Syllabus for Master Degree Entrance Examination (Agriculture; Horticulture & Agricultural Engineering) - 2016

For M.Sc.(Ag.):

AGRONOMY

Meaning and scope of Agronomy: National and International Agricultural Research Institutes in India, Agro-climatic zones of India. Tillage, crops stand establishment, Planting geometry and its effect on growth and yield cropping systems.


Rabi crops: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Management practices of some rabi crops viz. Wheat, Barley, Chick pea, Lentil, Peas, French bean, Pigeon pea, Mung bean, Urd bean, Rape seed, Mustard.; Groundnut, Sunflower, Linseed and Tobacco.

Kharif crops: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield. Management practices of some kharif crops viz. rice, maize, sorghum, pearl millet, minor millets, Pigeon pea, Mung bean and Urd bean, Forage crops, Sorghum, Maize, Cowpea, Cluster bean and Napier.

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control. Role of Integrated Weed Management (IWM) and IPM. Advance techniques of weed management by using bio-herbicides. Advantages and efficiency of bio-herbicides. Use of botanicals, different types of Botanicals, Semiochemicals, Allelochemicals - examples and uses. Survey and surveillance of Invasive weeds; Type of invasive weed species; their origin; Estimation of harmful effect from these invaded weeds, management of invaded weeds and measures for preventing of
their invasion.

Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservators of natural resources, LEIA & HEIA; Irrigation problems, waste lands and their development; Organic farming: definition, principles and components; Farming systems: definition, principles and components, IFS models for wetland, irrigated dryland and dryland situations.

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of - fibre crops; commercial crops; tuber crop; forage crops; oil seed crops; medicinal and aromatic crops.

Fibre Crops: Jute, Cotton and Sun hemp; Commercial Crops: Sugarcane and Sugar beet;


Tuber crop: Potato.
Oil seed crops: Sesame, Soybean, Safflower.
Forage crops: Berseem, Lucerne, Oat, Cowpea, Napier and Cluster bean.

Concept of organic farming, Requirement of organic production; Management of organic manures, vermicompost and vermicomposting, green manure and green manuring, recycling of organic residues, bio-fertilizers; Soil improvement and amendments through manures; concept of botanicals; use of bio-control agents, bio-pesticides; Weed management; Quality considerations, certification, labelling and accreditation processors, marketing, exports.
**CROP PROTECTION**

Introduction, Important Plant Pathogenic Organisms, different groups, fungi, bacteria, phytoplasmas, spiroplasmas, viruses, Ivirioids algae, protoza, and phanerogamic parasites with example of diseases caused by them. Prokaryotes: Classification of prokaryotes according to Bergey’s Manual of Systematic Bacteriology. General character of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions and subdivisions.

Economic importance, symptoms, causes, disease cycle and management of disease of rice, jute, maize, wheat, sugarcane, turmeric tobacco, groundnut, sesame, sunflower, cotton, red gram, Bengal gram, black gram, green gram.

Economic Importance, symptoms, causes, disease cycle and management of diseases of citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, apple, chilli, brinjal, bhindi, potato, crucifers, cucurbits, tomato, beans, onion, coconut, oil palm, betelvine, mulberry, coffee, tea, rose, chrysanthemum, jasmine and tuberose.


Tephritidae, Tachinidae, Agromyzidae.


Stored grain pests. Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (Eleucine coracana), wheat, sugarcane, jute, cotton, mesta, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, brlnjal, bhendi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, colacasia, moringa, amaranthus, chili, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, betelvine, onion, coriander, garlic, curry leaf; pepper, ginger and ornamental plants.

Introduction: History of phytonematology, Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non fumigants). Resistant varieties, IDM.

Pesticides- definition, categories. Insecticides- definition, classification based on toxicity, mode of entry, mode of action and chemical composition Formulation of insecticides- types, uses , advantages; insecticide additives Consideration for insecticide application; factors influencing insecticide efficiency Types of insecticides- properties and
uses of important insecticides under different groups viz. Organophosphate, Carbamates, chlorinated hydrocarbons and synthetic pyrethroids with advantages and limitations. New molecules in pest management insect growth regulators- types, uses and role in pest management. Other pesticides- types of acaricides, nematicides and rodenticides; properties and uses of important ones under each group. Insecticide appliances- classification and uses

Components of IPM - Physical, mechanical, biological, chemical and legislative methods. Biotechnological approaches in IPM. Pest surveillance and sampling. Ecological backlash and its management, resistance of population to pest management tactics, pest population resurgence and replacement. Problems and constraints in the implementation of IPM. IPM on rice, sugarcane, groundnut, brinjal, cabbage, black gram, mungbean, jute, mango.


