SYLLABI FOR ICAR’S ALL INDIA ENTRANCE EXAMINATION FOR ADMISSION TO MASTER DEGREE PROGRAMMES AND ICAR-PG SCHOLARSHIP/NTS (PGS)

Code 01: MAJOR SUBJECT GROUP - PLANT BIOTECHNOLOGY

(Sub-Subjects: 1.1: Plant Biochemistry/ Bio. Chem. 1.2: Plant Biotechnology & Molecular Biology/Biotechnology, 1.3: Plant /Crop Physiology)

UNIT-I: Importance of agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato, and mango. Major soils of India; role of NPK and their deficiency symptoms. General structure and function of cell organelles; mitosis and meiosis; Mendelian genetics. Elementary knowledge of growth, development, photosynthesis, respiration and transpiration; Elements of economic botany. General structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Organic farming; bio-fertilizers; bio-pesticides. Recombinant DNA technology; transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India. Elements of statistics.


UNIT-III: Characteristics of prokaryotic and eukaryotic organisms; differences between fungi, bacteria, mycoplasmas and viruses. Physical and chemical basis of heredity; chromosome structure. DNA replication, transcription and translation; genetic code; operon concept. Genetic engineering; restriction enzymes; vectors; gene cloning; gene transfer. Plant cell and tissue culture; micro-propagation; somaclonal variation. Transformation; recombination; Heterosis. General application of biotechnology. Molecular and immunological techniques. Concept of bioinformatics, genomics and proteomics.


Code 02: MAJOR SUBJECT GROUP - PLANT SCIENCES

(Sub-Subjects: 2.1: Plant Breeding & Genetics, 2.2: Plant Pathology, 2.3: Agricultural Microbiology/Microbiology, 2.4: Seed Science & Technology, 2.5: Plant Genetic Resources)

UNIT-I: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato, potato and mango. Major soils of India, role of NPK and their deficiency symptoms.

UNIT-II: Structure and function of cell organelles; mitosis and meiosis; Mendelian genetics; elementary knowledge of photosynthesis; respiration, and transpiration; structure and functions of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management.

UNIT-III: Characteristics of prokaryotic and eukaryotic organisms, differences between fungi, bacteria, mycoplasmas and viruses; physical and chemical basis of heredity; chromosome structure; genes/operon concept; protein biosynthesis; transformation, recombination, Heterosis; Elements of economic botany; integrated diseases management; sterilisation, disinfection and pasteurization; Koch’s postulates; etiological agents of rusts,
smuts, powdery/downy mildews, wilts, yellows, mosaic, necrosis, enations, blights and witches- broom; pH, buffer, vitamins, role of plant hormones in seed germination and dormancy; pollination/ fertilization in flowering plants; methods of seed testing; breeders, foundation and certified seeds; seed production in self and cross pollinated crops, nitrate assimilation; biological nitrogen fixation and other uses of microorganisms in agriculture.

UNIT-IV: Food and industry; composting and biogas production. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India.

Code 03: MAJOR SUBJECT GROUP - PHYSICAL SCIENCE

UNIT-I: Importance of Agriculture in national perspective; basic principles of crop production, diversification, diversification of Agriculture, principle of nutrient and water management, package of practices for rice, wheat sorghum, maize, chickpea, pigeon pea, potato, sugarcane, groundnut, major vegetable crops. Role of essential plant nutrients, their deficiency symptoms and management options. Structure and function of plant cells, cell division, Basic concept of plant physiology relating to crop production- Biochemical compounds viz, carbohydrates, proteins, enzymes, fats, liquid vitamins and their function, developmental programmes relating to rural upliftment and livelihood security; organisational set up of agricultural education research and extension and future strategies for up gradation.

UNIT-II: Volumetric and gravimetric analysis including complexmetric methods, periodic classification of element, Basic principle of instrumental analysis including spectro-photometry (Absorption and emission spectrography), Atomic structure –elementary concept of radioactivity, element and compound common ion effect, solubility product—hydrolysis of salts, buffer solution indicates equivalent weights and standard solution.

