

SYLLABUS SUMMARY
Meghalaya Agricultural Service - III

Multiple Choice Questions (MCQs)

Number of Papers = FIVE of 100 marks each

Grand Total = 500 marks

PAPER-I (100 Marks)	=	Agronomy (Part-1) = 40marks Horticulture (Part-2) = 40 marks Plant Physiology (Part-3) = 20 marks	} } }
PAPER-II (100 Marks)	=	Plant Breeding & Genetics (Part-1) = 40 marks Soil Science & Agril. Chemistry (Part-2) = 40 marks Agril. Microbiology (Part-3) = 20 marks	} } }
PAPER-III (100 Marks)	=	Agril. Entomology (Part-1) = 40 marks Plant Pathology (Part-2) = 40 marks Agril. Meteorology (Part-3) = 20 marks	} } }
PAPER-IV (100 Marks)	=	Agril. Extension (Part-1) = 40 marks Agril. Economics (Part-2) = 40 marks Plant Biotechnology (Part-3) = 20 marks	} } }
PAPER-V (100 Marks)	=	General English	

Syllabus for Meghalaya Agriculture Service – III
(For Multiple Choice Questions)

PAPER – I
(100 Marks)

Part – 1 (Agronomy)

- # **Introductory Agriculture** : *Branches of agriculture*; Subsistence and commercial agriculture; Basic elements of crop production; *Green revolution*; Major farming systems.
- # **Principles of agronomy** : Meaning, definition and scope of agronomy; *Seed* – definition - characteristics of good quality seed – vegetative propagation in field crops; *Tillage*-definition-objectives – types of tillage-tillage implements – tillth -characteristics of good till; *Crop nutrition* – nutrients –classification; *Nutrient sources*- organic manures –fertilizers – bio-fertilizers.
- # **Irrigation and water management** : *Role of water in soil and plants*; Irrigated agriculture vs. Rain fed agriculture, dry farming and dry land farming; *Soil-plant-water-relationships*; Evapo-transpiration, potential evapo-transpiration and consumptive use, *methods of irrigation*; *Agronomic techniques* to improve water use efficiency-factors affecting water use efficiency; *Agricultural drainage*- causes of water logging and types of drainage; *Water harvesting techniques* -in situ and ex situ water harvesting methods; *Watershed management*- concept-watershed and command area development approach; Steps and components of watershed management programmes.
- # **Weed management** : *Weeds*- Introduction, harmful and beneficial effects, classification, propagation and dissemination; Concepts of weed prevention, control and eradication; *Methods of weed control*; Integrated weed management (IWM); *Herbicides*- advantages and limitation of herbicide usage, Herbicide classification, formulations, methods of application; *Weed management in rice*.
- # **Field crops** : Origin, geographic distribution, economic importance, soil and climatic requirement , varieties, cultural practices , harvest and post harvest handling and value addition of major cereal – *Rice* and Tuber crop – *Potato*.
- # **Crop Production (Rice)** : *Rice-crop planning*, *Nursery raising*- land preparation, seed treatment, sowing, water management, nutrient management, and plant protection; *Main field preparation*, transplanting, nutrient management, water management, Identification of weeds and weed management.
- # **Field crops** : Origin, geographic distribution, economic importance, soil and climatic requirement , varieties, cultural practices , harvesting and post harvest handling of *oilseed - rapeseed and mustard*.
- # **Cropping patterns and farming systems** : Terms and definition- *Cropping pattern* - *Multiple cropping* and various forms-advantages and disadvantages-*Intercropping*-ecological basis of intercropping systems-types-sequential cropping and *crop rotation*-planned crop rotation-*Mixed farming* and farming systems; *Cropping systems*- Rice based cropping system; *Homestead farming*; *Integrated farming system* (IFS) models for uplands and low lands for sustainable agriculture-Evaluation of farming systems.
- # **Sustainable agriculture and organic farming** : *Sustainable agriculture*-concept themes-differences between conventional, sustainable, and alternate agriculture; *Natural resource management* (NRM) as a part of sustainable resource management; *Water conservation measures* – water harvesting – *ITK* and farmer centred techniques and practices; *Organic farming* and food security, Principles of organic farming-Tools and practices of organic farming; Current status of organic farming.

