Nutritional status by Standard methods. National Nutrition Policy, National programmes to combat malnutrition.

**Food Science and Processing Technologies:** Need & Scope of Food Science, Methods of cooking-merits & demerits. Food fortification, enrichment and supplementation. Food additives and Preservatives. Anti-nutritional factors & Toxicants in foods. Food hygiene and sanitation, Food-borne illnesses, infections and food poisoning. Food Adulteration, Food Standards, Laws & Regulations for food safety. Post harvest losses, food spoilage and its causes. Food Processing techniques, effects on nutritional value, food packaging and labeling. Processing techniques for cereals, millets and legumes, milk and milk products, fruits vegetables and oilseeds. Storage of perishable and non-perishable foods.

**Textile Science, Fashion Designing and Garment Production:** Natural and Man-made fibers: Classification and Processing. Dyes and Pigments - classification of dyeing techniques. Methods of printing (block, screen, stencil, roller, transfer printing and batik). Principles of weaving and basic weaves, Knitting - principles, classification and knitting machines.

**Human Development and Family Dynamics:** Stages of human development. Physical, emotional, intellectual, social, moral, language and personality development. Role of family, school and peer interaction in the development of the child. Theories of child/human development with special reference to cognitive development theories. Socio- cultural aspects of population growth and population policies. Developmental programmes for women and children. Status of women in India. Approaches to study family- developmental social, psychological and educational. Trends and issues in early childhood care and education. Theories of Personality development.

**Family Resource Management and Consumer Science:** Systems approach to Family Resource Management, Concept, Planning, Resources, management processes communication. Application of management process to time, money and energy for work simplification. Application of Mundel's classes of change in household work, agricultural and allied tasks. Equipment, tools and accessories for rural and urban houses. Guidelines for budgeting. Banking, e-banking and insurance. Credit. Consumer rights, Consumer Protection Act and other laws. Environment and health hazards due to pollution. Concepts of household and farm waste and its utilization techniques. Environmental education and rain water harvesting.

**Home Science Extension and Communication Methods:** Home Science extension education: concept, principles and approaches. Gender sensitivity in extension education programmes. Leadership-concept, types, identification, training and mobilizing local leaders for community participation. Panchayati Raj philosophy, concept, functioning and scope. Extension methods and audio-visual aids. classification, selection, use and production. Concept, functions, key elements, theories and models of communication. Concept, steps, principles and theories of programme planning. Evaluation concept, significance, methods and tools for monitoring and evaluation. Programmes and agencies promoting women as entrepreneurs. Types and techniques of training for developing entrepreneurial activities in Home Science areas. Self Help Groups-concept, organization, mobilization and functioning of SHGs for sustainability.

## **Syllabus- AGRONOMY/SOIL SCIENCE & AGRICULTURAL CHEMISTRY**

### **Agronomy**

Principles of crop production, crop plants in relation to environment, concepts involved in growth analysis; quantitative agro-biological principles and their validity; classification of climate, agro-climatic zones of India, their characteristic features; physiological limits of crop yield and variability in relation to the agro-ecological optimum; types of tillage - concepts and practices.

Principles and practices of weed control in component crops and cropping systems; crop weed competition, herbicide-formulations, classification, selectivity and mode of action, integrated weed management. Introduction, origin, history, production, distribution, cultural practices, varieties, quality, biomass production and bioenergetics of major field crops, forage, vegetable, spices and condiment crops.

Soil fertility and its management; essential plant nutrients, their functions and deficiency symptoms in plants; organic manures, chemical and bio-fertilizers and fertilizer usage. History of irrigated agriculture, soil-water-plant relationship, soil moisture stress and plant growth; drought resistance in crops, mechanisms of drought tolerance, and crop adaptability, soil and plant moisture conservation techniques, water harvesting and other agrotechniques for dryland agriculture; measurement of soil moisture, methods of scheduling irrigation, methods of irrigating crop plants, quality of irrigation water; watershed management concepts; management of excess soil water, agricultural drainage, principles and practices; problem soils - saline, alkali, saline- alkali and acid soils, principles and practices and prospects; wasteland management, soil erosion and its control.

