Brief Syllabus Outline

For

Prelim – ARS/NET Examination

(Objective Type Questions)

Agricultural Scientists Recruitment Board
Krishi Anusandhan Bhavan, Pusa,
New Delhi – 110 012

February – 2010

(Objective questions shall also be drawn from the detailed subject syllabus of ARS Main Examination)

INDEX

I. AGRICULTURAL SCIENCES

Part A : (GENERAL KNOWLEDGE)

History of agricultural development in India. Current production utilization and growth trends of agricultural commodities in India and abroad. Current issues, constraints, mitigation strategies, developmental programmes, legislations, frontier research areas, infrastructural development, plant genetics and breeding science developments, genetic engineering, biotechnology and GM crops. Agricultural microbiology, plant physiology, pest and disease science research and development. Status of Indian horticulture, fruits, vegetables, floriculture, post –harvest quality issues, value chain, quality seed production. Seed certification laws, hybrid technology, quarantine and SPS issues, plant genetic resources, plant variety protection (IPRs). biodiversity and Nano-biotechnology. Bioinformatics.

Part B :

1. CROP IMPROVEMENT

General Genetics. Mendelian inheritance, Genome organization, cytogenetics, reproductive systems, plant breeding traditional and contemporary methods. Plant classification, description and economic use of field crops. Evolution, biometrical and population genetics. Biotechnological tools for crop improvement, plant genetic resources, regulatory system, conservation, utilization, crop husbandry, seed biology, seed processing, seed quality control, seed production methods, seed storage, health, growth of seed industry, seed certification and seed laws

2. CROP PROTECTION

Pests, diseases and abiotic agents causing losses. Systematics, morphology, embryology, ecology, toxicology, modern approaches of management of pest and diseases; IPM of important pests, diseases, nematodes and others organisms attacking crop plants and vectors of plant diseases. Useful organisms- Honey bees and bee keeping, lack insect and silk worm. mycology and plant pathology, plant bacteriology, virology, abiotic diseases: diagnostics, epidemiology, forecasting, principles of plant pathology and diseases management. Plant Nematology: ecology, techniques, plant–nematode relationships, nematode, physiology, cytology and management, Pesticides: groups, mode of action, application methods and pesticide interactions. Host plant resistance and biological control.

3. BASIC PLANT SCIENCES.

Cell organelles, water relations, metabolic processes and growth regulation, crop productivity and modeling, mineral nutrition, climate and climate change, physiology of flowering, reproduction, seed, post - harvest physiology, morphogenesis, tissue culture, genetic transformation, enzymes, vitamins, hormones, cell structure and function, biomolecules, metabolism, molecular genetics, gene expression, techniques, gene cloning, plant genetic engineering, molecular markers, genomics, metabolism engineering, gene regulation and related topics of plant biotechnology, history of microbiology, microbial ecology and physiology, soil environment microbiology, taxonomy, techniques in microbiology, biofertilizers and microbial biotechnology, Production of bio-agents and bio-fertilizers.

4. HORTICULTURE.

Fundamentals of horticulture, orchards management, nursery management and seed production. Breeding of horticultural crops, improvement of fruits and plantation crops. Importance of fruits and vegetable in human nutrition. Contribution of horticulture in national economy and exports. Programmes of development, growth and development, physiology of flowering, fruit set and development, parthenocarpy and seedlessness, maturity and ripening, plant growth regulators and their role. Importance of vegetables and spices, hybrid seed production, breeding strategies for vegetables, tuber crops, potato and spices, biotic and abiotic stress breeding, biotechnological tools for breeding. Micropropagation, meristem culture, ovule culture, *in vitro* pollination. Green house management, stionic relations and rootstocks. Protected cultivation for improved productivity – vegetables and flowers. Floriculture and landscaping, production technology for indoor plants, flower arrangements, value addition, commercial floriculture, gardening and turf management, dry flowers and potted plants. Medicinal and aromatic plants of importance and their management. Importance of post harvest handling in horticultural crops, physiology of fruits, vegetables and flowers after harvest. Different methods of storage, cool chain management, processing, packaging, quality assurance, storage management.