Part-2 (Horticulture)

Fundamentals of horticulture : *Training and pruning* in horticultural crops - principles and methods - techniques of training and pruning; *Plant growth regulators* in horticulture - natural and synthetic regulators -preparation and methods of application; *Propagation by seed* -seed qualities, seed germination -types of seed dormancy, pre-sowing treatments - factors affecting germination; *Propagation by cuttings* -types of cuttings -factors affecting rooting of cuttings; *Propagation by layering* -advantages and disadvantages -types of layering; *Propagation by grafting*- advantages & disadvantages, stock-scion relationships, incompatibility; *Grafting and budding* -methods -advantages and disadvantages - after care; *Plant propagating structures* -green house/ glass house, net house, mist chamber; *Nursery* - site selection, lay-out, components, progeny orchards, management and maintenance.

Plantation crops : Plantation crops (*cashew and tea*) -introduction -importance - production - varieties, climate & soil - propagation - production of quality planting materials and hybrids - nursery management - layout, planting, aftercare irrigation, manuring - stage of harvest, harvesting, yield and uses.

Landscaping and ornamental horticulture : *Components of landscapes and gardens* - description and functional uses; *Principles of landscaping* - designing and preparation of landscape and garden plans; *Lawns* -types of lawn grasses -methods of establishing lawns - land preparation planting - mowing - rolling -application of manures and fertilizers - irrigation -weed control and plant protection - rejuvenation of lawns; *Annual flowers*- their use in gardens - selection -colour schemes -planting designs -season and methods of planting -cultural practices; *Shrubs and trees* -types - uses of shrubs in gardens -trees for landscapes -avenue planting -group planting and specimen planting - pruning -maintenance and rejuvenation of shrubs and trees; *Specialized gardening techniques* -rock gardening - water gardening - Bonsai -Roof gardens -terrace garden -sunken garden etc. - *Indoor gardening*; Introduction to *commercial floriculture* -problems and prospects of commercial floriculture in India; Principles of *flower arrangement* - styles and designs - tools, containers and accessories, collection and preparation of flowers and foliage, vase solutions for fresh flowers, *preservation of dry flowers* and foliage, flower arrangements and flowering and foliage plants in shows and exhibitions.

Vegetable crops : *Nutritive value of Vegetables*; Types of *vegetable farming*- kitchen garden, market garden, truck garden; Vegetable garden for seed production; Systems of vegetable cultivation-traditional and specialized systems; *Low-cost and high-tech-systems*; *Glasshouse cultivation* and other protected systems; Factors affecting *vegetable production*; Basic principles in vegetable production-nursery, sowing and transplanting, care and management, Irrigation-surface, sub-surface & spray irrigations; *Vegetable seed production*-general principles, isolation distance, cultural operations, seed standards and packing.

Fruit crops : *Classification of fruits*; General cultivation practices of fruit crops with reference to soil and climatic requirements, important cultivars, plant propagation practices, planting, after care and irrigation management, nutrition and other cultural operations; Training and pruning; *Nutrient deficiencies* of fruit plants and their correction, intercropping, major cultivation problems, harvesting, storage and marketing.

Spices plants : Importance of spices crops - *Ginger and Turmeric* in Meghalaya - varieties, climate, soil, propagation, planting, crop management including manuring and harvesting.

Food technology and postharvest management of horticultural crops : *General principles* & methods of preservation; *Principles of preservation* by dehydration, thermal processing, chemical preservatives, fermentation, ionizing and radiation; Importance of *postharvest management* of fruits, vegetables and other horticultural produce; *Postharvest losses* of fruits and vegetables.

