

## GROUP-7

### **Agriculture Posts-Level- B.Sc. Agriculture**

**1)** General awareness, Reasoning, Mathematics, Science, History including Haryana related history, current affairs, literature, Geography, Civics, Environment, Culture etc.- **(Weightage 20%)**

**2)** Computer terminology, Fundamentals, word software, excel software, Power point, internet, web browsing, Communication, emails, downloading and uploading data on websites etc. -

**(Weightage 10%)**

**3) Subject related syllabus-**

**(Weightage 70%)**

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#### **Introductory Botany**

Introduction and characteristics of plant; Concept of plant cells, plant tissue and plant organs; Plant habits: annuals, biennials, perennials; Seed and seed germination; Morphology and Micro-morphology of flowering plants. Binomial nomenclature and classification of plants; Introduction to plant taxonomy and plant systematic.

#### **Fundamentals of Genetics**

Introduction to genetics; Cell division: mitosis and meiosis; Mendelian principles of heredity; Study of chromosome structure; Multiple alleles, pleiotropism and pseudo alleles and blood group genetics; Linkage and its estimation, crossing over mechanisms, chromosome mapping; Sex determination and sex linkage, sex limited and sex influenced traits; Qualitative and quantitative traits, polygenes and continuous variations, multiple factor hypothesis; Cytoplasmic inheritance; Mutation- classification, Methods of inducing mutation and CLB technique, mutagenic agents and induction of mutation; Structural and numerical changes in chromosome; Nature, structure and replication of genetic material; Protein synthesis-transcription and translational mechanism of genetic material; Gene concept- gene structure and functions; Gene regulation- Lac and Trp operons.

#### **Fundamentals of Plant Breeding**

Historical development, concept, nature and role of plant breeding, major achievements; Modes of reproduction and apomixes; Self- incompatibility and male sterility- genetic consequences and cultivar options. Domestication, acclimatization, introduction; Centre of origin/diversity, Genetic basis and breeding methods in self- pollinated crops- mass selection and pure line selection, hybridization techniques and handling of segregating population (pedigree, bulk, SSD and back cross methods); Multiline concept; Genetic basis and methods of breeding cross-pollinated crops; Heterosis and inbreeding depression; Development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops-clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding; Mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses.

#### **Fundamentals of Crop Physiology**

Introduction to crop physiology and its importance in Agriculture; Plant cell, Mineral nutrition of Plants, Photosynthesis, Respiration, Plant growth regulators, Physiological aspects of growth and development of major crops, Photoperiodism and Vernalization. Translocation of solutes

#### **Principles of Seed Technology**

Seed and seed technology, Different classes of seed, seed production in different field crops, Maintenance of genetic purity during seed production, Seed certification, Seed Act and Seed Act enforcement, Seeds control order 1983, Detection of genetically modified crops, Seed drying, Seed treatment, its importance, Seed storage, general principles, stages and factors affecting seed longevity during storage, measures for pest and disease control during storage; Seed marketing-structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, role of WTO and OECD in seed marketing.

#### **Intellectual Property Rights**

Introduction and meaning of intellectual property, Treaties for IPR protection, Types of Intellectual Property and legislations covering IPR in India, Patents Act 1970 and patent system in India, compulsory

licensing, Patent Cooperation Treaty, Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights and farmer's rights. Registration of plant varieties under PPV&FR Act 2001, Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing. International treaty on plant genetic resources for food and agriculture (ITPGRFA).

## **Crop Improvement**

Botanical Name, family, chromosome number, centre of origin, nature of pollination, list of wild relatives, distributions of species of 18 selected crops (rice, maize, sorghum, pearl millet, pigeon pea, moong bean, soybean, groundnut, sesame, castor, cotton, tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber); Floral biology as well as study of genetics of qualitative and quantitative characteristics, Breeding methods, Major breeding objectives (including quality parameters) Ideotype concepts, distributions of species of 14 selected crops (wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander); Floral biology as well as study of genetics of qualitative and quantitative characters, Major breeding objectives (including quality parameters) Ideotype concepts for wheat, mustard and tomato; Climate resilient crop varieties for future. e.g short duration crops and high temperature tolerance in wheat and chickpea; International, National and State level research station.

## **Introductory Biotechnology**

History of Biotechnology, Concepts and applications of plant biotechnology, Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance, cryo-preservation; Concept of central dogma; DNA replication, Transcription and Translation, Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

## **Commercial Plant Breeding**

Introduction to commercial plant breeding; Line development and maintenance breeding of hybrids and seed production; Genetic purity test of commercial hybrids; Advances in hybrid seed production of maize, rice, pigeon pea, castor, cotton, cucumber etc; Quality seed production of vegetable crops (cucumber, tomato, chilli and capsicum), Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture technique and biotechnology tools; Step to step procedure for variety testing, release and notification system in India; State level and national level trials i.e., SSVT, LSVT, MLT etc.; Participatory plant breeding.