Balance of nature- natural control. Biological control- definition, its advantages and disadvantages. Biocontrol agents- insects, arachnids, nematodes, fungi, bacteria, viruses, protozoa, vertebrates. Brief history of bio-control with examples of successful cases. Insects parasitoids and predators- types of parasitism. Methods of biological control- conservation, augmentation and importation. Predators and parasitoids of agricultural importance: Coleoptera (Coccinellids, Carabids, Staphylionts); Neuroptera (chrysopids); Hemiptera (Mirids, Reduviids, Pentatomids); Diptera (Syrphids, Tachinids); Lepidoptera (Pyralid- Epircania melanolenca); Hymenoptera (Trichogrammatids, Eulophids, Scelionids, Mymarids, Braconids, Ichneumonids); Spiders (Arachina); Mites (Phytoseiids) and Weed feeding herbivores-Zygogramma bicoiorala. Bio-pesticides - Entomopathogenic microbes, Bacteria - Bascillus thuringensis, B popillae; Fungi - (Beauveria bassiana, Metarhizium anisopliae, Verticilium lecanii, Nomuraea rileyi. Viruses (NPV and GV); Nematodes (Heterohabidity idea, Steinernematidae and Protozoa). Methods of biotological control - conservation, augmentation and importance.

Mass production of bio control agents.


Definition, history, classification (according to chemical nature and use pattern) of synthetic & botanical Pesticides; Common Name, IUPAC Name, Trade Name, type of formulation, Chemical Structure, Mode of Action and Use of some common pesticides; Insecticide act; Hazards of pesticides (as pollutant and contaminant) and their safety assessments: ADI, NOAEL, MRL, PHI, etc.; Stereo Isomerism with special reference to Pesticide Chemistry; Important Name Reaction encountered in Pesticide Chemistry: Diel's
Alder Reaction, Aldol Condensation, Perkin Reaction, Fried el Crafts' Reaction, Grignard Reaction, Michaelis-Arbuzov and Perkow Reaction; An Introduction to Heterocyclic Compounds encountered in various Agrochemicals.

Classification, brief Chemistry and synthesis of some popular pesticides: Insecticides (Organo-Chlorines, Organo-Phosphates, Carbamates, Synthetic Pyrethroids), Fungicides and Herbicides; Brief Chemistry, Synthesis and use of some Acaricide, Nematicide, Rodenticide and Molluscicide; Introduction to pesticide residues; Principles of pesticide residue analysis.

Brief Chemistry of pesticides of plant origin and their application in plant protection: Pyrethroids, Nicotinoids, Rotenoids, Azadirachtin; Chemistry of Plant Pigments, Terpenoids, Flavonoids and Alkaloids; Principle of extraction and purification of bio-active constituents from plant.
NATURAL RESOURCE MANAGEMENT (NRM)

Concept of pedology and edaphology, Origin of the earth, Earth's crust; Composition: Rocks and minerals Weathering, Soil formation factors and processes, Components of soils; Soil profile, Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil compaction, Soil Color, Elementary knowledge of soil classification and soils of India; Soil water, Retention and potentials, Soil moisture contents, Movement of soil water, Infiltration, percolation, permeability, Drainage, Methods of determination of soil moisture and Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth; Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, Adsorption of ions, Ion exchange, CEC & AEC factors influencing ion exchange and its Significance. Soil organic matter, Composition, Decomposability, Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

Irrigation: definition and objectives, water resources and irrigation development in West Bengal and India; Soil plant water relationships: flow of water, water availability, soil moisture content; Methods of soil moisture estimation, evapotranspiration and crop water requirement; Soil water loss, infiltration-definition, equations and measurement; permeability and seepage; Methods of irrigation: surface, subsurface, sprinkler and drip irrigation, Traditional methods of irrigation. Measurement of irrigation water. Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its appraisal, use of saline water for irrigation. Drainage - principles, methods, coefficient.