Part – 3 (Plant Physiology)

Crop physiology : Importance in agriculture; Seed physiology, seed structures-morphological, physiological and biochemical changes during seed development, physiological maturity; Methods of testing seed viability and vigour, morphological, physiological and biochemical changes during seed germination, factors affecting seed germination; Growth and development, determinate and indeterminate growth; Measurement of growth, growth analysis, growth characteristics; Crop water relations, physiological importance of water to plants, water potential and its components, measurement of water status in plants; Transpiration, significance, transpiration in relation to crop productivity, water use efficiency - factors effecting WUE; Photosynthesis - relationship of photosynthesis and crop productivity, photorespiration - factors affecting photosynthesis and productivity - methods of measuring photosynthesis, photosynthetic efficiency; Translocation of assimilates, phloem loading, respiration and its significance, brief account of growth respiration and maintenance respiration, measurement of respiration; Nutriophysiology – definition – classification of plant nutrients based on quantity, function and mobility – physiology of nutrient uptake – functions of plant nutrients – deficiency and toxicity symptoms of plant nutrients – foliar nutrition – hydroponics; Plant growth regulators – occurrence – biosynthesis; Senescence – physiological and biochemical changes and their significance; Post harvest physiology – seed dormancy – definition – types of seed dormancy – advantages and disadvantages of seed dormancy – causes and remedial measures for breaking seed dormancy; Fruit ripening -metamorphic changes – hormonal regulation of fruit ripening.

PAPER –II
(100 Marks)

Part-1 (Plant Breeding and Genetics)

Morphology and systematics of crop plants : *Classification of plants* different systems of classification; General features of important families – morphology of roots, stem, leaves, flowers, fruits and seeds; *Introduction to field crops – Classification of field crops.*

Principles of genetics and cytogenetics : *Mendel's laws* of inheritance and exceptions to the laws; Types of *gene action*, Multiple alleles, Pleiotropism, Penetrance and expressivity; *Quantitative traits and Qualitative traits*; *Mutation* and its features; Methods of inducing mutations; *Study of chromosome structure*, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and differences between them; *DNA-* its structure and function – types of DNA – modes of replication and repair; *RNA-* its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; *Linkage and crossing* - types of linkage, over estimation of linkage.

Principles of plant breeding : Aims, objectives and importance of *Plant Breeding*; *Modes of reproduction*, Sexual, Asexual, Apomixis and their classification; *Modes of pollination*-genetic consequences, differences between self and cross pollinated crops; *Methods of breeding* – introduction and acclimatization; *Selection*- Mass selection, Johansson's pure line theory, genetic basis, pure line selection; *Hybridization*- Aims and objectives, types of hybridization; Methods of handling of *segregating generations*, pedigree method, bulk method, back cross method and various modified methods; Incompatibility and *male sterility* and their utilization in crop improvement; *Heterosis*, inbreeding depression; Various theories of Heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; synthetics and composites; *Population improvement programmes* – recurrent selection; *Methods of breeding* for vegetatively propagated crops; *Clonal selection*; Mutation breeding; Ploidy breeding; Wide hybridization and significance in crop improvement.

Breeding of crops and intellectual property rights : *Breeding objectives* and concepts of breeding in self pollinated , cross pollinated and vegetatively propagated crops; Origin and distribution of species, wild relatives and forms; *Breeding procedures* for development of hybrids, / varieties of various crops; *Mechanism of resistance in plants*; *Plant genetic resources*- conservation and utilization; *Biodiversity Act* and its implications; Exchange of germplasm, Material Transfer Agreement International treaties on plant genetic resources; *IPR* – definition, concepts, and components. -plant breeders rights and farmers rights; Plant variety registration, Benefit sharing, Concept of *Geographical Indications*.

Principles of seed technology : Importance of *Seed Production*, 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*, *Foundation and certified seed production*; *Seed certification*, procedure for seed certification, etc.; *Seed Drying*- forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, heated air drying, types of air distribution systems for seed drying; *Seed processing*- air screen machine and its working principle; Different upgrading equipments and their use, Establishing a *seed testing laboratory*; *Seed testing procedures* for quality assessment; *Seed treatment*- Importance, types, equipment etc.; *Seed packing* and seed storage, factors affecting seed longevity during storage and conditions required for good storage.

Part – 2 (Soil Science and Agricultural Chemistry)

• **# Introduction to soil science :** *Soil-Pedological and edaphological concepts; 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; Elementary knowledge of *soil classification*; *Soil water* - retention and potentials -soil moisture constants -movement of soil water – infiltration – percolation – permeability – drainage -methods of determination of soil moisture; Soil colloids – properties – nature -types and significance; *Layer silicate clays* -their genesis and sources of charges; *Adsorption of ions* -ion exchange; *Concept of pH* -soil acidity -brief overview of saline, sodic and calcareous soils; *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.

