

Ph.D. Entrance Examination Scheme and Syllabus

In the very nature of competitive examination no syllabus can be prescribed. It is an exercise to pick up the best. However, for guidance to the candidates the syllabus and standard of the Entrance Test will be that of **M.Sc. (Agriculture/ Horticulture)** .

Subject

A. Faculty of Agriculture :

1. Agricultural Chemistry & Soil Science
 2. Agricultural. Economics
 3. Agronomy
 4. Entomology
 5. Extension Education
 6. Horticulture
 7. Livestock Production & Management
 8. Molecular Biology and Biotechnology
 9. Plant Breeding & Genetics
 10. Plant Pathology
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B. Faculty of Horticulture

01 Fruit Science

Question Paper: The Question paper will be in English only. The question paper will consist 100 multiple choice objective type questions bearing number 1, 2, 3.....to..... 100. There will be four options (1,2,3,4) for each question. The candidates are required to choose the correct option and blacken the corresponding circle on the OMR. Detail for filling answer sheet is given on back side of OMR sheet. The test booklet may be used by the candidates for rough work and the squares printed in it may be used for deciding the correct answer from the various alternatives. Only OMR sheet will be collected from them at the end of the examination and assessment will be made only on the basis of the OMR sheet. Candidates may carry question booklets at the end of the examination.

Marking scheme: Four marks will be awarded for every correct answer and one mark will be deducted for every wrong answer. Thus, there will be **negative marking**. If more than one option is chosen, it will be treated as wrong answer. No marks will be awarded or deducted for unmarked/ un attempted questions. There is no provision of revaluation of answer sheets and original answer sheet will not be shown to anybody in any case. Merit will be notified on university website. Only candidates securing $\geq 50\%$ marks i.e. ≥ 200 out of 400 marks [with 5% relaxation for SC/ST/OBC (Non creamy layer)/SBC (Non creamy layer) candidates i.e. ≥ 180 marks] will be short listed for submitting the Option Form.

The Question paper will consist of multiple choice objective type questions.

The question paper of subject will be in the form of a test booklet **containing 100 questions** bearing number 1, 2, 3..... 100. There would be four suggested answers (1,2,3,4) for each question. The candidates are required to choose the correct answer and blacken the corresponding circle (Details for filling answer sheet is given on side I of sample answer sheet) in the answer sheet by black ball point pen only.

The test booklet may be used by the students for rough work and the squares printed in it may be used for deciding the correct answer from the various alternatives. **Assessment will be**

made only on the basis of the answer sheet. Candidates may carry question booklets with them at the end of examination.

Four marks will be awarded for every correct answer and one mark will be deducted for every wrong answer. **Thus there will be negative marking. Multiple marking will be considered wrong answer. No marks will be awarded or deducted for unmarked/ unattempted questions.**

Answer sheet along with answer key will be displayed on web site. Discrepancy if any may be communicated within stipulated time, thereafter no complaint will be entertained.

Campus will be allotted to the candidates only on the basis of their merit and online option form keeping reservation under consideration

SUBJECT PAPER

AGRICULTURAL CHEMISTRY AND SOIL SCIENCE

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; Ficks 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. host resistance biological

AGRICULTURAL ECONOMICS

Basic concepts in economics, theory of consumer demand, theory of production, market classification, theory of perfect and imperfect competition, theory of distribution, national income accounting, classical and Keynesian theories of income determination, money-concepts, functions, theories of demand for money, supply of money; general equilibrium of product and money markets; IS and LM functions; monetary and fiscal policies, banking - central and commercial, functions and problems of recent macro-economic policies of Government of India; research methodology, steps in agricultural economics research, data collection, analysis and report writing; simultaneous linear equations, linear programming, statistical inference, correlation and regression analysis, time series analysis and theory of index numbers.

Nature and scope of agricultural production economics vis-a-vis farm management; farm business analysis, farm records and farm cost accounting; farm planning and budgeting, production function and resource allocation; assumption of production function and different form of production functions, cost, profit and supply functions; nature and analysis of risk in farming; systems approach in farming; role of credit in agriculture, principles of agricultural finance, farm financial management, supply and demand for farm credit; recent innovations in the extension of credit to agriculture, theory and practice of co-operation; problems of cooperatives, management of co-operative institutions; cost-benefit analysis of agricultural projects.

Scope of marketing in a developing economy; practice and problems of marketing agricultural inputs and outputs; functions and channels of marketing, co-operative marketing; agricultural price analysis; demand analysis; problems and prospects of storage and processing of agricultural products; agricultural exports - problems and prospects. Market intermediaries and their role, marketable & marketed surplus estimation, marketing efficiency, market integration APMC regulated markets - Direct marketing, contract farming and retailing - Supply chain management, role of information technology telecommunication in marketing of agricultural commodities.