II. VETERINARY SCIENCES

Part A: (GENERAL KNOWLEDGE)

Historical developments in veterinary and animal sciences, Role of livestock sector in Indian agriculture, Current scenario of livestock and poultry production, health and epidemiology of diseases including emerging and exotic diseases, Knowledge on current issues and development programmes, Constraints in animal production systems, International organizations, policies and regulations on animal health, production and trade, Climate change and its effects on animals and relationship, contemporary advances in research and development : Animal anatomy, physiology, gynqeacology & obstetrics, veterinary clinical and preventive medicine, surgery & radiology, bacteriology, virology, parasitology, veterinary public health, pathology, immunology, pharmacology & toxicology, animal ethics & veterinary jurisprudence, animal production, animal genetics & breeding, livestock products technology including dairy sciences, poultry sciences and cutting –egde sciences such as biochemistry, biotechnology and its use for growth of animal sciences.

Part B:

5. BASIC VETERINARY SCIENCES

Animal Cell – organelles and functions, Digestive physiology of ruminants & non-ruminants, Animal systems and their physiology, Descriptive anatomy and histology, skeletal system, Animal and fish Biotechnology, Biochemical processes, enzymes, vitamins, hormones, minerals, Current developments in animal biochemistry, biotechnology and molecular biology, Techniques in biochemistry including physiological & clinical biochemistry, nutritional biochemistry and immunological biochemistry, Genetic engineering, cloning, process engineering, Embryo transfer, hybridoma.

6. PARACLINICAL VETERINARY SCIENCES.

Importance of paraclinical sciences, Animal Health, General Bacteriology and Mycology, Virology, Pathology, Parasitology, Animal and Avian diseases, Immunology, Molecular cell biology and diagnostic technology, Veterinary Public Health issues, Epidemiology, pharmacology, chemotherapy, Toxicology, Autocids, Endotoxicology and all paraclinical Veterinary Sciences topics.

7. CLINICAL VETERINARY SCIENCES.

Veterinary gynaecology and obstetrics, reproductive cycles in farm animals, Reproductive endocrinology, Gestation and reproductive disorders and infertility in animals: Andrology, Male fertility, Frozen semen technology, Artificial insemination, Assisted reproductive technologies, micromanipulation of embryo, Animal surgery and radiology, anaesthesia, orthopastic surgery and lameness, Thoracic surgery and surgery of other systems / organs, General agents of veterinary medicine and preventative medicine, Gastroenterology, Diseases of cardio-vascular and pulmonary systems, urinary and nervous systems. Legislations and veterinary jurisprudence, common toxicities and deficiency problems and metabolic diseases, Food and environmental hygiene.

8. ANIMAL PRODUCTION

Livestock production systems, changing trends, Mendelian genetics, cytogenetics, molecular / biochemical / population / quantitative genetics, mating systems, Breeding methods in animals, poultry, conservation of genetic resources, lab animal breeding, Animal nutrition, lactation, Feed evaluation and feed processing, Breeding / feeding / reproduction management, shelter / health management, Methiogenesis and interventions poultry science, animal / poultry product technology and management. Livestock population dynamics in India, Animal production systems, Adaptation, Breeding policies, different breeds, Nutritional requirement, Marketing of livestock and their products.

III. FISHERIES SCIENCES

Part A : (GENERAL KNOWLEDGE)

Fisheries resources of world and India; Importance of commercial fishery in India and its impact on rural economy; Fisheries and aquaculture related developmental programmes in India; Domestic and export marketing of fish and fishery products, trends, channels, mechanisms, trade and non-trade barriers; Contribution of fisheries and aquaculture to the food, income, GDP and livelihood securities; Common property resource management in fisheries and aquaculture; Protection of national biodiversity; Principles of fish genetics – Mendelian genetics, laws of inheritance, linkage and mutation; Fish biotechnology – structure of DNA and its replication, DNA repair, genetic code and protein synthesis, transgenics and their implications; Common fish diseases; Feeding behavior of fish, fish food organisms - phytoplankton and zooplankton, feed management in aquaculture; Institutional finance in fisheries; Fisheries extension methods and approaches.

