UPSC Agriculture Optional Syllabus

Paper-I

1. Ecology

- Ecology and its relevance to man
- Natural resources, their sustainable management and conservation
- Physical and social environment as factors of crop distribution and production
- Agro-ecology; cropping pattern as indicators of environments
- Environmental pollution and associated hazards to crops, animals, and humans
- Climate change - International conventions and global initiatives
- Greenhouse effect and global warming
- Advance tools for ecosystem analysis - Remote sensing (RS) and Geographic Information Systems (GIS)

2. Agronomy

- Cropping patterns in different agro-climatic zones of the country
- Impact of high-yielding and short-duration varieties on shifts in cropping patterns
- Concepts of various cropping and farming systems
- Organic and Precision farming
- Package of practices for production of important cereals, pulses, oil seeds, fibres, sugar, commercial, and fodder crops

3. Weed Science

- Weeds - their characteristics
- Dissemination and association with various crops; their multiplications
- Cultural, biological, and chemical control of weeds

4. Forestry

- Important features and scope
- Various types of forestry plantations such as social forestry, agro-forestry, and natural forests
- Propagation of forest plants
- Forest products; agro-forestry and value addition
- Conservation of forest flora and fauna

5. Soil Science and Nutrient Management

- Soil - physical, chemical, and biological properties

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- Processes and factors of soil formation
- Soils of India
- Mineral and organic constituents of soils and their role in maintaining soil productivity
- Essential plant nutrients and other beneficial elements in soils and plants
- Principles of soil fertility, soil testing, and fertilizer recommendations
- Integrated nutrient management
- Bio-fertilizers
- Losses of nitrogen in soil, nitrogen-use efficiency in submerged rice soils, nitrogen fixation in soils
- Efficient phosphorus and potassium use
- