

Integral Institute of Ag. Science and Technology (IIAST)
Integral University, Lucknow
Syllabus for the Entrance Examination
Ph.D. (Genetic and Plant Breeding)

Historical perspective on Genetics. Mendelian principles; Epistasis, Linkage: detection and estimation in various organisms. Multiple alleles. Mechanisms of sex determination- Sex linked, sex- influenced and sex-limited traits. Gene concept, allelism and fine structure of gene. DNA – structure, function, replication and repair. Genetic code. Gene- enzyme relationship. Replication, Transcription and Translation. Gene regulation in prokaryotes and eukaryotes. Split genes, alternative splicing, transcriptional and post-transcriptional regulation. Mobile genetic elements and dynamic nature of genome. Mutations: induction, detection and mechanisms. Environmental influence on gene expression. Extra nuclear inheritance. Polygenic inheritance. Population genetics. Introduction to recombinant DNA technology. Secondary and tertiary structures of RNA. Chromosome structure and function. Gene transfer, vectors, restriction enzymes, distinguishing transferred genes from endogenous genes. In vitro synthesis of recombinant DNA and gene cloning. Gene transfer methods – Agrobacterium mediated and direct gene transfer method. Role of genetic engineering – transgenic crops, current status and prospects, potential hazards of gene cloning. Construction of genomic libraries. Molecular markers and QTL Analysis, types and significance. Genome projects, genomics and proteomics. Bioinformatics.

Introduction of plant breeding. Plant introduction, domestication and acclimatization. Center of origin. Germplasm collection, evaluation and conservation. Gene pool concept. Gametogenesis and fertilization. Modes of sexual and asexual reproduction and its relation to plant breeding methodology. Apomixes, incompatibility and male sterility systems and their use in plant breeding. Pure line theory and concept of pure line. Mass selection, pure line selection, pedigree selection, bulk method, single seed descent and back cross method. Population breeding. Hybrid breeding. Synthetic varieties. Breeding vegetatively propagated crops. Role of Mutation in Plant Breeding. Application of biotechnology in plant breeding. Intellectual property rights in relation to plant breeding. Origin, distribution, classification, description and botany of cereals; oilseeds; fibers and sugar crops, fodder and green manures; Genetic basis and breeding for resistance to diseases and insect-pests. Breeding for vertical and horizontal resistance to diseases. Genetic and physiological basis of abiotic stress tolerance. Breeding for resistance to heat, frost, flood, drought and soil stresses. Important quality parameters in various crops, their genetic basis and breeding for these traits. Role of molecular markers in stress resistance breeding: MAS, MARS and MABB.

Historical background of quantitative inheritance. Quantitative characters. Multiple factors inheritance. Genetic control of polygenic characters. Genetic advance and types of selection and correlated response. Hardy Weinberg law. Linkage disequilibrium. Genetic load. Polymorphism. Breeding value, heritability. Response to selection, correlated response. Estimates of variance components and covariance among relatives. Mating designs with random and inbred parents. Estimation of gene effects and combining ability. Effects of linkage and epistasis on estimation of genetic parameters. Maternal effects. Genotype-environment interactions and stability of performance. Heterosis and its basis. Mating system and mating design- diallel, line X tester, NC-I, NC-II and NC-III designs, approaches to estimate and exploit component of self and cross pollinated crops. Genotype X environment interaction and stability analysis.

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Council meeting
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Variety Development and Maintenance; Variety testing, release and notification systems in India and abroad. DUS testing- Genetic purity concept and maintenance breeding. Principles & methods of seed production; Generation system of seed multiplication -nucleus, breeders, foundation, certified, - Quality seed production technology; of self and cross-pollinated crop varieties viz. cereals & millets; Pulses; Oilseeds; fibres and forages; Seed certification procedures; Seed laws and plant variety protection regulations in India and international systems

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**Integral Institute of Ag. Science and Technology,
Integral University, Lucknow
Syllabus for the Entrance Examination of
Ph.D. (Agribusiness Management)**

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.

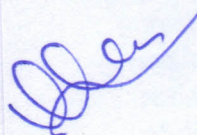
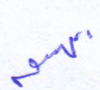

Organizational set up of agricultural research, education and extension in India. Elements of statistics. Farm equipment and Farm Machinery in India, sources of energy and power on farms. Irrigation and drainage systems. Basics of post-harvest technology, Basics of energy in agriculture.

Basics of veterinary, gynecology, veterinary microbiology, veterinary pathology and Parasitology, veterinary surgery, veterinary public health, veterinary pharmacology and toxicology. Basics of human food and nutrition, human/child development, home and family resource management, clothing and textile.

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.

Communicative ability: Test English comprehension wherein the knowledge of language skills are tested as to how effectively the candidate communicates his thoughts and ideas. Data Interpretation: Calculations requiring skills of interpretation of facts and figures. The questions can be posed as graphs, tables and charts.

Logical reasoning: Evaluating logical thinking capacity by providing various options. Fundamentals of managerial economics, market structure conduct and performance, demand analysis, production analysis, utility theories, 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.




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Integral Institute of Ag. Science and Technology (IIAST)
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Syllabus for the Entrance Examination
Ph.D. (Entomology)

Systematics History and development of Entomology, characteristics of phylum Arthropoda, Classification of insects up to order level, habits, habitats and distinguishing features of different Order and important Families.

Morphology Body wall, its structure, outgrowths, endoskeleton, Body regions, segmentation, sclerites and sutures, types of mouth parts, antennae, their structure and types. Thorax structure, thoracic appendages and their modification. Wings, their modification and venation, Abdomen; structure External genitalia

Embryology, Internal Anatomy and Physiology Embryonic and post embryonic development, types of metamorphosis, physiology of ecdysis. General features and types of larvae and pupae. Structure, function and physiology of Digestive, Circulatory, Respiratory, Reproductive, Nervous and Excretory systems, Sense Organs; structure and types.

Ecology Concept of ecology, Environment and its components-biotic and abiotic factors and their effects on growth, development, population dynamics, distribution and dispersal. Biotic potential and environmental resistance. agroecosystems analysis, their characteristics and functioning. Intra and inter specific relationship; competition, predator-prey and host-parasite interactions, ecological niche, pest out breaks.

Biological Control: Importance, history and scope, Biocontrol agents-parasites, predators and insect pathogens. multiple parasitism, hyperparasitism, superparasitism and their applied importance. exotic biocontrol agents. Classical biological control, conservation, habitat management and augmentation. Mass multiplication techniques and economics. Effective evaluation techniques, Successful cases of biological control of pests.

Chemical Control and Toxicology History, scope and principles of chemical control. Insecticides and their classification. Formulations of insecticides. different groups of insecticides: Physical, chemical and toxicological properties insect hormones, Insecticide induced resurgence. Problems of pesticide hazards and environmental pollution. Safe use of pesticides, precautions and first aid treatments. Insecticides Act 1968, registration and quality control of insecticides. Evaluation of toxicity, methods of toxicity testing, determination of LC 50 LD 50, LT 50, RL 50 etc. Pesticides residues in the environment and their dynamics of movements, methods of residue. Mode of action of different groups of insecticides; neuroactive (axonal and synaptic) poisons, respiratory poisons, chitin synthesis inhibitors. Metabolism of insecticides; activative and degradative metabolism, detoxification enzymes and their role in metabolism.

Host Plant Resistance Chemical ecology: mechano- and chemoreceptors. Host plant selection by phytophagous insects. Secondary plant substances. Basis of resistance (Antixenosis, Antibiosis, Tolerance). Biotypes development, Tritrophic interactions, induced resistance. Breeding for insect resistant plant varieties. Resistance development and evaluation techniques. Genetics of Resistance, Biotechnological approaches and development of transgenic insect resistant plants, Insect resistance to transgenic plants and its management.

Innovative Approaches in Pest Control, pheromones-types and uses, Hormonal control: types and function of insect hormones, insect hormone mimics, chemosterilants, antifeedants, attractants,

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repellents; their types, method of applications, advantages and limitations. Genetic control. Potentialities of IPM.

Integrated Pest Management: History, concept and principles. Components of IPM: Host plant resistance, agronomic manipulations, mechanical and physical methods, chemical methods, biocontrol agents utilization, genetic and behavioral control strategy etc. IPM strategies for field and horticultural crops. IPM case histories. Concept of damage levels- Economic threshold levels (ETL), Economic injury levels (EIL) and their determination. Plant quarantine laws and regulations.

Pesticide Application Equipments Types of appliances: sprayers, dusters, fog generators, smoke generators, soil injecting guns, seed treating drums, flame throwers, etc. Power operated sprayers and dusters. Types of nozzles and their uses. Aerial application of pesticides.

Pests of Field Crops and their Management Distribution, host range, biology and bionomics, nature of damage and management of arthropod pests of cereals, Oilseed, pulses and fibre crops, sugarcane and tobacco. Polyphagous pests: locusts, termites, hairy caterpillars, cut worms and white grubs.

Pests of Horticultural Crops and their Management Distribution, host range, biology and bionomics, nature of damage and management of arthropod pests of vegetables, fruits and plantation crops, spices, condiments and ornamentals, Vertebrate Pests.

Pests of Stored Products and their Management Fundamentals of storage of grains and grain products. Storage losses, sources of infestation/infection, factors influencing losses, insect and non-insect pests, their nature of damage and control. Storage structures, bulk storage and bag storage, Regulated and quarantine pests. Integrated management of storage pests.

Arthropod Vectors of Plant Diseases: Common arthropod vectors and their relationship with the plant pathogenic fungi, bacteria, viruses, mycoplasma. Mechanism of pathogen transmission Toxicogenic insects, mites and phytotoxemia. Management of vector and its effect on control of diseases.

Honey Bees and Bee-keeping Honey bees and their economic importance. Bee species, their behaviour, habit and habitats. Bee Keeping: bee pasturage, hives and equipments, seasonal management. Bee enemies including diseases and their control.

Silkworms and Sericulture Silkworm species, Rearing techniques of mulberry - muga, eri and tassar silkworms. Nutritional requirements of silkworms. Sericulture: rearing house and appliances, silkworm breeds, principles of voltinism and nioltinism, seed production and its economics. Different molecular approaches in developing silkworm breeds. Mulberry pests, diseases and their management. Enemies and diseases of silkworms and their management. Sericulture organization in India.

Lac Insect Lac insect, its biology, habit and habitats. Host Trees: pruning, inoculation, lac cropping techniques, and harvesting. Enemies of lac insect and their control.

Useful Insects Pollinators, biocontrol agents of weeds, soil fertility improving agents, scavengers. Use of insects and insect products in medicines. Usefulness of insects in scientific investigations, insects as food.

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Integral Institute of Ag. Science and Technology (IIAST)
Integral University, Lucknow
Syllabus for the Entrance Examination of
Ph.D. (HORTICULTURE)

Introduction to horticultural crops Systematic classification, nomenclature and botanical relationship of fruits, vegetable and ornamental plants.

Basic concept and principles of propagation. Asexual propagation of plants and the recent development in the field. Techniques of propagation and equipment. Polyembryony and its importance in Horticulture. Lay out and management of commercial nursery. Importance of orchard management, making fruit culture as applying impact of various operation like planting, irrigation and drainage, fertilizer application, pruning, soil management practices etc. On growth and productivity of fruit trees, problems being faced in these practice and method of solving them.

Control on growth, flowering, unfruitfulness, high-density planting system of training and pruning, protected cultivation of fruit plants, steonic relationship and new promising root stock of fruit crops. Varietals status and latest production technique including major problems and solution of important fruit crops.

Importance of vegetable and its prospects for improvement, origin, taxonomy and cytogenetic of important vegetable crops. Possibilities of breeding of important vegetable crops for higher yield, earliness, disease and pest resistance etc. Cultivars and environmental factor in relation to growth, development and productivity of important vegetable crop. Seed production technique for important vegetable crops.

Advance in flower plants improvement, nutrition, irrigation, pruning and training, physiology of flowering and colour development. Post-harvest handling of cut flowers for export and exhibition.

Importance, classification and usage, studies on importance, botanical description, distribution, composition, climate and soil, culture practices, yield and constituents of important medicinal and aromatic plants.