Microbial groups in soil - their occurrence, distribution, function; Ecological interrelationship-protocooperation, commensalisms, amensalism, competition, symbiosis, parasitism, predation, synergism; Nutrition of microorganisms; Microbial transformation of carbon - decomposition of organic matter, carbon assimilation, factors affecting organic matter decomposition; Microbial transformation of nitrogen - nitrogen cycle, mineralization, immobilization, nitrification, denitrification, nitrogen fixation; Microbial transformation of phosphorus - mineralization, solubilization, immobilization, oxidation and reduction of inorganic phosphate compounds; Microbial transformation of sulphur – mineralization, immobilization, oxidation and reduction; Basic concepts of bio fertilizers; Microbes fn composting.

Concept of manure. Methods of composting, Mechanical compost plants, Vermicomposting, phosphocompost, Green manures. Oil cakes, Sewage and sludge - Biogas plant slurry, Plant and animal refuges. Fertilizers - classifications, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, di-ammonium phosphate, ammonium poly phosphate), Bone meal, potassic and complex fertilizers their fate and reactions in the soil, Secondary and micronutrients fertilizers, Amendments. Fertilizer Control Order, Fertilizer storage; Biofertilizers and their advantage.


growth and production. Effect of weather parameters on crop production. Weather hazards important for agricultural activities - Flood, drought, cold wave, heatwave, hail storm, thunderstorm, frost, cyclone, their time and frequency of occurrence. Crops and their growth stages critical to different weather hazards. Crop protection measures against weather hazards - Wind break and shelter belts, protective irrigation, shading and mulching, artificial rain making and other management options. Concept of contingent crop planning in relation to weather hazard. Weather forecasting for agriculture. Types of forecasting - Short, medium and long range. Methods of weather forecasting - synoptic, statistical and numerical approaches.

PLANT SCIENCE

Mendel's laws of inheritance and exceptions to the laws. Types of gene action. Multiple alleles, pleiotropism, penetrance and expressivity. Quantitative traits, Qualitative traits and differences between them. Multiple factor hypothesis. Cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance. Mutation, its characteristic features, methods of inducing mutations and CLB technique. Gene expression, Structure of cell and cell organelles and their functions. Study of chromosome structure, morphology, number and types, karyotype and ideogram. Mitosis and meiosis, their significance and difference between them. DNA, RNA and their structure, function and types. Transcription, translation, genetic code and outline of protein synthesis. Crossing over, factors affecting it, mechanism of crossing over and cytological proof of crossing over. Linkage, types of linkage and estimation of linkage. Numerical chromosomal aberrations (polyploidy) and evolution of different crop species like cotton, wheat, rice, tobacco, triticale and Brassicas. Structural chromosomal aberrations.


Methods for breeding for vegetatively propagated crops. Clonal selection, Mutation breeding-ploidy breeding. Wide hybridization, significance in crop improvement

Breeding objectives and important concepts of breeding self and cross pollinated and vegetatively propagated crops. Hardy-Weinberg law. Study in respect origin and distribution of species, wild relatives and forms for cereals like Rice, wheat, Maize Millets, Sorghum, bajra, ragi. Pulses like Red gram, green gram, black gram, soybean. Oilseeds like Ground nut, Sesame, safflower sunflower, Castor mustard etc. Fibres like Cotton, Kenaf, Jute etc. Major breeding procedures for development of hybrids / varieties of various crops. Plant Genetic resources their conservation and utilization in crop improvement. Ideotype concept in crop improvement. Breeding for resistance to biotic and abiotic stresses; variability in pathogens and pests. Mechanisms of resistance in plant to pathogen and pests. Genetic basis of adaptability to unfavourable environments. Definition of biometrics, assessment of variability i.e. additive, dominance and epistasis and their differentiation. Genotype X Environment interaction and influence in yield / performance. IPR and its related issues. PPV and FRA.