Biochemistry : *Biochemistry* – Introduction and importance; *Enzymes* –Factors affecting the activity, classification, Immobilisation and other *industrial applications*; *Lipids* –Acyl lipids-their industrial application in soaps, detergents, paints, varnishes, lubricants, adhesives, plastics, nylon, Bio-diesel, Biodegradable plastics etc.; *Carbohydrates*; Nucleotides and Nucleic acids; Metabolic energy and its generation – *Metabolism* – basic concepts; *Biosynthesis* – carbohydrates, lipids, proteins and nucleic acids.

Organic farming and soil health : *Organic farming* for sustainable agriculture-Manures – bulky and concentrated – FYM – Compost- rural, urban, vermicompost, coirpith etc.; Quality parameters of *organic manures* and specifications; Recycling of *organic residue*; *Industrial effluents* and heavy metal contamination – bioremediation and phyto remediation; *Biofertilizers*; Soil micro flora – nutrient transformations; *Soil health* – concept and assessment – Soil Health Card; *Soil enzymes*; *Role of microorganisms* in degradation of pesticides; Integrated Nutrient Management (INM) and Integrated Plant Nutrient Supply System (IPNS).

Fertilizers and agro-chemicals : *Fertilizers* – classifications -manufacturing processes and properties of major nitrogenous -phosphatic -potassic and complex fertilizers -their fate and reactions in the soil; *Secondary and micronutrients fertilizers*; *Fertilizer Control Order* - fertilizer storage; *Organic chemistry* as prelude to agro chemicals -diverse types of agrochemicals -*botanical insecticides* (Neem), Pyrethrum, Synthetic pyrethroids.

Soil chemistry, soil fertility and nutrient management : *Soil as a source of plant nutrients* -essential and beneficial elements -mechanisms of nutrient transport to plants-factors affecting nutrient availability to plants; Nutrient uptake mechanisms; *Problem soils* – acid, salt affected and calcareous soils, characteristics, nutrient availabilities; *Reclamation* – mechanical, chemical and biological methods; Fertilizer and insecticides and their effect on soil water and air; *Soil fertility* – Different approaches for soil fertility evaluation; Methods - *Soil testing* – Chemical methods -critical levels of different nutrients in soil; *Plant analysis* – DRIS methods -critical levels in plants -rapid tissue tests -Indicator plants -biological method of soil fertility evaluation; *Soil test based fertilizer recommendations* to crops; Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Nutrient cycles, N, P, K and S; Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Environmental Science : Scope and importance of *environmental studies*; *Natural resources*- renewable and non-renewable resources; *Ecosystems*- Definition, concept, structure and functions - producers, consumers and decomposers of an ecosystem - energy flow in the ecosystem - types of ecosystems; *Bio-diversity*- definition, classification, threats to biodiversity and its conservation; *Environmental pollution*- causes, effects and control of air, water, soil; Causes, effects and management of *soil nuclear hazards and industrial wastes*; *Disaster management*- floods, earthquakes, cyclones and landslides.

Part-3 (Agricultural Microbiology)

Agricultural Microbiology : Introduction to microbial world -history of microbiology; Spontaneous generation theory – prokaryotic and eukaryotic microorganisms – bacterial cell -morphology and structure -germ theory of disease -protection against infections -applied areas of microbiology -metabolism in bacteria -ATP generation -chemoautotrophy, photo autotrophy, respiration, fermentation – bacteriophages -structure and properties of bacterial viruses – lytic and lysogenic cycles -viroids, prions -bacterial genetics -gene expression -genetic recombination -transformation, conjugation and transduction -genetic engineering -plasmids, episomes -genetically modified organisms -soil microbiology - microbial groups in soil -microbial transformations of carbon, nitrogen, phosphorus and sulphur -biological nitrogen fixation -microflora of rhizosphere and phyllosphere microflora - microbes in composting -microbiology of water -microbiology of food -role of microbes in fermentation -microbial spoilage and principles of food preservation -beneficial microorganisms in agriculture -biofertilizer (bacterial, cyanobacterial and fungal) -microbial insecticides -microbial agents for control of plant disease – biodegradation -biogas production -biodegradable plastics -plant microbe interactions – beneficial – symbiotic, associative and non symbiotic – PGPR – plant pathogens.