Part B:

09. FISHERIES SCIENCE

Global commercial fisheries resources, production trends; Taxonomy and biology of commercially important fish, food and feeding habits, age and growth, mortality, maximum sustainable yield; Monitoring, control and vessel surveillance systems; Aquaculture production at global and national level, major cultivable organisms and their taxonomy, biology and behavior; Hatchery technology and growout systems; Aquaculture engineering and farm design; Water and soil quality management; Non-food aquaculture - culture and breeding of ornamental fishes of commercial importance, seaweed and pearl culture; Aquatic environment management – role of probiotics, bioremediation, pollution and its control; Aquatic microbiology – diseases caused by bacteria, virus and fungi, isolation and identification of causative agents, treatment and control; Fish immunology; Fisheries management; Fishing practices; Fishery economics and marketing; Technology transfer; Climate change and its impact on fisheries and livelihood; Fish Genetics - physical basis of heredity; Mendelian principles – scope and limitations, genetic variation - causes and measurement, gametogenesis and mechanisms of sex determination; biotechnology - DNA structure and organization of chromosomes in eukaryotes, prokaryotes and viruses, cell organelles, DNA replication; Fish nutrition and biochemistry - nutrients, digestive enzymes, digestibility, types of feed, feeding rate, energetics, feed and feeding equipment, growth and reproductive hormones, glycolytic and Kreb’s cycle.

10. FISH HARVEST AND POST HARVEST TECHNOLOGY

Craft and gear technology in fisheries; Fish catching methods; Code of Conduct for Responsible Fisheries; Fish processing technology – fish handling, grading, chilling, freezing, canning and packaging; Machinery for handling and processing; Principles and methods of fish preservation, sanitary and phytosanitary requirements for maintenance of quality; Quality management of fish and fishery products; Transportation and marketing; Microbial contamination of fish and methods of prevention; Fish biochemistry – major and minor constituents of fish – proteins, carbohydrates, lipids and fatty acid profiles, vitamins and minerals, post -mortem changes in fish; National and international organizations for food standards; Processing engineering, refrigeration cycle, cold store, processing unit construction and management; Water budgeting; Waste management.

IV. NATURAL RESOURCE MANAGEMENT

Part A : (GENERAL KNOWLEDGE)

Historical developments in Indian Agriculture, current production trends; Natural resources - land, water, forest, environment, biodiversity and their relevance to agriculture, climate and weather; Drought management; Management of natural resources including recent advances, field crops, distribution, cultivation; Cropping and farming systems; Input management; Environmental sciences; Forestry and agro-forestry; Biodiversity; Air pollution; Ecology; Soils of India; Soil survey and classification; Soil health, organic/conventional farming; Soil fertility, salinity, alkalinity, acidity, reclamation; Water use efficiency, drainage, irrigation system.

PART B:

11. FORESTRY AND ENVIRONMENTAL SCIENCE

Role of forests in national economy; Forest types of India and their salient features; Introduction to succession, climax and retrogression; Renewal sources of energy and their potentials in India; Liquid fuels from petrocrops, energy plantations; Integrated rural energy programmes; Definition and scope of environmental science and its inter-relationship with agriculture; Components of environment; Environmental legislations in India; Types of environmental pollution; Acid rain; Effect of pollutants on crops, vegetation, animals and human health; National and international laws on pollution and policies and maximum permissible limits of air, soil and water pollutants; Physical, chemical and biological properties of wastes; Effluent treatment processes for major industries and other agro-industrial wastes; Biodegradation and bioconversion of organic wastes, recycling of wastes; Basic ecological concepts; Extent and causes of land degradation; Afforestration; Conservation of natural resources; Climate change and variability, greenhouse effect, greenhouse gases emission and mitigation; Disaster management; Evidence and causes of climatic change; Impact of climate change and adaptation framework; Global warming and global dimming; Carbon sequestration, International summit and convention, clean development mechanism; Biodiversity and life security, biodiversity conservation.