Review of nutritional problems of fruit crops. Factors affecting fruit tree nutrition. Characteristic symptoms of deficiency and toxicity of individual elements in fruits plants, possible causes and their control. Standardization of leaf sampling Techniques and uses of tissue analysis as a guide for orchard nutrition. Nutritional problems of saline, alkaline, sodic and waterlogged soils and roots-stocks fruits -crops suitable for such soils. Nutrition of important fruit crops with special reference to their growth, productivity and quality: mango, citrus, banana, guava, litchi, grapes, papaya, pome fruits, stone fruits, and other fruits.

Maturity and ripening process and factors affecting them quality examination for fresh market and processing. Biochemical changes in harvested produce. Factors responsible for deterioration of harvested produce. Role of plant regulators and irradiation in decay control. storage conditions and their influence of fresh fruits and symptoms of chilling injury Post harvest physiology of important crops; Mango, citrus, banana, grapes, papaya, apple & pear, stone fruits, tomato, potato, onion, peas, leafy vegetables.

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Integral Institute of agricultural science & Technology (IIAST)
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Syllabus for Entrance Examination of Ph.D.
(Agricultural Extension and Communication)

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. 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. 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. 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 5 programme 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. 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, cybercafe, 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. (Source- ICAR 2019)

19/04/19

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Integral Institute of Ag. Science and Technology (IIAST)
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Syllabus for the Entrance Examination
Ph.D. (Agricultural Microbiology)

History, development and scope of microbiology, evolution of microbial life. Theory of spontaneous generation. Prokaryotes, archaebacteria and eukaryotes. Techniques used in identification and classification of bacteria. Important groups of prokaryotes – photosynthetic bacteria, blue green algae, chemoautotrophic bacteria, spore forming bacteria, mycoplasma, viruses, bacteriophages and actinomycetes. Heterotrophic bacteria nitrobacteria, nitrogen-fixing bacteria and cyanobacteria, lactic acid bacteria, halophiles, thermophiles, acidophiles and methanogens. Structure and classification of viruses, growth of viruses, lytic and lysogenic cycles, plant viruses, viroids.

Principles of microbial ecology, Microbiology of ecosystems - soil, rhizosphere, phyllosphere, water - fresh and marine, and air. Microbial interactions - symbiosis, synergism, commensalism, parasitism, amensalism, antagonism and predation, adoption of micro-organisms to various ecosystems. Microbial growth curve. Mathematical expression of growth -continuous and batch cultures. Diauxic and synchronous growth. Microbial nutrition. Bacterial metabolism - aerobic and anaerobic respiration, electron transport chain, microbial photosynthesis, oxidative and substrate level photo-phosphorylation. Biosynthesis of cell wall, protein breakdown by microbes.

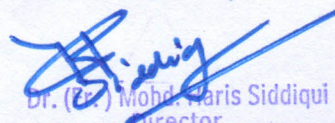
Soil microorganisms: major groups, decomposition of organic matter, soil health. Root exudates and rhizosphere effects. Manipulation of rhizosphere microflora in plant productivity. Microbial biomass. Nitrogen cycle: ammonification, nitrification and denitrification. Biological nitrogen fixation—symbiotic and asymbiotic. Biochemistry and genetics of nitrogen fixation. Microbial transformations of phosphorus, sulphur and minor nutrients. Role of bio-fertilizers in agriculture and forestry. Bioremediation of problem soils, plant growth promoting rhizobacteria and their mode of action. Formation and composition of soil organic matter: fulvic acid and humic acid.

Isolation and preservation of different types of microorganisms. Methods of sterilization and disinfection. Microbial assay of vitamins, enzymes and antibiotics, Pollution of soil, water and air, Role of microorganisms in pollution, sources of pollution and their impact on environment, microbiology of sewage and industrial effluents and their safe disposal, management of solid and liquid organic wastes, composting, biogas, water purification, sewage treatment, water-borne diseases and effluent management.

Industrial production of metabolites - organic acids, alcohols, antibiotics. Fermentor designs and types. Control of fermentation process - batch, feed batch and continuous. Downstream processing in fermentation industry. Production of single cell proteins and probiotics, hormones, biofertilizers, biopesticides. Phytoremediation. Microbiology of raw and processed foods. Fermented food – vinegar, wine sauerkraut, pickles, cheese, yogurt. Food preservation, contamination and spoilage, food-borne illness and intoxication. Food as substrate for micro-organism, microflora of meat,

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fish, egg, fruits, vegetables, juices, flour, canned foods; bio- degrading microbes, single cell protein for use as food and feed, bioactive food / probiotics.

Immunological methods:(Immuno diffusion RIA, ELISA etc.).Bioinoculant production technology for bio fertilizers and biopesticides. Theory and practical application of various forms of light microscopy including electron microscopy. Principle and application of various forms chromatography, TLC, Column chromatography, HPLC, GC, HPLC, Centrifugation, Gelelectrophoresis, and agarose gel electrophoresis, Flowcytometry, DNA microarray.

Molecular techniques for study in microbial diversity, Genomic and plasmid DNA isolation methods, Genetransfer methods in bacteria. Plasmid curing and compatibility determination, Plasmid encoded virulence factors detection methods. Principle and applications of PCR, Southern and Northern blotting, RAPD, RISA, FISH and FACS, Restriction endonucleases. Principle and application of metagenomics. Proteomics and RNA interference.

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Integral Institute of Agricultural Science & Technology
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Syllabus for the Entrance Examination of
Ph.D. (Agricultural Economics)

Basic microeconomic concepts; Theory of demand & supply, market equilibrium. Utility analysis, production functions, isoquants, cost functions, returns to scale and economies of scale, market structures, price discrimination.

Circular flow, national income & economic welfare. Theories of income and employment; Keynesian model of income and employment. Consumption, saving and investment function, rate of interest. Fiscal & monetary policy, Inflation, IS-LM curve and equilibrium, economic reforms. Business cycles. Nehru's economic philosophy.

Agriculture: economic growth and development. Supply side models: Adam Smith's and Ricardo's model. Demand side models: Malthusian and Harrod, Domar models, Rostow's stages, Lewis two sector model. Problems of agriculture in India; poverty and inequality; land reforms; theory of share tenancy. Five-year plans and agriculture. Agricultural strategy; unimodal and bimodal.