Elementary concepts of organic compounds- nomenclature and classifications including hydrocarbons, alcohol, aldehydes, acids and esters, carbohydrates, fats and liquids, amino acids, nucleic acids. Pesticides, their classification and uses; biopesticides and botanical pesticides.


Code 04: MAJOR SUBJECT GROUP - ENTOMOLOGY AND NEMATOLOGY
(Sub-Subjects: 4.1: Agricultural/ Horticultural Entomology, 4.2: Nematology, 4.3: Apiculture, 4.4: Sericulture, 4.5: Plant Protection.)

UNIT-I: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato, cole crops, mango, grapes, banana, oilseeds other than groundnut, soybean and mustard. Major soils of India, role of NPK and their deficiency symptoms. Mendelian genetics; elementary knowledge of photosynthesis; respiration, and transpiration; Major cropping systems (rice-wheat cropping, crop rotations, mixed cropping); soil degradation-soil salinity and acidity and management; some aspects of post-harvest technology; varietal improvement; importance of Heterosis in crop production; crop protection principles in field and storage. Major insect pests and diseases of agricultural crops like rice, cotton, pulses, oilseed crops like groundnut, soybean and mustard, vegetables like tomato, cole crops; fruit crops like mango and banana and their management principles. Transgenic crops. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India; Elements of statistics.

UNIT-II: Classification of animal kingdom up to class; distinguishing characters up to orders in class Insecta; general organization of an insect external morphology with special reference to lepidopteran larvae, coleopteran adults; and honeybee; metamorphosis and moulting; different physiological systems; insect- plant relationship; insect pests of agricultural and horticultural crops, and their stored/processed products, insect vectors of plant diseases-identification, biology, nature of damage, and their management tactics; and pests of household, medical and veterinary importance and their control; useful and beneficial insects like honeybee, lac insect, silkworm and pollinators; Nematode taxonomy, biology of important plant parasitic nematodes and their control; entomopathogenic nematodes, basic principles of insect and nematode pest management-cultural, biological, insecticidal, quarantine, and regulatory aspects; insecticide classification and insecticide resistance management; and insect protective transgenic crops.

Code 05: MAJOR SUBJECT GROUP - AGRONOMY
(Sub-Subjects: 5.1: Agronomy 5.2: Tea Husbandry & Technology)

UNIT-I: General: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, rapeseed and mustard, potato. Major soils of India, role of NPK and their deficiency symptoms. Structure and function of cell organelles; mitosis and meiosis; Mendelian genetics: elementary knowledge of photosynthesis; respiration, photosynthesis and transpiration; structure and functions of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Important rural development programmes in India; organisational set up of agricultural research, education and extension in India; Elements of statistics.


UNIT-III: Field crops: Origin, distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of cereals ( rice, wheat, maize, sorghum, pearl millet, minor millets, barley), pulses (chickpea, lentil, peas, Pigeon pea, mungbean, urdbean), oilseeds (groundnut, sesame, soybean, rapeseed & mustard, sunflower, safflower, linseed), fiber crops (cotton, jute, sun hemp), sugar crops(sugarcane), fodder & forage crops (sorghum, maize, napier, berseem, Lucerne, oats), medicinal & aromatic plants (menthe, lemon grass and isabgol) and commercial crops(potato, tobacco).

UNIT-IV: Weed management: Principles of weed management, Classification, biology and ecology of weeds, crop weed competition and allelopathy, concepts and methods of weed control, Integrated weed management,
Classification, formulations, selectivity and resistance of herbicides, Herbicide persistence in soil and plants, Application methods and equipments, Weed flora shifts in cropping systems, Special and problematic weeds and their management in cropped and non-cropped situations, Weed management in field crops.


UNIT-VI: Soil fertility and fertilizer use: Essential plant nutrients and their deficiency symptoms, concept of essentiality of plant nutrients, Indicators of soil fertility and productivity, Fertilizer materials and their availability to plants, slow release fertilizers, Nitrification inhibitors, Principles and methods of fertilizer application, Integrated nutrient management, site specific nutrient management.