12. AGRONOMY AND AGRICULTURAL METEOROLOGY

Concepts of Agronomy, constraints in crop production, distribution of crops, their relation with environment; Sustainable agriculture; Farming systems, cropping systems, cultural practices, crop relation, Hitech precision farming, greenhouse production technology; Crop management and principles of growing crops, weed management, herbicides, GM crops, soil management, dryland farming; Evapotranspiration and water management; Agricultural meteorology, elements of weather and climate effect on growth and yield of crops, cardinal temperature, photo- and thermo- periodism, contingency planning, agro-ecological zoning, micrometeorology; Crop protection from biotic and abiotic stresses, input use-efficiency, newer concepts in NRM, field designs to plan experiments.

13. SOIL SCIENCE

Concept and definition of soils, rocks and minerals; Pedology, pedogenic factors and processes; Soil survey, soil classification; Soil properties – physical, chemical and biological; Soil -water concepts, soil-water-plant atmospheric relationships, water stress, nutrient stress, water use, irrigation water management, soil reclamation; Hydrologic cycle, modeling of water nutrient balance; Soil chemistry, soil fertility, soil biology, soil / land degradation and management; Soil quality and carbon sequestration; Analytical methods and instrumentation use in Soil Science; Agricultural statistics required for Soil Science experimentation; Water science and technology; Watershed developments of water management systems.

V. SOCIAL SCIENCES

Part A : (GENERAL KNOWLEDGE)

Role of agriculture in economic development of the country, growth analysis, planning models. Changes in cropping pattern, capital formation, infrastructure, transfer of technology, Agro-economic theories, liberalization, agri-business systems, agro-processing, farm machinery, public distribution system, issues and challenges in marketing system. Agricultural trade structure in India, family resource management, decision making, entrepreneurship management, consumer education and managements, panchayat raj, agricultural communication and extension, development of agriculture extension in India, scope and role of agricultural extension/ veterinary extension/ home science extension/ dairy extension/ fisheries extension etc., Farming systems research and networking, ICT, agriculture extension management, research methodologies in extension education, agriculture human resource development. Statistical methods including descriptive statistics, correlation and regression and tests of hypothesis. Computer applications in social sciences/agriculture.

Part –B

14. HOME SCIENCE AND FARMING RESOURCE MANAGEMENT.

Systems approach to family resource management, concept, planning, resources, needs and communication. art principles and interior enrichment, housing and space design, household energy and equipment, family finance and consumer education, entrepreneurship management, ergonomics, markets and marketing, theories of human development, child care and education, population education and family welfare, parent and community education. textile science and care, traditional costumes, designing, fashion, trade and merchandising.

15. ECONOMICS AND AGRICULTURE BUSINESS MANAGEMENT.

Economic theories, managerial economics, international trade concepts, agriculture and environment, role of agriculture in Indian economy, productivity and performance of Indian agriculture, commercialization, liberalization, globalization, economic reforms, World Trade Organisation (WTO) Agreement on Agriculture (AOA), technical barriers to trade (TBT), agriculture policies, food security, agricultural diversification, agricultural credit and insurance, agricultural marketing and price analysis, demand and supply models, institutions invoved in agri-business, quantitative tools for decision making, organizational behaviour and HRM, farm business management and production economics, agriculture finance, marketing management, entrepreneurship skills and new venture planning.

16. AGRICULTURAL EXTENSION

Fundamentals of agriculture extension and communications, enerzing perspective of agriculture extension in India and other countries, veterinary extension / dairy extension / home science extension / fisheries extension, information and communication technologies, technology parks, management of agriculture knowledge, agriculture extension management, extension education, research methodologies, HRD, development strategis and issues in agriculture extension.

17. STATISTICS AND COMPUTER APPLICATION.

Elements of set theory, de Morgan's laws, functions, real and complex numbers, arithmetic, geometric and harmonic progressions, polynomial and roots, groups, rings and fields. Galois field– Fermat's little theorem and primitive elements. Basic terminology of matrix algebra – vector space, linear independence, orthogonality, row and column spaces, matrix operations, determinants, rank and inverse of matrices, system of linear equations. Special matrices – idempotent, symmetric, orthogonal. Special products of matrices– Kronecker and Hadamard product. Eigenvalues of a symmetric matrix. Generalized inverses and their applications. Limits and continuity, differentiation of functions, Taylor's and Maclaurin's theorem, mean-value theorem, partial differentiation, maxima and minima, L'Hospital rule. Integration of rational, irrational and trigonometric functions. Applications of integration Linear Programming – formulation and graphical solution, simplex method, duality, transportation and assignment problem.