Agricultural developmental & compensation policies. Agriculture credit and finance policy. Agriculture taxation. Food security: agricultural subsidies, subsidies on agricultural inputs, PDS, TPDS, NFSA, 2013, ICDS and mid-day meal scheme. New agriculture policy. Trade policy; Export promotion vs import substitution. Foreign exchange rates, exchange controls, and the devaluation decision.

Production function, factor-product, factor-factor and product-product relationship, law of equi-marginal, opportunity cost, law of variable proportions, comparative advantage, returns to scale. Cost functions, price and output determination. Farm income and profitability, technical and economic efficiency. Farm records; farm inventory, balance sheet, profit and loss accounts. Farm planning and budgeting, risk and uncertainty. Resource economics, unique properties of natural resources.

Agricultural finance: institutional and non-institutional, commercial banks, microfinance, KCC and SHGs, RRBs, RBI, NABARD, ADB, IMF and World Bank. Credit appraisal: 3rs, 3cs and 7ps of credit. SWOT analysis. Project appraisal; NPV, IRR, BCR, Network analysis; PERT & CPM. Agricultural cooperation, Types of cooperative societies, ICA, NCUI, NCDC, NAFED.

Agricultural marketing: marketing mix and market segmentation (STP), producer's surplus, Product life cycle (PLC), marketing functions, grading & standardization, AGMARK. Marketing channels; integration, efficiency, costs and price spread. Govt. agencies; CWC, SWC, FCI, CACP & DMI. Marketing risk; types, speculation & hedging, futures trading. Administered prices. GATT and WTO; (AoA); SPS. EXIM Policy; Agricultural exports; APEDA and MPEDA.

Research Process, Measurement, Attitude Measurement, Sampling, Field work, Descriptive Statistics, Measures of Central Tendency and Dispersion, Data Reduction, Tabulation & Analysis, Report writing. Linear programming: objective, assumptions, formulation of linear programming problem, simplex, method; primal and dual LP problems; role of business decision making models.

*Announcement
Attend
Put up in the next
ATC meeting
A.A.A.
13.6.2020*

*Rahil
10/6/20*

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**Integral Institute of Agricultural Science & Technology,
Integral University, Lucknow
Syllabus for the Entrance Examination of
Ph. D. (Agroforestry)**

National Forest Policy 1894, 1952 and 1988; Indian Forest Act, 1927; Forest Conservation Act, 1980 and Wildlife Protection Act, 1972; Forest types of India: distribution and types; Succession, climax and retrogression; Concepts of biomass, productivity, energy flow and nutrient cycling in forest ecosystem; Migration and dispersal mechanism.

Concept and definition of agroforestry, social forestry, community forestry and farm forestry; Classification of agroforestry systems: Multipurpose tree species and their characteristics suitable for agroforestry. Alley cropping, home gardens, shifting cultivation, shelterbelts and windbreaks, Principles and criteria of plant selection in agroforestry- Resource use efficiency in agroforestry. Effects of deforestation on soil erosion, land degradation, environment and rural economy; Wastelands: their extent, characteristics and reclamation.

Forest Mensuration - definition, object and scope; Measurement of diameter, girth, height, stem form, bark thickness, crown width and crown length; Measurement methods and their principles. Measurement and computation of volume of logs and felled/standing trees; Geographic information systems and remote sensing - concept and scope.

Definition, object and scope of silviculture; Site factors - climatic, edaphic, physiographic, biotic and their influence on forest vegetation; Forest regeneration: natural and artificial; Silvicultural systems - high forest and coppice systems; Silviculture of important tree species - Populus, Eucalyptus, Dalbergia, Acacia, Tectona, Shorea, Prosopis, Casurina, Pinus, Azadirachta, and Albizia bamboo, *Melia dubia*, *Ailanthus excelsa* .

Forest nursery - need, selection and preparation of site, layout and design of nursery beds; Tending operations - weeding, cleaning, climber cutting, thinning - mechanical, ordinary, crown and selection thinning, improvement felling, pruning and girdling.

Forest management: definition and scope; Concept of sustained yield and normal forest; Rotation; Estimation of growing stock, density and site quality; Management of even aged and uneven aged forest; Joint forest management; Conservation and management of natural resources including wildlife.

Climate change: greenhouse effect, sources and sinks of greenhouse gases, major greenhouses gases; Global climate change - its history and future predictions; Impact of climate change on agriculture, forestry, and wildlife, Ozone layer depletion; Disaster management, floods, droughts, earthquakes; Tsunami, cyclones and landslides; Agroforestry and carbon sequestration.

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21/05/2020


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Syllabus for the Entrance Examination
Ph.D. (Agri-Informatics)

Introduction and Applications of e-Agriculture, Introduction to Online Agricultural resources: Consortium for e-resources in Agriculture (CeRA), e-agriculture community, National Agricultural Bioinformatics Grid (NABG): ASHOKA - Advanced Supercomputing Hub for OMICS Knowledge in Agriculture: features and applications; National Bio-Computing Portal: objectives, facilities provided at NBCP.

Use of ICT in Agriculture, Computer Models for understanding plant processes, Preparation of contingent crop-planning using IT tools.

Application of Remote Sensing: Definition of Remote Sensing. Agriculture, Forestry, Flood delineation, Soil moisture, Sea ice, Land cover, Mapping, Oceans and coastal regions, Geospatial technology for generating valuable agri-information.

Digital Image Processing: Image enhancement. Data classification. Geographical Information Systems and its applications. Digital Representation of Geographic data, Raster and Vector Based GIS data. Integration of Aerial Photography into GIS

Soil and crop management: Soil Information Systems Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System.

Bioinformatics and Biological DATABASES: Introduction to Bioinformatics: The Genesis of Bioinformatics, Bioinformatics Versus Other Disciplines, Biological databanks: Types, Nucleic Acid and Protein Sequence Databases, Structural Databases, Literature databases, Genome and Organism-specific databases for example OMIM, TAIR, NCBI, TIGR, GOLD.