UNIT-VIII: Problem soils: Problem soils and their distribution in India, Characteristics and reclamation of these soils, Crop production techniques in problem soils.


**Code 06: MAJOR SUBJECT GROUP - SOCIAL SCIENCES**


UNIT-I: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato and mango. Major soils of India, role of NPK and their deficiency symptoms. Structure and function of cell organelles, mitosis and meiosis; Mendelian genetics; elementary knowledge of photosynthesis; respiration, and transpiration; structure and functions of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Important rural development programmes in India; organisational set up of agricultural research, education and extension in India; Elements of statistics. Measures of central tendency and dispersion, regression and correlation; concept of probability, sampling techniques and tests of significance.

UNIT-II: Theory of consumer behaviour, theory of demand, elasticity of demand, indifference curve analysis, theory of firm, cost curves, theory of supply, price determination, market classification, concept of macroeconomics, money and banking, national income. Agricultural marketing—role, practice, institutions, problems and reforms, role of capital and credit in agriculture, crop insurance, credit institutions, cooperatives, capital formation in agriculture, agrarian reforms, globalization, WTO & its impact on Indian agriculture.

UNIT-III: Basic principles of farm management, concept of farming system and economics of farming systems, agricultural production economics—scope and analysis, factor-product relationship, marginal cost and marginal revenue, farm planning and budgeting, Agricultural finance: nature and scope. Time value of money, Compounding and discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's, 5C's and 7 P's of credit, repayment plans. History of financing agriculture in India. Commercial banks, nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, Asian Development Bank, World Bank, role of capital and credit in agriculture; credit institutions, cooperatives and agrarian reforms in India.

UNIT-IV: Extension Education- concept, meaning, principles, philosophy, scope and importance; Extension programme planning and evaluation- steps and principles, models of organizing agricultural extension; historical development of extension in USA, Japan and India. Rural development, meaning, importance and problems; Rural development
programmes in India- Pre-independence era to recent ones; Extension teaching methods, definition and concept of sociology, differences between rural & urban communities, social stratification., social groups, social organization and social change. Rural leadership, educational psychology- learning and teaching, role of personality in agricultural extension Indian rural system- its characteristics; value system, cost and class; structure and customs; rural group organization and adult education.

UNIT-V: Communication, principles, concepts, process, elements and barriers in teaching methods. Different kinds of communication methods and media and AV aids/materials. Media mix, Campaign, Cyber extension- internet, cybercafé, Kisan Call Centers, teleconferencing, agriculture journalism, diffusion and adoption of innovations-adopter categories, capacity building of extension personnel and farmers- training to farmers, women and rural youth.

**Code 07: MAJOR SUBJECT GROUP - STATISTICAL SCIENCES**

(Sub-Subjects: 7.1: Agricultural Statistics, 7.2: Computer Application, 7.3: Bioinformatics)

UNIT-I: Agriculture: Importance of Agriculture/Forestry/Livestock in national economy. Basic principles of crop production. Major diseases and pests of crops. Elementary principles of economics and agri-extension. Important rural development programmes in India. Organizational set up of Agricultural research, education and extension in India.

UNIT-II: Mathematics: Real and complex numbers; polynomial and roots; de Moivre’s theorem and its applications.

Elements of set theory- De Morgan’s laws; vector space, linear independence, orthogonality; matrices- addition and multiplication, rank of a matrix, determinants, inverse of a matrix, solution of a system of linear equations, characteristic roots and vectors; convergence of infinite sequences and infinite series- tests for convergence, absolute convergence; co-ordinate geometry in two dimensions - line, circle, parabola, ellipse and hyperbola.

Differential calculus: limits, differentiation of function of a single variable; Taylor’s and Maclaurin’s theorems, mean-value theorem; maxima and minima; indeterminate form; curvature, asymptotes, tracing of curves, function of two or more independent variables, partial differentiation, homogeneous functions and Euler’s theorem, composite functions, total derivatives, derivative of an implicit function, change of variables, Jacobians. Integral calculus: integration by simple methods, standard forms, simple definite integrals, double integrals, change of order of integration, Gamma and Beta functions, application of double integrals to find area. Ordinary differential equations: differential equations of first order, Exact and Bernoulli’s differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut’s equation, methods of finding complementary functions and particular integrals.