Cropping systems - principles and practices; changing cropping patterns in different agro-climatic zones; sustainability - concept and practices; agro-forestry systems - concepts and practices. Principles of experimental designs, analysis and interpretation of data, methods of statistical analysis and statistical designs

### **Soil Science & Agricultural Chemistry**

Rocks and minerals; mineral weathering and soil formation; classification of soils, major soils of India; principal silicate structures; nature and properties of organic and inorganic constituents of soils, ion exchange phenomenon; activity of ions in soil system; fixation and release of nutrients. Soil fertility evaluation; movement of water; problem soils, soil-related constraints in crop production and remedial measures, soil amendments; soil and water conservation; sampling and analytical procedures for soils, plants, water, manures, fertilizers and soil amendments; quality of irrigation water; fertilizer recommendations; soil organic matter, soil microflora; carbon, nitrogen and phosphorus cycles; biofertilizers; phosphate solubilization; Darcy's law; Fick's law, steady and transient state diffusion in soils. Essential plant nutrients; manures; utilization of organic wastes and industrial by-products; fertilizers and their production, properties and usage; secondary and micronutrients.

## **Syllabus-PLANT PROTECTION (PATHOLOGY/ENTOMOLOGY/NEMATOLOGY)**

### **Plant pathology**

Landmarks and pioneers of plant pathology; theory of microscopy and staining; structural and physiological differences amongst fungi, bacteria, rickettsias, mycoplasmas, viruses and viroids; principles of culturing and preservation of pathogens; characteristic symptoms; host-parasite relationships; symbiosis; economically important diseases of crop plants induced by fungi, bacteria, rickettsias, mycoplasmas, viruses and viroids; phanerogamic parasites, non-parasitic diseases; nutrition, growth, reproduction, life cycle, ultrastructure, genetics and classification of microorganisms; Mendelian principles; cell structure; seed germination; origin of life and evolution; beneficial microorganisms including mycorrhiza; variation in phyto-pathogens and their ecology; introductory epidemiology; transmission and detection of pathogen; host resistance; seed -borne pathogens and plant quarantine; chemical and biological control, integrated management practices

### **Entomology**

Position of insects in animal kingdom - their origin, phylogeny and distribution; history and basis of insect classification; distinguishing characters of insect Orders and economically important families; concept of species and speciation; rules and regulations of zoological nomenclature; morphology - external and internal; embryonic and post-embryonic development.

Insect ecology - biotic potential, biotic and abiotic resistance, effect of temperature, humidity and light on insect development and population dynamics; diapause, food chain, migration and dispersal. Fundamentals of insect physiology, different systems, their structure and function, metabolism, sense organs, insect behaviour, host plant relationship.

Social and other beneficial insects; pests of field crops and stored food; principles of pest control; classification, mode of action and metabolism of insecticides; insecticidal residues; resistance and resurgence; parasites, predators and pathogenic microorganisms of crop pests, biological control. Antifeedants, hormones, growth regulators, semiochemicals, host-plant resistance and genetic manipulation, insect quarantine, concept of integrated pest management, non-insect pest and their control

### **Nematology**

History of nematology; importance of nematodes in agriculture and public health; techniques in nematology; broader classification of nematodes, important plant parasitic nematode genera and their identification, principles of classification; gross morphology of nematodes.

Biology of nematodes; physiology of digestion; intermediary metabolism and excretion in nematodes; symptomatology, histopathology and host specialization. Important plant diseases by nematodes; ecological factors influencing nematode activities and population dynamics; principles of nematode control and nematode management

## **Syllabus- ANIMAL HUSBANDRY**

### **Animal Biochemistry**

Structure and properties of biologically important carbohydrates and Aminoacids, Physical and chemical p

roperties of proteins. Structure of different types of nucleic acids. Major classes of enzymes, general properties and mechanism of their action. Bioenergetics, biological oxidation, respiratory chain and oxidative phosphorylation. Citric acid cycle and ATP generation. Glycolysis, pentose phosphate pathway and glycogenesis. Major disorders of lipid, carbohydrate, nucleic acid and amino acid metabolism. Inborn errors of metabolism and scope of gene therapy in combating genetic disorders. Mechanism of storage, transmissions and expression of genetic information.