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13.6.2020

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Integral Institute of Agricultural Science and Technology (IIAST)
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Syllabus for Entrance Examination of
Ph. D (Agriculture) Agronomy

Principles of crop ecology; Ecosystem concept and determinants of productivity of ecosystem; Physiological limits of crop yield and variability in relation to ecological optima; Crop adaptation; Climate shift and its ecological implication; Greenhouse effect; Agro-ecological and agro climatic regions of India; Geographical distribution of cereals, legumes, oilseeds, vegetables, fodders and forages, commercial crops, condiments and spices, medicinal and aromatic plants; Adverse climatic factors and crop productivity; Photosynthesis, respiration, net assimilation, solar energy conversion efficiency and relative water content, light intensity, water and CO₂ in relation to photosynthetic rates and efficiency; Physiological stress in crops; Remote sensing: Spectral indices and their application in agriculture, crop water stress indices and crop stress detection.

Scope and principles of weed management; Weeds' classification, biology, ecology and allelopathy; Crop weed competition, weed threshold; Herbicides classification, formulations, mode of action, selectivity and resistance; Persistence of herbicides in soils and plants; Application methods and equipment; Cultural, physical, mechanical weed control, Biological weed control, bio-herbicides: Integrated weed management; Special weeds, parasitic and aquatic weeds and their management in cropped and non-cropped lands; weed control schedules in field crops, vegetables and plantation crops; Role of GM crops in weed management.

History of soil fertility and fertilizer use; Concept of essentiality of plant nutrients, their critical concentrations in plants, nutrient interactions, diagnostic techniques with special emphasis on emerging deficiencies of secondary and micro-nutrients; Soil fertility and productivity and their indicators; Fertilizer materials including liquid fertilizers, their composition, mineralization, availability and reaction products in soils; Water solubility of phosphate fertilizers; Slow release fertilizers, nitrification inhibitors and their use for crop production; Principles and methods of fertilizer application including fertigation; Integrated nutrient management and bio-fertilizers; Agronomic and physiological efficiency and recovery of applied plant nutrients; Criteria for determining fertilizer schedules for cropping systems direct, residual and cumulative effects; Fertilizer related environmental problems including ground water pollution; Site-specific nutrient management; Contamination of heavy metals in peri-urban soils and their remediation.

Concept of dryland farming; dryland farming vs rainfed farming; History, development, significance and constraints of dryland agriculture in India; Climatic classification and delineation of dryland tracts; Characterization of agro-climatic environments of drylands; Rainfall analysis and length of growing season; Types of drought, drought syndrome, effect on plant growth, drought resistance, drought avoidance, drought management; Crop Planning including contingency, crop diversification, varieties, cropping systems, conservation cropping and mid-season corrections for aberrant weather conditions; Techniques of moisture conservation in-situ to reduce evapotranspiration, runoff and to increase infiltration; Rain water harvesting and recycling concept, techniques and practices; Timelines and precision key factors for timely sowing, precision in seeding, weed control; Fertilizer placement, top dressing and foliar application, aqua-fertigation; Concept and importance of watershed management in dryland areas.

Problem soils and their distribution in India, acid, saline, waterlogged and mined - soils; Response of crop to acidity, salinity, sodicity, excess water and nutrient imbalances; Reclamation of problem soils, role of amendments and drainage; Crop production techniques in problem soils - crops, varieties, cropping system and agronomic practices; Effects of water table fluctuation on crop growth; Degraded lands and their rehabilitation.

Crop production techniques for cereals, millets, legumes, oilseeds, fiber crops, sugarcane, tobacco, fodder and pasture crops including origin, history, distribution, adaptation, climate, soil

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season, modern varieties, Seed rate, fertilizer requirements, crop geometry, inter-cultural operations, water requirement, weed control, harvest, quality components, industrial use, economics and post-harvest technology.

Frequency distribution, standard error and deviation, correlation and regression analyses, coefficient of variation; Tests of significance-t, F and chi-square (X^2); Data transformation and missing plot techniques; Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs; Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.


Concept of sustainability; Sustainability parameters and indicators; Conservation agriculture; Alternate land use systems; Types, extent and causes of wasteland; Shifting cultivation; Agro forestry systems; Agricultural and agro-industrial residues and its recycling, safe disposal; Allelopathy and biomass production.

Soil and water as vital resources for agricultural production; Occurrence of groundwater, groundwater aquifers, exploration of groundwater; Hydrological cycle; Soil-plant water relationship; Fate of rain water received at the soil surface, runoff and infiltration reciprocity, factors affecting infiltration, means to enhance infiltrability of soil, mechanical and biological means to reduce runoff and soil loss; Water harvesting for crop lifesaving irrigations; watershed management; Soil and water conservation; Contingent crop plans and other strategies for aberrant weather conditions; Cropping patterns, alternate land use and crop diversification in rainfed areas; Analysis of hydrologic data and their use. Agricultural drainage.

Soil water relations, water retention by soil, soil moisture characteristics, field capacity, permanent wilting point, plant available water and extractable water; Soil irrigability, classifications, factors affecting profile water storage; Determination of soil water content, computation of soil water depletion, soil water potential and its components, hydraulic head; Movement of soil water saturated and unsaturated water flow; Field water budget, water gains and water losses from soil, deep percolation beyond root zone, capillary rise; Evapotranspiration (ET), scope for economizing water, measures for reducing direct evaporation from soil and crop canopies; Soil physical properties in relation to plant growth and development; Erodability of soils and their prevention.

Plant water relations: Concept of plant water potential, cell water relations, plant water potential and its components; Significance of osmotic adjustment, leaf diffusive resistance, canopy temperature, canopy temperature depression (CTD); Water movement through soil - plant atmosphere systems, uptake and transport of water by roots; Development of crop water deficit, crop adaptation to water deficit, morpho-physiological effect of water deficit; Drought tolerance, mechanisms of drought tolerance, potential drought tolerance traits and their measurements. management and breeding strategies to improve crop productivity under different patterns of drought situations of limited water supplies; Effect of excess water on plant growth and production; Types of droughts, drought indices.