Calculus of finite differences, interpolation; numerical differentiation and integration, difference equations; solution of simple non-linear equations by numerical methods like Newton- Raphson method.

UNIT-III: Introduction: Statistics – definition, use and limitations; Frequency Distribution and Curves; Measures of Central Tendency; Arithmetic mean; Geometric mean, Harmonic mean, Median, Mode; Measures of Dispersion: Range, Mean deviation, Quartile deviation, Variance and Coefficient of Variation; Probability: Definition and concepts, law of addition and multiplication, conditional probability, Bayes’ theorem; Binomial, multinomial, Poisson and normal distribution; Introduction to Sampling; Random Sampling; Standard Error; Tests of Significance - Types of Errors, Null Hypothesis, Level of Significance, Testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples; Student’s t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test for goodness of fit and independence of attributes; Correlation and Regression and associated tests of significance. Experimental Designs: basic principles, Analysis of variance, Completely Randomized Design (CRD), Randomized Block Design (RBD).


Code 08: MAJOR SUBJECT GROUP - HORTICULTURE


UNIT-I: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato and mango. Major soils of India, role of NPK and their deficiency symptoms. Structure and function of cell organelles; mitosis and meiosis; Mendelian genetics; elementary knowledge of photosynthesis; respiration, and transpiration; structure and functions of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Major pests and diseases of rice, wheat, cotton, chickpea, sugarcane and their management. Important rural development programmes in India; organizational set up of agricultural research, education and extension in India; Elements of statistics.

UNIT-II: Layout and establishment of orchards; pruning and training; propagation, climatic requirement and cultivation of fruits like mango, banana, citrus, guava, grape, pineapple, papaya, apple, pear, peach and plum; cultivation of plantation crops like coconut and cashew nut and spices like black pepper, coriander, turmeric, important physiological disorders; major vegetable crops of tropical, subtropical and temperate regions like cole crops (cauliflower, cabbage and knol khol), cucurbits (pumpkin, bottlegourd, bittergourd, luffa, muskmelon and watermelon, cucumber), root crops (radish, tapioca sweet potato and potato), leafy vegetables (fenugreek and spinach); solanaceous crops (tomato, chillies and brinjal); techniques for raising the nursery; nutritive value of fruits and vegetables and their role in human nutrition; basic physiology of ripening in fruits and vegetables and their products; type of fruits and vegetable products and control of fungal and bacterial diseases; major floricultural crops grown in India for commercial purposes like rose, carnation, chrysanthemum, marigold, tuberose, gladiolus, orchids; establishment and maintenance of lawns, trees, shrubs, creepers, hedges and annuals; type of gardens, methods of crop improvement; male sterility and incompatibility; pure line and pedigree selection; backcross, mass selection; heterosis; plant nutrients, deficiency symptoms of nutrients, manures and fertilisers, systems of irrigation, management of important pests and diseases of fruits and vegetables.

Code 09: MAJOR SUBJECT GROUP - FORESTRY/AGROFORESTRY & SILVICULTURE


UNIT-II: Forest- importance, types, classification, ecosystem, biotic and abiotic components, ecological succession and climax, nursery and planting technique, social forestry, farm forestry, urban forestry, community forestry, forest management, silvicultural practices, forest mensuration, natural regeneration, man-made plantations, shifting cultivation, taungya, dendrology, hardwoods, softwoods, pulp woods, fuel woods, multipurpose tree species, wasteland management. Agroforestry – importance and land use systems, forest soils, classification and conservation, watershed management, forest genetics and biotechnology and tree improvement, tree seed technology, rangelands, wildlife – importance, abuse, depletion, management, major and minor forest products including medicinal and aromatic plants, forest inventory, aerial photo interpretation and remote sensing, forest depletion and degradation – importance and impact on environment, global warming, role of forests and trees in climate mitigation, tree diseases, wood decay and discolouration, tree pests, integrated pest and disease management, biological and chemical wood preservation, forest conservation, Indian forest policies, Indian forest act, forest engineering, forest economics, joint forest management and tribology.
Code 10: MAJOR SUBJECT GROUP - AGRICULTURAL ENGINEERING AND TECHNOLOGY

UNIT-I: Elementary Statistics and theory of probability, differential and integral calculus, linear algebra and Fourier series, differential equations, vector algebra & vector calculus, elementary numerical analysis.