Classification, tabulation and presentation of data. Measures of central tendency and dispersion, moments, skewness and kurtosis. Elements of probability theory, laws of probability. Mathematical expectation. Probability distributions – binomial, Poisson, normal distributions and their applications. Sampling distributions – t, chi-square and F. Tests of significance based on Z, t, Chi-square and F distributions. Point and confidence interval estimation. Testing of hypothesis – two types of errors, level of significance and power of a test. Correlation, Regression analysis, partial and multiple correlation. Coefficient of determination. Multivariate normal distribution, Hotelling T^2, cluster analysis, discriminant analysis, principal component analysis. Non-parametric tests – sign test, run test, Wilcoxon test, Mann-Whitney U-test.

Concept of sampling, sampling versus complete enumeration, simple random sampling, stratified random sampling, cluster sampling and systematic sampling, ratio and regression estimators. Basic principles of design of experiments, uniformity trials, analysis of variance, completely randomized design, randomized complete block design, Latin square design. Factorial experiments (symmetrical as well as asymmetrical). Variance stabilizing transformations. Analysis of covariance. Mendel's laws, linkage, heritability, selection indices, Hardy-Weinberg law. Index numbers-their characteristics and construction. Elements of time series analysis.

Definition of computer, its characteristics and uses. Speed and processing power of a computer. Number systems – decimal, octal, binary and hexadecimal. Central Processing Unit (CPU) – the control unit, arithmetic logic unit and register. Input and output units. Organizing and accessing stored data– field, record and file. File organization –sequential, direct and indexed file. Multimedia-requirements and applications. Operating system (OS)-functions, Windows. Word Processing, spreadsheets. Networking – need, basic components. Connecting computers – local area networks, wide area networks. TCP/IP, HTTP protocols. Value added network services-Email, on-line services, Internet, etc.

VI. AGRICULTURAL ENGINEERING AND TECHNOLOGY

Part A : (GENERAL KNOWLEDGE)

Historical background and current status of agricultural engineering education in India, important Indian Organizations/institutions related with agricultural engineering; role of farm mechanization in crop production; different types of farm equipment, IC engines; Indian tractor industry; engineering properties of biological materials; unit operations in agricultural processing; machinery for crop processing; types of farm structures; soil and water conservation measures; soil erosion; hydrologic cycle, principles of fluid mechanics, methods of irrigation, types of irrigation pumps; instruments and methods for measuring temperature, pressure, RH, soil/grain moisture, radiation, fluid flow, engine power, electrical energy, etc; renewable sources of energy; basics of computer hardware and operating systems; elementary statistics.

Part –B

18. FARM MACHINERY AND ENERGY

Farm mechanization in India; status of power availability for crop production in India; soil dynamics in tillage and traction, precision agriculture, tillage implements, equipment for conservation agriculture, seed drills/planters, plant protection equipment, harvesting and threshing equipment; thermodynamics of I.C. engines; tractors and systems; power tillers; hydraulic power and controls; machine elements; renewable energy sources and conversion systems and applications. Energy requirements in agriculture production; ergonomics and safety in agriculture; testing and performance of tractors and farm machinery; costing of tractor-implement system.

19. POST HARVEST ENGINEERING AND TECHNOLOGY

Engineering properties and quality of biomaterials, aerodynamics, food quality. Post harvest unit operations, grading, premilling/conditioning treatments, cleaning, washing etc., Process technology and machinery, functional and structural designs, Material handling, packaging materials and characteristics. Transport, storage engineering. Thermodynamics, Heat and mass transfer, fluid mechanics, PHT project planning and agriculture business management. Process control software and hardware.