Management of irrigation water; History of irrigation in India; Major irrigation projects in India; Water resources development; Crop water requirements; Concepts of irrigation scheduling, Different approaches of irrigation scheduling; Soil water depletion plant indices and climatic parameters; Concept of critical stages of crop growth in relation to water supplies; Crop modeling, crop coefficients, water production functions; Methods of irrigation viz. surface methods, overhead methods, drip irrigation and air conditioning irrigation, merits and demerits of various methods, design and evaluation of irrigation methods; Measurement of irrigation water, application and distribution efficiencies; Management of water resources (rain, canal and ground water) for agricultural production; Agronomic considerations in tile-design and operation of irrigation projects, characteristics of irrigation and family systems affecting irrigation management; Irrigation legislation; Water quality, conjunctive use of water, irrigation strategies under different situation of water availability, optimum crop plans and cropping


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Patterns in canal command areas; Socio-economic aspects of on-farm water management; Irrigation water distribution, Estimation of ET by direct and indirect methods, Irrigation efficiencies; Design of irrigation canals, design of irrigation structures; Interaction between irrigation and fertilizers.

Problem soils and their distribution in India; Salt-affected, acidic, water logged soils; Ground water resources, water quality criteria and use of brackish waters in agriculture; Excess salt and salt tolerant crops; Hydrological imbalances and their corrective measures; Concept of critical water table depths for crop growth; Contribution of shallow water table to crop water requirements; Management strategies for flood prone areas crop and crop calendar for flood affected areas; Drainage for improving water logged soils for crop production; Crop production and alternate use of problematic soils and poor quality water for agricultural and fish production; Amelioration of salt affected soils.

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Integral Institute of Ag. Science and Technology (IIAST)
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Syllabus for the Entrance Examination of
Ph.D. (Soil Science)

Concept of land, soil and soil science; Composition of earth crust and its relationship with soil; Rocks, minerals and other soil forming materials; Weathering of rocks and minerals; Factors of soil formation; Pedogenic processes; Soil profile, horizons and their nomenclature; Soil taxonomy – epipedons, diagnostic subsurface horizons and other diagnostic characteristics; Soil moisture and temperature regimes; Application and use of global positioning system for soil survey; Soil survey- types and techniques.

Soil physics and its relation with other branches of soil science; Soil texture-textural classes; Soil structure- classification; soil aggregation; soil consistency; Soil crusting; Bulk density, particle density and porosity of soils; Soil compaction and consolidation; Soil water- soil water retention, Soil water potential; Soil-moisture characteristic curve; hysteresis; Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity- measurement of hydraulic conductivity in saturated and unsaturated soils; Infiltration; Evaporation; Hydrologic cycle; Soil-plant-atmosphere continuum; Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; Modes of energy transfer in soils; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management. Soil erosion by water and wind- types, effects, mechanisms. Land degradation; Remote sensing techniques; Concept of watershed.

Chemical composition of the earth's crust and soils; Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics; Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC); diffuse double layer theories of soil colloids, zeta potential; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, clay-organic interactions. Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, thermodynamics, statistical mechanics; anion and ligand exchange - inner-sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, AEC, CEC; Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibria; step and constant-rate K; Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity, Chemistry of salt-affected soils and amendments; soil pH, EC, ESP, SAR and important relations; soil management and amendments, Chemistry and electrochemistry of submerged soils.

Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid

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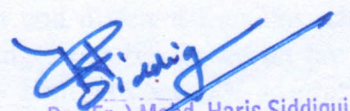
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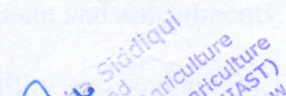
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and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions. Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions. Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium- factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers, Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity–intensity relationships; soil test crop response correlations and response functions, Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site -specific nutrient management; plant need based nutrient management; integrated nutrient management, Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Soil biota, soil microbial ecology, types of organisms; soil microbial biomass; microbial interactions; un-culturable soil biota. Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora. Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients. Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil. Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers – definition, classification, specifications, method of production and role in crop production.

Methods of analysis, particle size distribution, bulk and particle density, moisture constants, modern methods of soil, plant and fertilizer analysis, flame photometry and inductively coupled plasma optical emission spectroscopy; atomic absorption spectrophotometry-


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**Integral Institute of Agricultural Science and Technology,
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**Syllabus for the Entrance Examination of
Ph.D. (Livestock Production and Management)**

Development of Dairy Industry in India and world –Present status and future prospects of livestock development in India. Important breeds of cattle and buffalo, traits of economic importance and their inter-relationships. Selection of high quality animals. Breeding Management: System of breeding. Methods of Breeding. Prenatal and postnatal care and management of cattle and buffalo. Care of neonate and young calves. Management strategies for reducing mortality in calves, age at first calving and calving interval in cattle and buffaloes. Management of labour, Different laws governing the livestock sectors to produce quality products on par with international standards. Technique of harvesting clean and hygienic livestock products, health management. Wallowing in buffaloes. Management of draught animals and summer management. Feed and fodder resources used for feeding of cattle and buffaloes. Scientific technique of feeding, watering. Computation of practical and economical ration, supply of green fodder around the year and enrichment of poor quality roughages.

Functional morphology of male and female reproductive organs of farm animals. Managerial strategies for attaining early maturity in farm animals. Heat detection methods, associated problems and their management. Oestrus synchronization, methods and limitations. Artificial breeding and its economic importance. Post A.I. management, pregnancy development and diagnosis. Management of down calvers. Post-partum care. Factors influencing reproductive efficiency in buffalo and crossbred cattle and measures for improvement. Management of calving problem, dystocia, prolapse and retained placenta. Management of breeding bulls. Methods of semen collection, factors affecting quality semen, production, evaluation, processing and preservation of semen. Merits and demerits of different extenders. Planning and management of frozen semen bank and bull station. Handling of frozen semen. Maintenance of records for artificial breeding and frozen semen bank.

General principles in planning animal houses. Farmstead and animal houses. Selection of site and planning; layouts for livestock farm of different sizes in different climatic zones in India. Farm structures -General principles of construction of enclosures, floor and road. Housing requirements of different classes of Livestock -Preparation of layouts, plans, arrangement of alleys. Fitting and facilities in the houses for horses, dairy cattle, calves, bulls, work cattle, dogs, pigs, sheep, goats, and poultry. Improvement of existing buildings; water supply; feed and fodder delivery systems. Economics of Livestock housing. Housing -Disease control measures and sanitation of all classes of livestock.