UNIT-II: Electric motors: Types, performance, selection, installation and maintenance, measuring instruments, fundamentals of computers, power distribution.

UNIT-III: Thermodynamic principles; fluid mechanics, theory of machines.

UNIT-IV: Soil mechanics, soil classification, compaction & shear strength of soils, engineering mechanics, strength of materials.

UNIT-V: Importance of farm equipment and role of mechanization in enhancing productivity & profitability of Indian agriculture; analysis of forces, design and production of farm machinery and power units; mechanics of tillage & traction operation, repair and maintenance of farm machines and equipment, farm engines; tractors and power tillers; tractor stability and operators comfort; field capacity and cost analysis; test codes and procedure; safety and ergonomic principles. Role of energy in economic development; solar, wind and bio-energy; biogas plants & gasifiers; biofuels from biomass; collection, characterization and storage of biomass, solar cookers & solar refrigerators.

UNIT-VI: Biochemical and engineering properties of biological materials; quality control & safety of raw and finished products. Principles, practices and equipments for drying, milling, separation and storage of agricultural produce and by-products; material handling equipment and operations; farmstead planning; heating & cooling load calculation; seed processing practices and equipments; food preservation methods and products development; refrigeration and air conditioning; cold stores; waste management, cost analysis & food processing plants layout, feasibility reports.

UNIT-VII: Surveying and leveling; hydrology, water resources in India; efficiency in water use; irrigation system and equipment; water conveyances and associated efficiency; soil-plant-water relationship; estimation of evaporation and water requirements of crop; water harvesting and use, farm ponds and reservoirs, command area development, land use capability classification, ground water development, wells and pumping equipment, soil erosion and its control, land shaping and grading equipment and practices, hydraulic structures, drainage of irrigated and humid areas; salt balance and reclamation of saline and alkaline soils.

Code 11: MAJOR SUBJECT GROUP - WATER SCIENCE AND TECHNOLOGY
(Sub-Subject: 11.1: Water Science and Technology)

Unit-I: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice, wheat, chickpea, pigeon-pea, sugarcane, groundnut, tomato and mango. Major soils of India, role of NPK and their deficiency symptoms. Structure and function of cell organelles; mitosis and meiosis; Mendelian genetics; elementary knowledge of photosynthesis; respiration, and transpiration; structure and functions of carbohydrates, proteins, nucleic acids, enzymes and vitamins. Pests and diseases of major crops and their management, important rural development programmes in India; organizational set up of agricultural research, education and extension in India.

Unit-II: Water resources of India, surface and groundnut resources, rainfall, rainfall-runoff relations, measurement and estimation of runoff, irrigation development in India, command area development, watershed management principles, government schemes in watershed management program, water harvesting structures including farm ponds, water quality including physical, chemical and biological properties.

Unit-III: Physical properties of soils—texture, structure, density and consistency, infiltration, field capacity, permanent wilting point, available water hydraulic conductivity, soil water flow including Darcy's law, mechanical analysis,
chemical properties of pH, EC, atoms, molecules, colloids, clay mineral, major and trace elements, salinity and sodicity, cation exchange capacity, evaporation, evapotranspiration, water requirements of crop, plant growth process, soil and water conservation practices and tillage.

Unit-IV: Simultaneous and quadratic equations, differentiation and integration, differential equations, elements of statistics, frequency distribution, probability concepts, basic concepts of economics, energy, horse power, efficiency of machines, concepts of fluid flow, hydrostatic pressure, surface tension, irrigation water distribution and control, irrigation methods, irrigation efficiencies, irrigation scheduling, water lifting devices and pumps, construction of wells, drainage principles and applications, surface drainage, subsurface drainage, water pricing, water laws and irrigation acts.