Theory of growth and growth models; agricultural policy, planning and development in India, inter-regional variations in agricultural development, agricultural technology and income distribution; agrarian reforms and output and input price policies; infrastructure and institutions for agricultural development, equity and ecological consideration in agricultural development. OLS and their properties, multicollinearity, heteroscedasticity and autocorrelation.

Concepts, classification and problems of natural resource economics- Economy Environment interaction, Resource scarcity - Limits to Growth - Measuring and mitigation natural resource scarcity, common property rights, sustainability, environmental pollution.

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 and Rajasthan, their characteristic features; physiological limits of crop yield and variability in relation to the agro-ecological optimum; types of tillage - concepts and practices; recourse conservation technology.

Weed ecology & physiology; crop-weed interference; methods of weed control; principles and practices of weed management in crops and cropping systems; herbicide-formulations, classification, selectivity and mode of action; adjuvants; integrated weed management; herbicide resistance.

Agrometrology in relation to crop environment; solar radiation utilization & photosynthesis; monsoon characterization; weather forecasting; climate change: its impact on agriculture, mitigation and adaptation.

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; dynamics of major plant nutrients; organic manures, chemical and biofertilizers and fertilizer usage; integrated plant nutrient management; precision farming & site specific nutrient management; organic farming: concept, principles & components, quality considerations, labeling & accreditation process.

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 agro techniques 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, 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.

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. Life table concept, survivorship curves, degree-day model, predator prey relationship, diversity indices (index).

Fundamentals of insect physiology, different systems, their structure and function, metabolism, sense organs, insect behavior, 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 pests and their control.

EXTENSION EDUCATION

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, namely CD, Panchayatiraj System, IADP, IRDP, SGSY, PMGSY, DPAP, KVK, ATIC, ATMA, IVLP, ICDS, NREGP, Farmers Field School, Kisan Call Centre.

Principles of extension management, different theories of management processes and functions of managerial organisational 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. Participatory extension approaches (RRA, PRA, PLA, AEA, PAR, FPR); Participatory tools and techniques; Participatory technology development and dissemination.

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; research designs; data collection devices; 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.

HORTICULTURE

Recent trends in planting systems, cropping systems, improved varieties, canopy management, nutrient management, water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, physiological disorders, insect pest and diseases, maturity indices, harvesting, grading, packing, storage and ripening techniques of fruit crops –mango, banana, citrus, guava, grapes, pomegranate, papaya, sapota, custard apple, aonla, phalsa, ber, apple, pear, peach, plum, strawberry, wood apple, bael, litchi. Propagation, tissue culture and nursery management of fruit plants. Biodiversity, germplasms conservation, gene centres, intellectual property rights of fruits crops.

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures of vegetables- tomato, brinjal, chillies, okra, cucurbitaceous vegetables, beans, sweet potato, yam, cole crops, root crops, peas, leafy vegetables, bulb crops. Introduction, importance of spice crops-historical accent, present status - national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, sowing/planting times and methods, nutritional and irrigation requirements,

pharmaceutical significance, plant protection measures, physiological disorders - black pepper, cardamom, clove, cinnamon and nutmeg, turmeric, ginger and garlic, coriander, fenugreek, cumin, fennel, ajwain, Scope and global scenario of cut flowers in global trade, varietal wealth and diversity, Patent rights, nursery management, influence of environmental parameters, light, temperature, moisture, humidity and CO₂ on growth and flowering. Cut flower standards and grades, harvest indices Water and

nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM in crop- rose, chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, liliams, dahlia, gypsophilla. Landscape designs, types of gardens, Styles of garden, Urban landscaping, Landscaping for specific situations, Garden plant components, Lawns, Establishment and maintenance,

Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping. Cacti, succulents, tree, shrubs, climbers, alpine and annual flower plants in landscaping. Important landscape in India. Maturity indices, harvesting practices for specific market requirements, Physiology and biochemistry of fruit ripening, pre-cooling, Methods of storage ventilated, refrigerated, MAS, CA storage, physical injuries and disorders. Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies. Dried and dehydrated products, Role of photoperiod, vernalization, dormancy, respiration, transpiration, photosynthesis and senescence in plants. Essential plant nutrients and their uptake in horticultural crops.