DNA replication and control of gene expression in prokaryotes and eukaryotes. Biosynthesis of proteins. DNA technology and its scope in animal health and production. Deficiencies and nutritional significance of vitamins and trace elements in domestic animals and poultry, nutraceuticals & probiotics. General description of nature of hormones, receptors and mechanisms of their action. Blood composition. Important plasma proteins and their functions. Biochemical tests for hepatic and renal functions. Urine composition and analysis. Basic principles of photometric, chromatographic, eletrophoretic and radio isotopic methods of biochemical analysis. Methods of isolation, purification and characterization of proteins, DNA and RNA. Basic principles of RIA, ELISA, PCR, RFLP and DNA fingerprinting.

### **Animal genetics and breeding**

Brief history of domestication of livestock. Important breeds of livestock & poultry with special reference to economic characters. Genetic and phenotypic consequences and applications of inbreeding and out-breeding. Genetic basis of heterosis and its use. Description of animal population. Value and means; Average effect of gene and gene substitution. . Concept of heritability, repeatability; & phenotypic, genetic and environmental correlations. Purpose - wise breeding strategies for livestock and poultry under different agro-climatic zones of India. Ex-situ and In-situ conservation of animal and poultry genetic resources. Development of new breeds / strains for better productivity in animals. Basis and methods of selection. Construction of selection indices. Different methods of sire evaluation. Prediction of response. Improvement of response. Effect of selection on variance. Long -term and short -term objectives of selections. Laboratory animal species viz, mice, rat, guinea pig, rabbit, dog and monkey –Their chromosome numbers and genome size.

### **Animal Nutrition**

Minerals: Classification of minerals, Physiological functions, Deficiency symptoms and toxicity -Inter-relationships-Requirements -Different sources and bio-availability. Requirements and sources of vitamins. Feed Additives: Nutritional role. Natural and cultivated forages-Their composition and nutritive values. Nutritive value Index. Forage quality evaluation in range animals -Role of indicator methods-Advances in silage and haymaking-Factors affecting quality of conserved forages -Quality criteria and grading of silage and hay under tropics.

Methods of feed processing-physical, chemical and biological effect of processing on nutritional quality and utilization. Pelleted and extruded feeds. Quality control of raw feedstuffs and finished feeds: Significance of BIS (standards). Handling and storage of raw and finished feeds. Role of nutrition to control digestive and metabolic disorders (milk fever, ketosis, ruminal acidosis-laminitis, bloat), metabolic profile tests. Role of nutrition in immunity, nutrition and reproduction, nutrients as antioxidants.

### **Animal Physiology**

Animal cell structure, composition and functions. Composition of blood, structure & functioning of its constituents. Blood coagulation and anti coagulants. Body defense mechanism. Mechanics of respiration. Neural and chemical control of respiration. Modern concepts of urine formation. Uremia and other renal disorders. Digestion in ruminant and monogastric animals. Control of motility and secretion of alimentary canal. Gastric hormones and reflexes in the control of digestive functions. Absorption from rumen and the digestive tract. Muscle types. General organization of nervous system. Neurone structure and function. Functions of spinal cord, brain stem and cerebellum. Hypothalamus and its autonomic functions in endocrine and visceral regulation. Mechanism of hormone action. Feedback control of hormone secretion. Mechanisms of different hormone actions. Endocrine disorders. Gonadal hormones and their functions in male and female.