Code 12: MAJOR SUBJECT GROUP – HOME SCIENCE (CURRENTLY RENAMED AS COMMUNITY SCIENCE)


UNIT-II: Elements of Human Nutrition i.e. Food groups and the nutrients contributed by each group to the diet, composition and nutritive value of foods; food processing and preservation, meal planning i.e. principles menu planning for normal individuals for different age groups and at different stages of life, diet therapy, institutional food management, community nutrition and health, food related laws, policy and programmes in India. Organic and genetically modified foods.

UNIT-III: Introduction to child/human development-meaning, concept, principles, prenatal development (conception to child birth), care of new born, pre-natal and post natal care of mother, development of child in early and late childhood, early childhood education, adolescence, development and relationship with peers & family, marriage and family dynamics, meaning, definition of family life cycle, family welfare programmes in India, community education, child studies methods, participation in pre-school/crèche.

UNIT-IV: Concept and principles of management, management process, work, work environment, work simplification, fundamentals of housing, principles of design & home furnishing-selection, care and maintenance of accessories, equipments, furniture, paintings, family finance/ economics and consumer education. Functional interiors for special needs.

UNIT-V: Introduction to clothing construction- sewing machine its parts and use, preparation of fabric for lay out textile fiber-classification, processing/manufacturing method, clothing need of family members, household textile and consumers, weaving and hosiery, traditional textiles and embroideries of India, care of clothing and textile finishes, dying & printing. Organic dyes.

UNIT-VI: Introduction to Home Science Education communication and extension methods, programme planning & evaluation, entrepreneurial education, projected and non-projected aids (audio-visual aids) rural development programmes in India. Empowerment of women.

Code 13: MAJOR SUBJECT GROUP - ANIMAL BIOTECHNOLOGY
(Sub-Subjects: 13.1: Animal Biotechnology, 13.2: Vety./Animal Biochemistry)

UNIT-I: Structure of prokaryotic and eukaryotic cells, cell wall, membranes, cell organelles, organization and functions, chromosome structure and functions, cell growth division and differentiation. Sub unit structure of
macromolecules and supermolecular systems. Self assembly of sub units, viruses, bacteriophage, ribosomes and membrane systems.


UNIT-IV: History of molecular biology, biosynthesis of proteins and nucleic acids, genome organization, regulation of gene expression, polymerase chain reaction, basic principles of biotechnology applicable to veterinary science gene sequence, immunodiagnostics, animal cell culture, in vitro fertilization. Sub-unit vaccines: Principles of fermentation technology. Basic principles of stem cell and animal cloning.

Code 14: MAJOR SUBJECT GROUP - VETERINARY SCIENCE


UNIT-II: Classification and growth characteristics of bacteria, important bacterial diseases of livestock and poultry, general characters, classification of important fungi. Nature of viruses, morphology and characteristics, viral immunity, important viral diseases of livestock and poultry. Viral vaccines. Antigen and antibody, antibody formation, immunity, allergy, anaphylaxis, hypersensitivity, immunoglobulins, complement system. Etiology of diseases and concept, extrinsic and intrinsic factors, inflammation, degeneration, necrosis, calcification, gangrene, death, atrophy, hypertrophy, benign and malignant tumours in domestic animals. General classification, morphology, life cycle of important parasites, important parasitic diseases (Helminths, Protozoa and Arthropods) of veterinary importance with respect to epidemiology, symptoms, pathogeneses, diagnosis, immunity and control.


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UNIT-IV: Zoonotic diseases through milk and meat, Zoo animal health. Source and nature of drugs, pharmacokinetics, Chemotherapy-sulpha drugs, antibiotics, mechanism and problem of drug resistance. Drug allergy, important poisonous plants, toxicity of important agro-chemicals and their detoxification, drugs action on different body systems.

**Code 15: MAJOR SUBJECT GROUP - ANIMAL SCIENCES**


UNIT III: General concepts of livestock production and management, status of dairy and poultry industry, impact of livestock farming in Indian agriculture. Livestock housing, production and reproduction management, lactation management, breeding programmes for livestock and poultry. Composition, quality control and preservation of livestock products, methods of processing and storage livestock products. International Trade/WTO/IPR issues related to livestock products.