PAPER- III
(100 marks)

Part-1 (Agricultural Entomology)

Insect morphology, physiology and systematic : History of Entomology; Classification of phylum Arthropoda; Relationship of class Insecta with other classes of Arthropoda; Insects in relation to man; Morphology-structure and function of insect cuticle; Body segmentation - Structure of head, thorax and abdomen; Structure and modifications of insect antennae, mouth parts and legs; Wings-venation, modifications, wing coupling and articulation; Sense organs; Metamorphosis and diapauses; Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system; Types of reproduction in insects; Classification – importance, history, development and binomial nomenclature; Methods of collection and preservation of insects; Classification – Orders - *Orthoptera*, *Isoptera*, *Thysanoptera*, *Hemiptera*, *Coleoptera*, *Lepidoptera*, *Hymenoptera*.

Insect ecology and integrated pest management : Insect Ecology-introduction, importance; Effect of abiotic factors-temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents; Effect of biotic factors – food, natural enemies; Concepts of balance of life in nature, biotic potential and environmental resistance; Categories of pests. Pest surveillance and pest forecasting; IPM-introduction, importance, concepts, principles; Tools of IPM; Important groups of microorganisms used in pest control; Chemical control – importance, hazards and limitations. Classification of insecticides; Toxicity of insecticides and formulations of insecticides; Study of important insecticides - Botanical insecticides, Synthetic insecticides, Nematicides, rodenticides, acaricides and fumigants; Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes; Plant protection equipment; Recent methods of pest control-repellents, antifeedants, hormones, attractants, Pheromones, Chitin synthesis inhibitors, irradiation and genetic control; Practices, scope and limitations of IPM.

Pests of crops and stored grains and their management : Distribution, biology, nature and symptoms of damage and management strategies of insect pests of different crops viz., rice, maize & vegetables; Stored grain pests – Introduction - Causes of storage losses; Coleopteran and lepidopteran pests-biology and damage - Preventive and curative methods of management .

Plant parasitic nematodes, other non insect pests and their management : Plant parasitic nematodes - physiology and classification; Nature and symptoms of damage in crops; Biology and management of important nematode pests of crops; Mites-biology, nature and symptoms of damage on crops. Management of important mite pests of crops; Rodents -general characters of important species, biology, habits and management.

Part-2 (Plant Pathology)

Introductory plant pathology : Introduction, Definition and objectives of Plant Pathology; History -Terms and concepts -Important plant pathogenic organisms, different groups etc.; Survival and Dispersal of Plant Pathogens; Phenomenon of infection – pre-penetration, penetration and post penetration; Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides; General Characters of fungi - Definition of fungus - somatic structures, types and modifications of fungal thalli, fungal tissues, reproduction in fungi (asexual and sexual); Nomenclature - Binomial system of nomenclature - rules of nomenclature; Classification of fungi.

Principles of crop disease management : Plant Disease Epidemiology; General principles of plant diseases management ; Plant Quarantine and Inspection – Quarantine Rules and Regulations; Cultural methods; Physical Methods; Heat and Chemical methods ; Methods of application of fungicides. Host plant resistance – Defense mechanism in plants; Application of biotechnology in plant disease management –Development of disease resistant; Integrated plant disease management (IDM) – Concept, advantages and importance.

Diseases of field crops and their management : Economic importance, symptoms, cause, epidemiology, disease cycle and integrated management of diseases of rice, maize, solanaceous vegetables and Tuber crops.

Diseases of Horticultural Crops and Their Management: Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of: citrus, banana, pineapple, cashew, arecanut, ginger, rose and orchids.