Factors affecting reproduction. Artificial insemination–collection, preservation and transport and semen diluents. Freezing of semen. Oogenesis. Follicular development. Ovulation. Corpus luteum. Reproductive cycles in animals. Factors affecting reproductive cycles. Female reproductive hormones. Oestrous synchronization, super-ovulation. Maintenance of pregnancy and its hormonal control. Growth regulation and factors affecting prenatal and post-natal growth. Physiology of climate stress. Effects of stress on production and reproduction. Mechanism of adaptation. Photoperiodicity and biological rhythms.

### **Animal Reproduction and Gynaecology**

Biology of sex. Functional anatomy of female reproductive system of farm animals. Growth, puberty and sexual maturity. Reproductive cycles (oestrous cycle) in female farm animals. Transport and survival of gametes, fertilization, cleavage, implantation and recognition of pregnancy. Development of foetus and foetal membranes. Placenta-classification and functions. Gestation and pregnancy diagnosis in farm animals. Reproductive hormones, classification, chemical composition and mechanism of action. Hormonal regulation of male and female reproduction. Abortion - causes, diagnosis and prevention. Veterinary Obstetrics: Parturition –Signs approaching parturition, initiation and stages of parturition, induction of parturition and postpartum period. Presentation, position and posture. Post-partum complications in domestic animals.

Male Infertility: Fertility, infertility and sterility in male domestic animals. Causes and forms of male infertility. Evaluation of male for breeding soundness, reproductive health status. Frozen Semen Technology and Artificial Insemination: Advantages and disadvantages of AI and frozen semen, selection of bulls for AI purpose. Management of breeding bulls, methods of semen collection in different domestic animals, semen evaluation including latest techniques for evaluation of motility and fertilization. Insemination techniques.

Reproductive Technology: Synchronization of oestrous cycle in domestic animals, control of ovulation. Embryo transfer technology Infertility in Cows and Buffaloes:



Incidence and economic role of infertility, forms of infertility, congenital and hereditary defects, infectious diseases. Pathological conditions of ovary, oviduct, uterus, cervix and vulva. Management causes of infertility. Hormonal causes of infertility, anestrus, repeat breeding, cystic ovarian degeneration, sexual health control and reproductive health programmes. Examination of cows and buffaloes for breeding soundness

### **Livestock Production and Management**

Present status and future prospects of livestock and poultry development in India. Various livestock and poultry development programmes operative in the country. Mating behaviour in various species of livestock and poultry. Mixed farming, arable farming, integrated and specialized farming systems. Important methods of selection and systems of breeding in farm animals and birds. Nutritional requirements and feeding managements of different categories of livestock and poultry. Feed additives including antibiotic and probiotic feeding in farm animals and birds.

Formulation and compounding of rations for various categories of livestock and poultry. Least cost ration formulation. Systems of feeding livestock and birds. Feeding standards for livestock and poultry. Feed conversion efficiency of various categories of livestock and poultry. Reproductive systems of farm animals and birds. Climate and nutrition affecting reproductive performance in farm animals. Importance of early pregnancy diagnosis. Methods of heat detection. Causes of disturbed fertility and its prevention in farm animals. Management factors affecting reproductive efficiency.

Housing systems, Selection of site and lay out of animal and poultry houses. Space requirement for livestock and poultry. General approach to livestock health programmes. prevention of diseases. Hygiene and sanitation on animal farm. Symptoms of ill health, important infectious diseases of livestock and poultry and their control. Vaccination schedules in animals and poultry. Internal and external parasites and their control. Accidental health disorders and their control.

Cattle and buffalo production trends and factors affecting them. Prenatal and postnatal care and management of cattle and buffalo. Management strategies for reducing mortality in calves, age at first calving, and calving intervals. Management to improve reproductive efficiency in cattle and buffalo. Classification of feeds and forages. Feed and fodder resources used for feeding of livestock and poultry.

Economic principles as applied to livestock production. Production functions. Farm size, resources and product combinations. Cost concepts. Effect criteria in use of resources in livestock production. Insurance and financing of livestock enterprises.