UNIT IV: Concept of sociology, differences between rural, tribal and urban communities, social change, factors of change. Principles and steps of extension education, community development- aims, objectives, organizational set up and concept evolution of extension in India, extension teaching methods. Role of livestock in economy. Identifying social taboos, social differences, obstacles in the way of organizing developmental programmes. Concept of marketing, principles of co-operative societies, animal husbandry development planning and programme, key village scheme, ICDD, Gosadan, Goshala, Role of Gram Panchayat in livestock development. Basics of statistics, data analysis and computational techniques.

**Code 16: MAJOR SUBJECT GROUP - FISHERIES SCIENCE**


UNIT-IV: Common crafts and gears used for fish capture. Boat building material and demerits of wood, steel, aluminum, Ferro cement and FRP. Different types of fibres and netting materials and their characteristics, preservation of netting, parts of a trammel net, purse-scene, gill net and tuna long line. Food chemistry, fundamentals of microbiology. General methods of fish preservation and fishery by products. Canning and packaging techniques, processing and product development techniques.

UNIT-V: Introduction to fishery economics and concepts of cooperative, marketing and banking management. Supply v/s demand economics of hatchery management and fish culture operations. Profit maximization. Problems in estimating costs and returns in fisheries. WTO agreements in Fisheries sector, intellectual property rights (IPR) and international fish trade; Fisheries extension methods. Training and education needs in fisheries. Communication concepts, Modern tools of fishery extension education, participatory rural appraisal (PRA). Rapid rural appraisal (RRA), role of women in fisheries; Basics of statistics in fisheries and computer science.

**Code 17: MAJOR SUBJECT GROUP - DAIRY SCIENCE**

(Sub-Subjects: 17.1: Dairy Microbiology, 17.2: Dairy Chemistry)

Unit-I: Chemical composition of various food of plant and animal origin, structure and functions of food constituents, additives, preservatives, flavours and antioxidants, composition and physico-chemical and nutritional properties of milk and colostrum, chemistry of milk, constituents, nutrients and milk products. Test for the quality of milk, butter, ghee, milk powder etc., adulterants, neutralizers and preservatives, their detection, heat stability of milk.

Unit II: Introduction to dairy microbiology – Milk production hygiene and critical risk factors affecting microbiological quality on-farm; Microorganisms associated with milk and their classification based on growth temperature—psychrotrophs, mesophiles, thermodurics and thermophiles; Microbial metabolites and their role in spoilages - souring, curdling, gassiness, ropiness, proteolysis, lipolysis, abnormal flavour and colour; Antimicrobial systems in raw milk; Microbiological grading of raw milk; Microflora of mastitic milk and its importance in dairy industry; Food poisoning, food infections, toxin-infections and other milk borne diseases and their control.

Unit-III: Composition and chemistry of cream, butter, ghee, ice-cream, cheese, condensed and dried milks, infant food, spoilage of ghee and use of antioxidants, chemistry of milk fermentation, chemistry of rennin coagulation of milk and changes occurring during ripening of cheese, physico-chemical changes in the manufacture and storage of milk powder, lactose, crystallization and its significance, physicochemical changes during the manufacture of indigenous milk products, quality standards of dairy products.

Unit IV: Bacteriological aspects of milk processing - Thermization, pasteurization, boiling, sterilization, UHT, bactofugation, and membrane filtration; Microbiological quality of cream, butter, ice-cream, concentrated dairy products, dried milks, infants milk foods, indigenous dairy products; Factors affecting the microbiological quality of these products during production, processing, handling, storage and distribution; Enumeration, isolation and identification of conventional and emerging dairy pathogens, detection of microbial toxins, drug residues in milk and their public health importance; Microbial defects associated with dairy products and their control; Microbiology of dairy starters; Classification, genetic aspects and carbohydrate metabolism of Lactic Acid Bacteria (LAB); Preservation, propagation and quality control of dairy starters and their inhibition by antibiotic residues, detergents, sanitizers, bacteriophages etc.; Microbiology of fermented milks, cheeses and application of probiotic concept in dahi, yoghurt, Kefir, Kumiss, Bulgarian milk, cultured buttermilk, leben,