## **Environmental Studies and Disaster Management**

Multidisciplinary nature of environmental studies, Natural Resources, Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources, Ecosystems, Energy flow in the ecosystem, Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation, Value of biodiversity, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India. Conservation of biodiversity, Environmental Pollution, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. nuclear hazards. Solid Waste Management, Social Issues and the Environment, Environmental ethics, Wasteland reclamation, Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment, Environment and human health, Role of Information Technology in Environment and human health.

DISASTER MANAGEMENT: Natural Disasters, Climatic change, Man Made Disasters, Disaster Management, International strategy for disaster reduction, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state,

district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

## **Agricultural Heritage**

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

## **Introductory Agro-meteorology & Climate Change**

Meaning and scope of agricultural meteorology; Earth atmosphere its composition, extent and structure; weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, cyclone, anticyclone, Land breeze and sea breeze; Atmospheric temperature, Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification, Weather hazards, Agriculture and weather relations, causes of climate change and its impact on regional and national Agriculture.

## **Crop Production Technology**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops, cultural practices and yield of Rabi crops.

## **Weed Management**

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non-chemical methods of weed management. Herbicide Resistance and its management.

## **Farming System and Sustainable Agriculture**

Farming System, Cropping system and pattern, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

## **Geo-informatics and Precision Farming**

Precision agriculture, Geo-informatics, Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture.

## **Principles of Organic Farming**

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP;

Certification process and standards of organic farming; Processing, levelling, economic considerations and viability, marketing and export potential of organic products.

## **Rainfed Agriculture and Watershed Management**

Rainfed agriculture, Drought, Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

## **Fundamentals of Plant Pathology**

Introduction, Causes and factors affecting disease development, Important plant pathogenic organisms (different groups): fungi, bacteria, phytoplasma, Spiro plasma, viruses, viroid's, algae, protozoa and phanerogamic plant parasites, Diseases and symptoms due to abiotic causes, Pathogenesis, Role of enzymes and toxins, Defence mechanism in plants. Epidemiology, Fungi, Bacteria and mollicutes, viruses, Growth and reproduction of plant pathogens. Liberation, dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens.

## **Agricultural Microbiology**

Introduction. Microbial world, Bacterial genetics, Role of microbes in soil fertility and crop production, biological nitrogen fixation, Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation.

## **Introductory Plant Nematology**

Introduction, History of Phyto nematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes, Classification of plant parasitic nematodes based on feeding habits. Identification of economically important plant nematodes, Symptoms caused by nematodes, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses, Different methods of nematode management. Cultural methods chemical methods.

## **Principles of Integrated Disease Management**

Categories of diseases, IPM, Economic importance of diseases and pest risk analysis, Methods of detection and diagnosis of diseases. Calculation and dynamics of economic injury level and importance, Methods of control, Principles and methods of plant disease management, Ecological management of crop environment, Introduction to conventional pesticides for the disease management, Survey surveillance and forecasting of diseases, Development and validation of IPM module, Case histories of important IPM programmes. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

## **Diseases of Field and Horticultural Crops and Their Management**

Symptoms, aetiology, disease cycle and management of major diseases of, Field Crops: Rice, Maize, Sorghum, Bajra, Groundnut, Sesamum, Soybean, Pigeon pea, Finger millet, Black & green gram, Castor, Tobacco, Horticultural Crops, Banana, Papaya, Pomegranate, Brinjal, Tomato, Okra, Beans, Colocasia, Coconut, Tea, Cluster bean, disease cycle and management of following diseases: Field Crops: Wheat, Sugarcane, Sunflower, Mustard, Lentil, Pea, Horticultural Crops: Mango, Citrus, Grape vine, Guava, Ber, Apple, Peach, Sapota, Cucurbits, Onion and garlic, Chillies, Ginger, Turmeric, Fenugreek, Cumin, Fennel, Coriander, Cruciferous vegetables, Rose.

## **Fundamentals of Soil Science**

Soil as a natural body, Soil genesis, Soil physical properties: soil texture, Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction- pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays, soil organic matter, soil organisms.

## **Manures, Fertilizers and Soil Fertility Management**

Classification and importance of organic manures, Chemical fertilizers, History of soil fertility and plant nutrition. Criteria of essentiality. Role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

## **Fundamentals of Plant Biochemistry**

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate, Structures of Monosaccharides, Proteins, Introduction to secondary metabolites, Enzymes, Vitamins and mineral nutrition for human health, Nucleic acids, RNA, Metabolism of carbohydrates, Substrate level and photo phosphoryl) reaction ion, Metabolism of lipids.

## **Problematic Soils and their Management**

Soil quality and health, their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different agro-climatic zones of Haryana.