Beginning of genetics; early concepts of inheritance, Mendel's laws; Chromosomal theory of inheritance. Multiple alleles, Gene interactions. Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Extra chromosomal inheritance: ultrastructure and function of mitochondria, biological membranes, Chloroplast and other
organelles. Male sterility and Incompatibility: application in crop improvement. Allelic complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters. - Frequencies of genes and genotypes- Causes of change: Hardy-Weinberg equilibrium. Historical background of molecular genetics; Genetic material in organisms; Structure and properties of nucleic acid Organization of DNA in chromosomes, Unique and repetitive sequences; DNA replication, transcription and their regulation – Transcription factors and their role; Genetic code, regulation of protein synthesis in prokaryotes and eukaryotes –RNA editing, concept on operon. Principles of PCR, Methods of studying polymorphism at biochemical and DNA level.


Mendelian traits vspolygenic traits - nature of quantitative traits and its inheritance - Multiple factor hypothesis - analysis of continuous variation; Variations associated with polygenic traits - phenotypic, genotypic and environmental - non-allelic interactions; Nature of gene action - additive, dominance, epistatic and linkage effects. Correlation and Path analysis: direct and indirect effect, Principles of Analysis of Variance (ANOVA) - Expected variance components, random and fixed models; Comparison of means and variances for significance. Analysis of genotype x environment interaction - adaptability and stability; Models for GxE analysis and stability parameters;

Special approaches for crop improvement in self-pollinated crops: Population breeding approach; Rapid isolation of homozygous lines; Development of Multiline varieties; Development of hybrid variety in self pollinated crops (Rice, Sorghum). Special approaches for improvement of cross/often cross pollinated crops. Development and maintenance of inbred lines and production of hybrid seed in maize and cotton. Physiological concept of Plant Breeding. Physiological parameters to crop yield and their application in crop improvement programme with reference to cereals, pulses and oilseeds.


Importance of transgenic plants and their development. Breeding for improvement of Tree crops. Introduction to IPR, PPV & FRA. Preparation of passport data and registration of plant varieties.

Definition of Crop Physiology – it’s Importance in agriculture and horticulture. Crop Water Relations - Physiological importance of water to plants - Water potential and its components. Transpiration - Definition, types of transpiration, mechanism, of opening and closing of stomata, transpiration in relation to crop productivity. Water Use Efficiency, WUE in C3, C4

Crop growth analysis: Dry matter partitioning, Harvest index, Growth analysis formulae, Determination of LAI, Specific leaf weight, Crop growth rate, Relative growth rate and NAR.


Physiological basis of abiotic stress tolerance: General features of drought and salinity stress, Plants’ responses to drought and salinity stress, Escape and tolerance mechanism, Physiological and biochemical changes associated with tolerance, morpho-physiological traits for selection of tolerant types. Growth and metabolic processes associated with tolerance to water logging.

Nutriphysiology: Solute transport, Plant nutrients and their functions, Deficiency and toxicity symptoms of nutrients, Detection of deficiency symptoms of different nutrients in crop plants.

Reproductive biology: Alternation of generation, Sporogenesis and gametogenesis, Pollen germination and pollination biology, Physiological changes associated with fruit ripening and seed development, Photoperiodism, Phytochrome and its role in plants.

Photosynthesis – photosynthetic pigments, light reactions and carbon linked reactions, photorespiration, C3, C4 & CAM pathways; Nitrate assimilation, Biological nitrogen fixation; DNA replication, transcription and translation.

Introduction to Seed and it's importance of in Production system; Seeds structure and their development; Types of seed (Orthodox and Recalcitrant); Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed. Different classes of seed, Production of nucleus & breeder's seed; Seed Production, Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); Foundation and certified seed production of rice (varieties & hybrids); Foundation and certified seed production of cotton and sunflower (varieties and hybrids); Foundation and certified seed production of castor (varieties and hybrids); Foundation and certified seed production of tomato and brinjal (varieties and hybrids); Foundation and certified seed production of chilies and bhendi (varieties and hybrids); Foundation and certified seed production of onion, bottle gourd and ridge gourd (varieties and hybrids); Seed certification, phases of certification,
procedure for seed certification, field inspection and field counts etc.; Seed Act, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through different methods. Seed multiplication ratio (SMR) and seed replacement ratio (SRR) of different crops. Drying, Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Seed testing procedures for quality assessment - sampling methods & equipments, it's importance, test for germination, viability & vigour; Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage. General principles of seed storage, measures for pest and disease control, temperature control, Seed marketing, Factors affecting seed marketing.