20. LAND AND WATER ENGINEERING

Status of water resources in India. Methods of irrigation, water use efficiency.; principles of surface and ground water flow; aquifer types and parameters; soil moisture, soil-plant-water relationships; water movement through soil-plant system, crop coefficient and irrigation requirement; hydrologic cycle; hydraulics of open channel and pipe flow; wells and irrigation pumps; drainage design and construction; soil erosion and its control; watershed constructions; land leveling machinery

21. FOOD SCIENCE AND TECHNOLOGY

Introduction of Food Technology: definitions, scope and opportunities. Food industries development in the country, Causes of food spoilage, Food attributes, Method of food preservation, Use of non-thermal technologies, micro filtration (UF&MP) bactofugation, ultra high voltage electric fields, irradiation, themosonication}, alternate-technologies (ohmic heating, dielectric heating, infrared and induction heating) & biological technologies (antibacterial enzymes, proteins & peptides) in food processing. Unit operations of food processing, machineries for various unit operations. Mass and energy balance in food processing. Packaging materials. Flavor composition of food beverages, economic considerations for domestic and export marketing, organic foods, Therapeutic foods, nutritional disorders association with foods, specialty foods.

VII. DAIRY SCIENCES AND TECHNOLOGY

Part A : (GENERAL KNOWLEDGE)

Status of Dairy Industry in India. Principles of production, processing and marketing, Special milks, Important detergents and sanitizers. Heat transfer, constructional and operational features of cream separation, Homogenizers, Butter and cheese making equipment. Auto process controls, Steam generation, milk products and advanced dairy technology. Dairy chemistry, chemistry of milk, biological and chemical methods for detections of adulteration, Physico-chemical properties of dairy products, Microflora associated and bacteriological aspects of processing, Microbiological quality, hurdle technology and cultures in dairy Probiotic and functional dairy foods. National and international standards for milk and milk products.

PART B

22. BASIC DAIRY SCIENCES

Specific compositional differences among milk from various species, Factors affecting composition of milk. Colostrum and abnormal milk. physical properties of milk. Salt balance and its importance in processing of milk. Chemistry of milk lipids, milk proteins, lactose, minerals, vitamins and milk enzymes, biological and chemical methods of detection of milk adulteration. Physico-chemical characteristics of cream, butter, *ghee*, condensed milk and evaporated milk, dried milks, cheese and fermented milks, ice-cream and frozen products. Various chemical changes during manufacture and storage. PFA, AGMARK and BIS standards of milk and milk products. Concepts of Good Manufacturing Practices (GMP). Total Quality Management (TQM), risk analysis and HACCP. Microflora associated with milk and milk products and their importance. Bacteriological aspects of processing techniques like bactofugation, separation, thermolization, pasteurization, sterilization and UHT processing. Type of spoilage in heat treated milks. Prevention of post processing contaminations. Microbiological quality of cream, butter, ice-cream and frozen products, condensed and evaporated milks, dried milks, indigenous dairy products and by-products, microbiological defects in various dairy products, Principles of preservation, biopreservation. National and international microbiological standards for milk and milk products. Principles of enumeration of conventional and emerging pathogens in dairy production; Biosensor based techniques for monitoring microbial and non-microbial contaminants in dairy industry. Types and utility of starter cultures, DVS and probiotic organisms.

23. DAIRY ENGINEERING AND TECHNOLOGY

Status of dairy Industry in India. Principles and practices of production of high quality milk. Method of raw milk procurement and preservation. Physical properties and chemical composition of milk of various species. Standardization of milk. Centerifugal separation, clarification and bactofugation, pasteurization, sterilization, UHT processing and asceptic packaging. Basic principles in production, processing and marketing of special milks, cream, butter, butter oil, *ghee*, ice-cream and frozen products, different types of cheese and fermented milks. PFA, BIS, AGMARK standards for milk and milk products. Properties of important dairy detergents and sanitizers. Basic principles of heat transfer. Common heat exchangers used in dairy plants. Constructional and operational features of cream separator, clarifier, homogenizer, butter and cheese making equipments. Steam generation, boilers and their accessories, vapour compression refrigeration system elements and controls, defrosting and condensers. Ion exchangers in water softening and demineralization operations in dairy plant. Waste water treatment and pollution control laws.

Note: -There is no separate syllabus for the disciplines of Basic Engineering and Textile Sciences for ARS Examination-2010. The syllabus of the disciplines of Basic Engineering and Textile Sciences of ARS Main Examination-2010 will be adopted for drawing papers for Prelim ARS Examination-2010 and ARS Main Examination-2010.