Part-3 (Agricultural Meteorology)

Agricultural meteorology : Introduction to Meteorology and Agricultural Meteorology - Scope and importance of Agricultural Meteorology; Composition of Atmosphere; Role of greenhouse gases in global cooling and warming -Concept of weather and climate -Micro-meso-macro and phyto climates; Nature and properties of solar radiation -Radiation balance -Response of plants to solar radiation and photo-synthetically active radiation; Soil temperature and its variations; Atmospheric pressure and its variation with height -Global distribution of pressure and wind; Atmospheric humidity -saturation and actual vapour pressure -relative humidity and dew point temperature -Cloud classification and measurements -cloud seeding -Rainfall and its mechanisms -forms and types of rainfall - Indian monsoons -southwest monsoon -northeast monsoon -monsoon variability across India; Importance of weather forecasting in Agriculture -weather service to farmers - agricultural seasons -crop weather diagrams and calendars – crop weather relationships - Role of weather on insect pest and diseases -weather and climate related natural disasters, risk and management ; Climate change and global warming -weather modification - Introduction to Remote Sensing.

PAPER – IV
(100 Marks)

Part-1 (Agricultural Extension)

Sociology and psychology as applied to agricultural extension : *Sociology and Rural Sociology*- meaning, definition, scope; Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension; *Social Groups* – meaning, definition, classification, factors considered in formation and organization of groups; Motivation in group formation and Role of Social groups in Agricultural Extension; *Social Values and Attitudes* – meaning, definition, types and Role of Social Values and Attitudes in Agricultural Extension; *Social Institutions* – meaning, definition, major institutions in Rural society and their Role in Agricultural Extension; *Social Organizations* – meaning, definition, types of organizations and Role of Social organizations in Agricultural Extension; *Social change* – meaning, definition, nature of Social change, dimensions of social change and factors of social change; *Social problems*; *Leadership* – meaning, definition, classification, roles of a leader; *Training of Leaders* – meaning, definition, methods of training; Advantages and Limitations in use of local leaders in Agricultural Extension; *Teaching* – learning process – meaning and definition of Teaching; *Learning* - learning experience and learning situation - elements of learning situation and its characteristics; Principles of *adult learning* and their implications for teaching.

Agricultural extension and rural development : *Extension Education and Agricultural Extension* – meaning, definition, concepts, objectives and principles; *Rural development* – meaning, definition, concepts, objectives, importance and problems in rural development; *Community Development Programme* – meaning, definition, concepts, philosophy, principles, objectives; Differences between Community Development and Extension Education; *Social Justice* and Poverty alleviation programmes; New trends in extension, privatization; *Women in Agriculture*; Reorganized extension system (*T&V System*) – salient features, fortnight meetings, monthly workshops, linkages, merits and demerits.

Communication and extension methodologies for transfer of agricultural technology: *Communication* – meaning, definition, models, elements and their characteristics; Types and Barriers in communication; *Communication Skills*- meaning and process of communication, verbal and non-verbal communication; Listening and note taking, writing skills, oral presentation skills; *Extension teaching methods* – meaning, definition, functions and classification; *Individual contact methods* – Farm and Home visit, Result Demonstration; *Field trials* – meaning, objectives, steps, merits and demerits; *Group contact methods* – Group discussion, Method demonstration; *Field Trips* – meaning, objectives, steps, merits and Demerits; *Small group discussion techniques* – lecture, symposium, panel, debate, forum, buzz group, workshop, brain storming, seminar and conference; *Mass contact Methods* – campaign, exhibition, kisan mela; *Radio & Television* – meaning, importance, steps, merits & demerits; Factors influencing selection of Extension Teaching Methods and Combination (Media Mix) of Teaching methods; *Capacity building* of Extension Personnel and Farmers; *Types of training* to farmers, farm women and Rural youth – FTC and KVK; *Extension Programme Planning* – meaning, definitions of planning, programme, project, importance, principles and steps in Programme Development Process; *Monitoring and evaluation* of Extension Programmes.

Entrepreneurship development and extension management : *Entrepreneurship Development*- Concept of entrepreneurship, entrepreneurial and managerial characteristics, entrepreneurial motivation, enterprise launching and management; *Contract farming* and

joint ventures, public-private partnerships; *Social Responsibility* of Business; *Social auditing*; Nature, scope, *principles of management* and administration with special reference to agriculture.