LIVESTOCK PRODUCTION AND MANAGEMENT

Advances in housing management of dairy cattle and buffaloes in various agroclimatic zone of India. Management systems for cattle and buffaloes. Establishing Dairy Cattle Enterprise. Breeding Management. Advances in Feeding Management of cattle and buffalo, feeding for milking herd, dry cows, bulls and calves, Management of high yielding animals. Numbers and distribution of milch and dual purpose breeds of cattle and buffaloes. Sheep production. Advances in feeding management, Nutrient deficiencies in forage, General feeding practices, Feeding materials, Feeding lambs and ewes during lactation. Role of sheep husbandry in agriculture, Present development programmes in sheep and goat production. Role of goat in animal agriculture, Goat farming in India, selection of Breeding stock, Breeding problems, Housing, Principles of feeding, Milking practices. The present and future of Swine production systems in India and production policies adopted in advanced countries. Principal of animal experimentation. Planning and designing of experiments. Integration of research in various disciplines of animal production. Scientific writing research papers, reviews and reports etc. and their presentation. Importance and limitations of rabbits for meat and fur production. Common breeds and strains of poultry. Utilization and disposal of animal waste, Health hazards, Waste utilization, technologies for processing and treatment of animal wastes.

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Structure and organization of prokaryotic and eukaryotic cells; Cytoskeletal elements; organization and expression of prokaryotic and eukaryotic genome; concept of gene; quantitative trait loci, mutation; genetic recombination; transformation; transduction; conjugation; structure, function and regulation of genes in pro- and eukaryotes; transcription and translation; recombinant DNA, restriction enzymes, vectors, plasmids, cosmids and bacteriophages, expression vectors, cloning strategies, construction and screening of genomic and cDNA libraries, nucleic acid hybridization and DNA sequencing; restriction fragment length polymorphism; monoclonal antibodies and their application; enzyme engineering; genetic transformation of eukaryotes; crop improvement through genetic engineering; role of tissue culture in crop improvement; microbes in agriculture and industry; structure and function of proteins, nucleic acids, carbohydrates, lipids, enzymes; metabolism, glycolysis, citric acid cycle; respiration, bioenergetics; nucleic acid and protein biosynthesis; photosynthesis, nitrogen fixation. IPR in Biotechnology. Biosafety and Bioethics issues. Cell division and regulation of Cell cycle; Membrane transport; Signal transduction; Protein targeting; Molecular marker and its application in Agricultural; Genomics, Proteomics and metabolomics; Properties of nonomaterials and characterization, Synthesis and Application of nonomaterials. Introduction to Bioinformatics and Biological database. BLAST and FASTA.

PLANT BREEDING and GENETICS

Structure and function of cell and cell organelles, cell cycle; mitosis and meiosis; nucleic acids - their structure; Mendelian principles; chromosome structure and organization; types of chromosomes; chromosome function; linkage and crossing over - theories and molecular mechanism; recombination and gene mapping in diploids, fungi, bacteria and human; ploidy variations - euploids and aneuploids; chromosomal aberrations; extra chromosomal inheritance; gene mutation-mechanism, induction; gene concept; complementation, genetic fine structure; genetic code, information transfer and protein synthesis, gene regulation and gene manipulation; gene transfer technology; origin and evolution of important crop plants like wheat, rice, maize, sugarcane, potato, brassica, cotton, etc. Genetic basis of plant breeding; pure line selection; male sterility and incompatibility and their use in plant breeding; pedigree selection, mass selection and backcross method of selection; heterosis; plant introduction and exploration and their role in plant breeding; breeding for disease, insect and pest resistance; role of interspecific and intergeneric hybridisation; population improvement procedures; recurrent selection techniques; combining ability and its relationship with the components of gene action; seed production techniques; selection methods and changes in gene frequencies; mutation and its role in breeding; use of biotechnology in plant breeding. Molecular markers and their applications in genetic analysis and plant breeding.

PLANT PATHOLOGY

Landmarks and pioneers of plant pathology; theory of microscopy and staining; structural and physiological differences amongst fungi and fungi like organism, bacteria, rickettsias, phytoplasma and spiroplasma, viruses and viroids; principles of culturing and preservation of pathogens; characteristic symptoms; host-parasite relationships and its basis; symbiosis; economically important diseases of crop plants induced by fungi and fungi like organism, bacteria, rickettsias, phytoplasma and spiroplasma, viruses and viroids; phanerogamic parasites, non-parasitic diseases; nutrition, growth, reproduction, life cycle, ultrastructure, genetics and classification of microorganisms; Molecular methods for detection and diagnosis of Pathogenic microbes like fungi, bacteria and viruses. Mendelian principles; cell structure; seed germination; origin of life and evolution; beneficial microorganisms including mycorrhiza; variation in phytopathogens and their ecology; introductory epidemiology.

Faculty of Horticulture

FRUITS SCIENCE

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, cashew nut, 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 micropropagation 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.

Important statistical designs; methods of their statistical analysis; general principles of flower and vegetable production; major methods of preservation and processing of horticultural crops.