## **Soil, Plant and Water Testing**

Soil analysis, Standardization of solutions and reagents, Estimation of pH, EC, organic carbon, available N, P, K, S & micronutrients in soil (Fe, Mn, Zn, Cu, B) and nutrient index, fertilizer recommendation Plant analysis, Sampling stages and plant part to be sampled, Estimation of N, P, K, S and micro nutrients (Fe, Mn, Zn, Cu and B) from plant sample, Rapid plant tissue test, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient ranges. Irrigation Water analysis, Quality criteria, classification and suitability of irrigation water and water quality index. Introduction of analytical instruments and their principles, calibration and applications

## **ENTOMOLOGY**

Part – I: History of Entomology in India, Part – II: Morphology, Part – III: Structure of male and female genital organs, Part – IV: Systematics

## **Principles of Integrated Pest Management**

Part I: Insect Ecology, Part-II: Categories of insect pests, IPM, Part III: Recent methods of pest control

Part IV: Economic importance of insect pests

## **Management of Beneficial Insects**

Part I: Importance of beneficial Insects, Part II: Honey bee species, seasonal management, hive products, diseases and enemies. Part III: Types of silkworms, voltinism and biology of silkworm, Part IV: Species of lac insect, morphology, biology, host plant, lac production, Part V: Identification of major parasitoids and predators commonly being used in biological control.

## **Pests of Field Crops and Stored Grains and their Management**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, identification, biology and bionomics, nature of damage, and management of insect and non-insect pests of paddy, sorghum, maize, Pearl millet, ragi (Eleusinecoracana), wheat, sugarcane, cotton, sun hemp, pulses, groundnut, castor, gingelly, safflower, sunflower, mustard, soybean, cumin, fennel, Fenugreek, tobacco etc. Common phytophagous mites, rodents, snail, slug, crab and bird pests. Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods.

## **Pests of Horticultural Crops and their Management**



Distribution, biology, nature and symptoms of damage, and management strategies of insect and non-insect pests of vegetable crops viz., brinjal, okra, tomato, potato, cruciferous and cucurbitaceous vegetables, pulse vegetable, leafy vegetables, sweet potato, elephant foot, yam, Colocasia, moringa; spices crops viz., chilies, onion, turmeric, garlic, ginger, coriander and curry neem leaf; fruit trees viz., mango, sapota, citrus, banana, cashew, pomegranate, custard apple, aonla, Ber, guava, papaya and grape vine and plantation crops viz., coconut, areca nut and date palm and ornamental plants. Plant protection in protected cultivation.

## **Production Technology for Fruit and Plantation Crops**

Importance and scope of fruit and plantation crop industry in India; High density planting; Use of rootstocks; Production technologies for the cultivation of major fruits mango, banana, citrus, grape, guava, papaya, apple, pomegranate, Sapota, Custard apple minor fruits: jackfruit, strawberry, pineapple, Ber and Jamun plantation crops- major coconut, areca-nut, cashew minor ;, tea, coffee & rubber.

## **Production Technology for Vegetable and Spices**

Importance of vegetables & spices in human nutrition and national economy, Major crops: Fruit vegetables, Cucurbits, Cole crops, Tuber, Spices, Minor crops: Cucurbits, Legumes, Root vegetables, Tuber, Leafy vegetables, Bulb crops.

## **Post-harvest Management and Value Addition of Fruits and Vegetables**

Importance of fruits and vegetables, extent and possible causes of post-harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Role of ethylene; Post harvest disease and disorders; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy - Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables - Concept and methods, osmotic drying. Canning — Concepts and Standards, packaging of products

## **AGRICULTURAL ECONOMICS**

Economics, Basic concepts, Demand, Elasticity of demand, Laws of returns, Distribution theory, National income, Population, Money, Economic systems.

## **Agricultural Finance and Co-Operation**

Agricultural Finance, Credit analysis, Sources of agricultural finance, An introduction to higher financing institutions, Preparation and analysis of financial statements, Basic guidelines for preparation of project reports, SWOT analysis, Agricultural Cooperation, Agricultural Cooperation in India, cooperative warehousing, Crop insurance, Pradhan-Mantri Fasal Bima Yojana.

## **Agricultural Marketing Trade and Prices**

Agricultural Marketing, classification and characteristics of agricultural markets, pricing and promotion strategies, marketing process and functions, Market functionaries and marketing channels, costs and price spread, Role of Govt. in agricultural marketing, Risk in marketing, Agricultural prices and policy, Trade.

## **Farm Management, Production and Resource Economics**

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms, Principles of farm management, Meaning and concept of cost, Importance of farm records and accounts in managing a farm, Meaning and importance of farm planning and budgeting, Concept of risk and uncertainty occurs in agriculture production, Concepts of resource economics, Positive and negative externalities in agriculture.

## **Renewable Energy and Green Technology**

Classification of energy sources, contribution of these of sources in agricultural sector,introduction of solar energy,application of solar energy, introduction of wind energy and their application, Availability of bio mass and their application in different places.

### **Protected Cultivation and Secondary Agriculture**

Green house technology, Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation, Drying and dehydration, Material handling equipment.

### **Rural Sociology & Educational Psychology**

Sociology and Rural sociology, educational psychology,Behaviour, Motivation, Teaching-Learning, Rural Leadership.

### **Human Value and Ethics**

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self-Exploration. Self-Awareness. Self-Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

**Important Note: The Weightage as mentioned against the syllabus is tentative & may vary.**