Part-2 (Agricultural Economics)

Principles of agricultural economics : *Agricultural economics* - meaning, definition, basic concepts - Goods, service, utility, value, price, wealth, welfare; *Consumer surplus*-meaning, definition, importance; *Demand*- meaning, definition, kinds of demand, demand schedule, demand curve, law of Demand, extension and contraction vs increase and decrease in demand; *Supply*- meaning, supply function, law of supply and factors influencing; *Production*- meaning, factors of production; *National Income*- definition and concepts; *Public finance* and public resource- meaning; *Taxation*- types; Inflation- definition, types of inflation; *Welfare economics*- meaning and basic concepts.

Agricultural finance and co-operation : *Agricultural finance*- nature and scope; *Agricultural credit*- meaning, definition, need, classification; *Sources of agricultural credit*- non institutional sources - money lenders - indigenous bankers - Institutional sources - Commercial banks, social control- nationalization of commercial banks -Lead bank scheme- Service area approach -Regional rural banks -NABARD-Establishment-Role and functions; *Higher financing agencies*, RBI, AFC, Asian development bank, World bank; *Crop insurance* programme in India; *Agricultural cooperation*- philosophy and principles, Indian cooperative movement, cooperative credit structure.

Production economics and farm management : *Production economics* - meaning, definition, nature and scope of agricultural production economics - basic concepts and terms - technical units - farm firm – plant; Resources and resource services-fixed and variable resources-flow and stock resources-product-production; *Production period*- production function-continuous and discrete function -short and long term production function-choice indicator, slope of a curve-concepts of production; *Production functions*-meaning, definition, types; *Laws of returns*- increasing, constant and decreasing; Factor product relationship; Determination of optimum input and output; *Economic principles* applied to the organizations of farm business; *Farm inventory* –Methods of valuation of farm assets-depreciation-meaning -methods of computation; *Types and systems of farming*- Farm planning and budgeting, Farm budgeting.

Agricultural marketing, trade and prices : *Agricultural marketing*- concepts and definition- scope and subject matter-Market and marketing-meaning-definitions-elements of a market-classification-agricultural marketing; Producer's surplus -meaning-types of producers surplus-marketable surplus-marketed surplus-importance, factors affecting marketable surplus; *Marketing channels*- meaning-definition-channels for different products; *Marketing efficiency*- meaning-definition-marketing costs-margins and price spread-factors affecting the cost of marketing; Measures to improve marketing efficiency and tools for risk management-cooperative marketing-futures trading-contract farming; *Globalization and liberalization*-WTO and AoA-Market access-domestic support-Export subsidies-EXIM-Policy; *Agricultural price policy* in India-objectives – role of CACP-administered prices.

Fundamentals of agri-business management : *Agribusiness*: meaning, definition, structure of agribusiness, (Input, farm, product sectors); *Management*- definition, types of management-Tactical-Strategic and operational level management-Agribusiness management-Distinctive features; *Management functions*- meaning-definitions-Planning, organizing, direction, coordinating, controlling; *Agro based industries*-Importance and need-Types of agro-based industries-Financial management-Importance-Balance sheet;

Marketing management- meaning, definitions, marketing management functions-5Ps of marketing; *Market segmentation*- meaning and need; *Pricing policy* -meaning and methods; *Project*- definitions- project cycle – Identification – formulation – implementation – monitoring - appraisal and evaluation techniques.

Part-3 (Plant Biotechnology)

Principles of plant biotechnology, bio-safety rules and intellectual property rights :
Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement; Techniques of In-vitro cultures, Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above *in-vitro* culture; Applications and Achievements; Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement; Genetic engineering; Restriction enzymes; Blotting techniques. Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications; DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement; Bio-safety rules and regulations: Rules related to GM crops-research, development, field trials, and commercial cultivation. Intellectual Property Rights-concepts, Trade related aspects of IPR; Intellectual property and international trade -WTO, WIPO, GATT, TRIPS. Protection of plant and animal genetic resources, biological materials, gene patenting, biotechnology related IPR issues -status.