Floral types, structures and biology of field crops, seed germination and dormancy, concept and importance of quality seeds, classes of seed and its production technologies, seed sampling; Seed Testing; Maintenance of Seed Purity and management of deterioration, Seed Certification and its utilization; Hybrid seed production technology, Isolation distance, synchronization of flowering, roguing etc., male sterility in seed production, Seed Multiplication Ratio (SMR), Seed Replacement Rate (SRR). Seed production of paddy, wheat, maize, sorghum, bajra, sesame, mustard, green gram and black gram, Seed processing cleaning, grading, drying, treatment and packaging.

SOCIAL SCIENCE


Farm Planning (FP) - Purpose- Types of FP- Essential Elements of FP- Stages of FP- Principal Characteristics of good farm plan-Basic of FP and budgeting. Farm budgeting (FB) - Objectives of FB- Types of FB- Practical and Complete Budgeting- Elements of Partial Budgeting- Difference between Partial and Complete budgeting- Advantage of FB. Locating weak points in Existing Farm Plan-Alternate Farm Plan- Practicability of Alternate Plan. Farm environmental Pollution- estimation-cost benefits-farm project evaluation-plan, programme and appraisal-the present worth summing method-amortization method. Linear Programming (LP)-A Budgeting Technique- Definition-Requisites of LP-Assumptions of LP-Elements of LP- Disposal Activities-Solution of LP: Feasible and Optimal Feasible Solution, Geometric Method, Simplex Method, problem of cost minimization the dual problem, Solution to the dual problem.

Rural Sociology: Meaning, concept, importance in agricultural Extension; Social Group: Meaning, concept and classification. Social Stratification: Meaning, function, forms of stratification, Difference between class and caste system. Cultural concept: Culture,


Community Development Programme: Meaning, Definition, Concepts, Philosophy, Principles, Objectives, Differences between Community Development and Extension Education, National Extension service.

Panchayati Raj, 3-tiers of Panchayati Raj system Powers Functions and Organizational setup. Agricultural Development Programmes with reference to year of start, objectives and salient features: Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC, NAIP, Social Justice and Poverty alleviation programmes: Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jyanti Gram Swarajgar Yojana (SJGSY), Prime Minister Employment Yojana (PMENY), new trends in extension, privatization, Women Development programmes : Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS), and Mahila Samriddi Yojana (MSY), NREGA, Reorganized extension system (T & V System): Salient features, Fort night Meetings, Monthly workshops, Linkages, Merits and Demerits, Emergence of Broad Based Extension (BBE).


Entrepreneurship and Entrepreneurship Development: Definition, types, factors responsible for Entrepreneurship, models status of agri-horti entrepreneurship in India, globalization and emerging issues of managing agri-preneurship. Managing an enterprise: motivation and entrepreneurship development, importance of planning, monitoring, evaluation and follow-up, managing competition, entrepreneurship development programme, SWOT analysis, generation, incubation and commercialization of ideas and innovations.


Principles and techniques of Writing: Development news, stories, popular articles, technical articles and extension bulletins. Presentation: Individual and group presentation. Group Discussion: techniques and organization; organization of seminars, conference etc.

Changing Scenario of Agriculture and human resource management; theory of personality and socialization, behaviour and enterpreneurship; enterpreneuria! motivation and skills in changing organization; personality profiling; experiential learning cycle and behaviour, ELC based training programme and methodology. Communication and behavioural skill. Simulation theory and processing.

Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Dements of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test- SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient Y and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between Y and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysts with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

Frequency distribution: Construction of table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, pie chart, scatter diagram, line diagram. Measures of mean; mode, standard deviation, variance and coefficient of variation, percentiles, quartile, and median for raw and grouped data. Tests of Significance: Large sample and small sample test: Z test, Student's t-test, F test; Chi-Square test. Computation of Correlation Coefficient Y and its testing, linear Regression of Y on X and X on Y. Inter-relation between Y and the regression coefficients, fitting of regression equations. Analysis of Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design.
Concept of production function, Demand and supply curves, Engel curve, Input-output analysis, Static and dynamic models of economics, Single and simultaneous equation models, Identification, Method of estimation of parameters: Maximum likelihood and least squares, Multi-collinearity, Autocorrelation, Time series analysis, and Index number.