Climate and classification of climatic regions -Climatic factors - Assessment of climate -Study of climatic factors in relation to animal production. Introduction of breeds into different climatic regions. Measurement of Temperature, Relative humidity, Air Velocity and Mean temperature of the surrounding, measurement of intensity of light in animal houses.

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Syllabus for the Entrance Examination of
Ph.D. (Agricultural Biotechnology)

Prokaryotic and eukaryotic cell architecture, Cell wall, plasma membrane, Structure and function of cell organelles: vacuoles, mitochondria, plastids, golgi apparatus, ER, peroxisomes, glyoxisomes. Cell division, regulation of cell cycle, Protein secretion and targeting, Cell division, growth and differentiation.

Structure and function of carbohydrates, lipids, proteins and nucleic acids, Synthesis of carbohydrate, glycolysis, HMP, Citric acid cycle and metabolic regulation, Oxidative phosphorylation and substrate level phosphorylation, Vitamins, plant and animal hormones. Functional molecules, antioxidants, nutrient precursor, HSPs, anti-viral compounds.

Enzymes, structure conformation, classification, assay, isolation, purification and characterization, catarisis specificity, mechanism of action, active site, regulation of enzyme activity, multienzyme complexes, immobilized enzymes and protein engineering, immobilized enzymes and their application.

Concept of gene, Prokaryotes as genetic system, Prokaryotic and eukaryotic chromosomes, methods of gene isolation and identification, Split genes, overlapping genes and pseudo genes, Organization of prokaryotic and eukaryotic genes and genomes including operan, exon, intron, enhancer promoter sequences and other regulatory elements. Mutation – spontaneous, induced and site-directed, recombination in bacteria, fungi and viruses, transformation, transduction, conjugation, transposable elements and transposition.

Expression of genetic information, operon concept, Transcription – mechanism of transcription in prokaryotes and eukaryotes, transcription unit, regulatory sequences and enhancers, activators, repressors, co-activators, Co-repressors in prokaryotes and eukaryotes, inducible genes and promoters, Transcription factors post transcriptional modification and protein transport, DNA-protein interaction, Genetic code. Mechanism of translation and its control, post translational modifications.

Isolation and purification of nucleic acids. Nucleic acids hybridization: Southern, northern and western blotting hybridization. Immune response monoclonal and polyclonal antibodies and ELISA, DNA sequencing. Construction and screening of genomic and C-DNA libraries. Gel electrophoretic techniques. Polymerase chain reactor spectroscopy, rtPCR ultracentrifugation, chromatography, FISH, RIA etc.

Restriction enzymes and their uses. Salient features and uses of most commonly used vectors i.e. plasmids, bacteriophages, phagmids, cosmids, BACs, PACs and YACs, binary vectors, expression vectors. Gene cloning and sub-cloning strategies, chromosome walking, genetic transformation, Basis of animal cloning. Biology. Risk assessment and IPR.

Ribosome structure and function. Protein biosynthesis in prokaryotes and ekaryotes. Post-translational modification. Gene regulation, RNA processing and Post transcriptional modifications. Bioprospecting, biofortification, gene pryrimiding and gene fusion, nbozyme technology.

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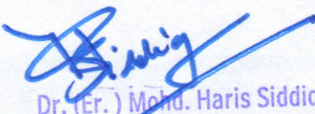
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Photoregulation and phytochrome regulation of nuclear and chloroplastic gene expression. Molecular mechanism of nitrogen fixation. Molecular biology of various stresses, viz. abiotic stresses like drought, salt, heavy metals and temperature; and biotic stresses like bacterial, fungal and viral diseases. Signal transduction and its molecular basis, molecular mechanism of plant hormone action mitochondrial control of fertility, structure, organization and regulation of nuclear gene concerning storage proteins and starch synthesis.

Basic techniques in cell culture and somatic cell genetics. Regulation of cell cycle and cell division.. Clonal propagation. Concept of cellular totipotency. Anther culture, somaclonal and gametoclonal variations. Hybrid embryo culture and embryo rescue, somatic hybridization and cybridization. Application of tissue culture in crop improvement. Secondary metabolite production. In vitro, mutagenesis, cryopreservation and plant tissue culture repository. Isolation of genes of economic importance. Gene constructs for tissue-specific expression. Different methods of gene transfer to plants, viz. direct and vectormediated. Molecular analysis of transformants. Potential applications of plant genetic engineering for crop improvement, i.e. insect-pest resistance (insect, viral, fungal and bacterial disease resistance), abiotic stress resistance, herbicide resistance, storage protein quality, increasing shelf-life, oil quality, Current status of transgenics, biosafety norms and controlled field trials and release of transgenics (GMOs).

DNA molecular markers: Principles, type and applications; restriction fragment length polymorphism (RFLP), amplified fragment length polymorphism (AFLP), randomly amplified polymorphic DNA sequences (RAPD), Simple sequence repeats (SSR), Single nucleotide polymorphism (SNP), Structural and functional genomics, gene mapping, genome mapping, gene tagging and comparative genomics and application of genomics.


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Syllabus for the Entrance Examination of
Ph.D. (Farm Machinery and Power Engineering)**

Status of farm mechanization in India; power availability on farms; hand tools used for different kinds of farm operations and materials for construction. Functional requirement, principle of working, constructional features and operation of animal and power operated equipment for land development, tillage, sowing, planting, transplanting, fertilizer application, inter-cultivation, plant protection, harvesting, threshing, mowing, chaff cutting and baling; special equipment for crops such as sugarcane, cotton, groundnut, potato and plantation crops like coconut, cashew nut *etc.*

Design and selection of machinery elements *viz.* gears, pulleys, chains and sprockets, belts, bearings, couplings and springs and fasteners. farm machine system characteristics and evaluation, dynamic balancing and stability of farm machines, force analysis on agricultural tools and implements, pull, draft, unit draft and power of farm equipment, design of soil working tools for sowing and planting; design of fertilizer applicators, inter cultivation equipment, harvesters and threshers; pneumatic and hydraulic controls. Calibration of seed drills, planters, plant protection equipment; methods of testing and performance evaluation of tillage equipment, seed drills and planters, fertilizer applicators, sprayers and dusters, harvesting and threshing equipment, grain and straw combines, and special equipment such as sugarcane, cotton, rice and potato planter; calculations of field capacity, efficiency and rates of seed fertilizer and chemical applicators; calculation of capacity, efficiency and losses in threshers, harvesters and chaff cutters. Farm machinery selection and management for different soils, crops and operations; cost analysis of animal and tractor operated implements and tractors; matching power-implement system, estimation of energy and power requirements, reliability of farm machinery.