Code 18: MAJOR SUBJECT GROUP - DAIRY TECHNOLOGY
(Sub-Subjects: 18.1: Dairy Technology, 18.2: Dairy Engineering)


Code 19: GROUP - FOOD SCIENCE TECHNOLOGY
(Sub-Subject: 19.1: Food Technology/Food Science & Technology, 19.2: Food Safety & Quality Assurance, 19.3: Food Science & Nutrition)


UNIT-II: Engineering properties of food materials, System analysis, mass and energy balance, Principles operations and equipment for food materials flow handling, cleaning, de-husking, sorting and grading; peeling, size reduction, mixing and forming, bakery foods manufacture, extrusion, separation, filtration and membrane processes, expression, baking roasting, frying, extraction and leaching, crystallization, distillation, blanching, pasteurization, sterilization, evaporation, drying, freezing, packing, heat exchanging, dairy specific operations. Process equipment design, heat and mass transfer, equipment for steam generation, compressed air, refrigeration and air conditioning, water and waste water treatment, biochemical engineering and thermo bacteriology. Automation, on-line data acquisition and process control. Food plant layout and design. Energy audit.

UNIT-III: Preparation and manufacturing technology of cereals and bakery products, beef, pork, poultry, fish & sea foods and egg, sausages and table ready meats, dairy products, fresh fruits, fresh vegetables, processed fruits, processed vegetables, Post Harvest Handling and storage of Fruits and Vegetables. Sugars, sweets, fats and oils, fermented foods, alcoholic and non-alcoholic beverages, indigenous foods, fast, readymade and fashion foods. Dehydration and concentration methods, irradiation, microwave and solar processing of foods, food by-products & downstream processing, flavoring and pigment technology. Judging of food products, food
plant management and legal aspects, food plant safety, risk and hazards. Effluent treatment and environment pollution, waste solids upgrading and treatment, food storage, functions of packaging, packaging operations, types of containers, FFS, hermetics closures, canning packaging materials and package testing, transportation and marketing food products.


**Code 20: Group– Agri-Business Management**

(Sub-Subjects: 20.1: Agri-Business Management (MBA), 20.2: Agricultural Marketing & Cooperation (M.Sc.))

UNIT-I: Social, political and economic structure in rural India. Importance of agriculture/forestry/ horticulture/livestock in national economy. Cultivation of major cereal crops, legume crops, vegetable crops, fruits and their importance in human diet. Major soils of India, essential plant nutrients, their role, deficiency symptoms and sources. Pests and diseases of major crops, vegetables, fruits and their management. Forestry production, pests and diseases management of major trees grown in India. Watershed management. Organizational set up of agricultural research, education and extension in India. Elements of statistics.

UNIT-II: Farm equipments and Farm Machinery in India, sources of energy and power on farms. Irrigation and drainage systems. Basics of post-harvest technology, Basics of energy in agriculture.


UNIT-V: **Quantitative ability**: Test the ability of candidates to make mathematical calculations under stress conditions. All these calculations will be based on analytical skills of the candidates with understanding of mathematics at intermediate level.

UNIT-VI: **Communicative ability**: Test English comprehension wherein the knowledge of language skills are tested as to how effectively the candidate communicates his thoughts and ideas.

UNIT-VII: **Data Interpretation**: Calculations requiring skills of interpretation of facts and figures. The questions can be posed as graphs, tables and charts.

UNIT-VIII: **Logical reasoning**: Evaluating logical thinking capacity by providing various options.

UNIT-IX: Fundamentals of managerial economics, market structure conduct and performance, agricultural marketing concepts- functions and institutions, trade in agriculture sector; principles of corporation; cooperatives in India; agribusiness institutions in India; entrepreneurship development.

Besides above, any other topic of scientific, social and educational importance can also be included. Around 20–25% questions shall be related to agriculture and agriculture related science subjects including recent developments.