Sampling versus complete enumeration, Sampling errors and non-sampling errors, Simple random sampling; with replacement and without replacement, Estimation of population mean and population proportion and their standard errors and Stratified Random Sampling.
For M.Sc.(Hort.):

Course outline for M.Sc. (Horticulture) Entrance Examination

Economic importance and classification of horticultural crops; Layout and establishment of orchards; training and pruning; planting systems; vegetable gardens; cropping systems; nursery management; propagation structures; methods of propagation; nutritive value of fruits, plantation, vegetables and spices and their role in human nutrition. Growth and development of horticultural crops; physiology of ripening in fruits and vegetables; important physiological disorders of different horticultural crops; manures and fertilizers; systems of irrigation; protected cultivation of horticultural crops; management of important pests and diseases of fruits, plantation crops, flowers, vegetable and spice crops; organic horticulture.

Seed germination; maintenance of genetic purity of a variety; seed quality; seed certification; seed storage; seed treatment; seed production; hybrid seed production. Mendelian genetics; breeding system; DNA as genetic material; methods of crop improvement; male sterility and self-incompatibility; pure line and pedigree selection; backcross, mass selection; heterosis; mutation breeding; alteration of ploidy; clonal breeding; different in vitro culture; somaclonal variation; embryo culture; micro-propagation.

Propagation, climatic requirement and cultivation practices of fruits like mango, litchi, banana, citrus, guava, jack fruit, sapota, custard apple, bael, ber, aonla, pomegranate, grape, pineapple, papaya, apple, pear, peach, olive, plum, strawberry.

Propagation, climatic requirement and cultivation practices of major plantation crops like coconut, cashew nut, tamarind, betel vine, areca nut, cocoa, coffee, rubber, tea, bamboo. Propagation, climatic requirement and cultivation practices of major vegetable crops like cole crops (cauliflower, cabbage, broccoli, Brussels sprouts, knol khol), cucurbits (pumpkin, bitter gourd, bottle gourd, ridge gourd, muskmelon, watermelon, cucumber, pointed gourd), root and tuber crops (radish, carrot, beet, tapioca, sweet potato, amorphophallus), leafy vegetables (leaf amaranth, fenugreek, palak, basella); solanaceous crops (tomato, chillies, sweet pepper, brinjal), leguminous crops (garden pea, cowpea, lablab bean, cluster bean) and others (okra, moringa, asparagus).

Propagation, climatic requirement and cultivation practices of major spice crops like, black pepper, coriander, turmeric, ginger, garlic, onion, garlic, fenugreek, fennel, black cumin, opium poppy, ajowan, dill, celery, vanilla, cinnamon, clove, nutmeg and medicinal crops like, Rauvolfia, Dioscorea, Isabgul, Datura, Cinchona, etc.

Different ornamental plants (trees, shrubs, climbers, creepers, palms, herbaceous perennials, annuals); ornamental planning; bonsai; propagation, climatic requirement and cultivation practices of major floricultural crops grown in India for commercial purposes like rose, carnation, chrysanthemum, marigold, tuberose, gladiolus, orchids; establishment and maintenance of lawns, trees, shrubs, creepers, hedges and annuals; type of gardens, dry flowers; garden design; objectives and potential of agro-forestry.

Food and nutrients; physio-chemical properties of fruits and vegetables; maturity indices of different horticultural crops; ripening and storage factors affecting deterioration of horticultural produce; principles and methods of processing and preservation of horticultural crops; different products of fruits and vegetables; quality parameters and specifications; pre-and post- harvest treatment of fruits, vegetables and flowers for storage; storage system; packaging methods.
For M.Tech.(Ag. Engg.):

**Code 10: MAJOR SUBJECT GROUP “K” - AGRICULTURAL ENGINEERING AND TECHNOLOGY**
K-5: Bio-energy including Renewable Energy Sources)

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

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

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

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

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

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

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

**Code 11: MAJOR SUBJECT GROUP “L” - WATER SCIENCE AND TECHNOLOGY**
(Subject: L-1: Water Science and Technology)

**Unit-I**: Importance of Agriculture in national economy; basic principles of crop production; cultivation of rice,