Engineering thermodynamics, power cycles, fuels; various systems of IC engines; operations, adjustment and troubleshooting of different systems; calculations of power, torque, speed, firing arrangement and intervals, heat load and power transmission from piston to the flywheel; tractor power transmission, differential, final drives; power outlets such as P.T.O. and drawbar; recent trends in tractor design; emissions and control of pollutants; mechanical and power steering; tractor chassis mechanics, hitching systems, hydraulic controls for tractors, automatic position and draft control; tractor performance tests, operation and maintenance tractors and power tillers.

Anthropometry in equipment design, physiological cost and effect of work on physiological responses, fatigue and comfort; ergonomics in design of farm tools; safety aspects of agricultural machinery; effect of noise and vibration on work performance; chemical hazards and control measures; operator's protective gadgets; design of tractor controls *viz.*, hand and foot controls, visual range and limitations, seat design *etc.*

Dynamic properties of soil and their measurements; stress-strain relationships; theories of soil failure, mechanics of tillage tools; design parameters and performance of tillage tools. Introduction of traction devices, tyres-types, function & size, their selection; mechanics of traction devices, traction theories, slippage and sinkage of wheels, evaluation and prediction of traction performance; soil compaction - causes and methods for alleviating the effect on soil and crop responses.

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Conventional and renewable energy sources in agriculture; solar radiation and its measurement; characteristics of solar spectrum; solar energy collection, storage and applications; solar photovoltaic conversion and SPV powered systems. Types of wind mills and their applications; thermo-chemical conversion of biomass, direct combustion, Pyrolysis and gasification, chemical conversion processes, carbonization, briquetting and densification of biomass; bioconversion into alcohols, methyl and ethyl esters, organic acids, solvents of amino acids; types of biogas plants, biogas properties, uses and distribution, alternate fuels for IC engines. Energy requirement in agricultural production systems, energy ratio and specific energy value, inflow and outflow of energy in unit agricultural operation, energy audit, accounting and analysis.

Specification of materials, surface roughness, production drawing, computer aided drawing heat treatment, workshop practices applied in prototype production, common tools and press operations, metal cutting and machining, jigs, fixtures and gauges, casting and die-casting processes; basic joining processes, welding processes, weldments testing and metallurgy.

Mechanical measurements, sensors and transducers, application of electrical strain gauges, signal transmission and processing, dynamic measurements; measurement of temperature, pressure, strain, force, torque, power vibrations etc.; determination of calorific value, fluid flow rates etc; signal conditioning and monitoring, data acquisition and storage.

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Integral Institute of Ag. Science and Technology (IIAST)
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Syllabus for the Entrance Examination of
Ph.D (Agricultural Biochemistry)

Scope and importance of biochemistry and molecular biology in plants. Structural and functional organization of prokaryotic and eukaryotic cells, viruses and bacteriophages, cell organelles function and their fractionation. Chemical bonding in biological systems, pH and buffers. Thermodynamics and bioenergetics-concept of entropy, and free energy changes in biological reactions, Redox reactions, Role of high energy phosphates. Biomembranes. Classification structure, chemistry, properties and function of carbohydrates, proteins, lipids and nucleic acids. Components of immune system, Prostaglandins.

Anabolism, catabolism and their regulation. Metabolism of carbohydrates –glycolytic pathway, HMP pathway, TCA cycle, glyoxylate pathway and gluconeogenesis. Biological oxidation-electron transfer and oxidative phosphorylation. Lipid metabolism, degradation and biosynthesis of fatty acids, ketogenesis and causes of ketosis. Biosynthesis of sterols and phospholipids. Protein degradation by proteases and ubiquitin-Proteasome System, Amino acid metabolism –catabolism of amino acids, transamination and deamination, urea cycle, biosynthesis of amino acids. Conversion of amino acids into bioactive compounds. Metabolism of nucleic acids-degradation and biosynthesis of purines, pyrimidines and nucleotides. Integration of carbohydrate, lipid and amino acid metabolism. Signal transduction mechanisms. Role of G-proteins, cyclic nucleotides and calcium in transduction. Disorders of lipid, carbohydrate, nucleic acid, amino acid metabolism. Inborn errors of metabolism. Secondary metabolites, Alkaloids, Phenolics and Isoprenoids, biotransformation and over expression. Role of oligosaccharides and polysaccharides in cellular metabolism.

Major classes of enzymes, general properties, kinetics, active site and its mapping, activation energy and transition state. Mechanisms of enzyme action, inhibition and activation. Coenzymes and cofactors. Isoenzymes and immobilized enzymes. Abzymes, pseudoenzymes, bifunctional enzymes and enzyme promiscuity. Regulation of enzyme activity, allosteric regulation. Multi substrate reactions, kinetic experiments to determine the mechanism of multi substrate reactions. Isolation, purification and measurement of enzyme activity. Enzyme units. Enzyme engineering. Role of enzymes in agriculture, industry, and medicine. Structure, mode of action and metabolic functions of vitamins. Deficiency diseases associated with vitamins. General description of nature hormones and disorders associated with endocrine glands, viz. pituitary, thyroid, adrenal, pancreas and gonads. Peptide and steroid hormones. Phytohormones –auxins, gibberellins, cytokinins, ethylene, abscisic acid and new plant bio-regulators like SA, Brassinosteroids. Molecular mechanism of plant hormone action.

Principles of optical, phase contrast, fluorescence and electron microscopy, spectrophotometry, UV and VIS, fluorimetry, turbidometry and atomic absorption spectrophotometry. Radioisotopic techniques – scintillation counters and autoradiography and their application in biological sciences. Electrophoresis - general principles and application, gel electrophoresis, isoelectric focusing, pulsed field gel electrophoresis, immunoelectrophoresis. Chromatographic techniques -paper, thin layer, column chromatography, GC and HPLC. Centrifugation -principles of sedimentation in various rotors, differential centrifugation, density gradient centrifugation and ultracentrifugation.

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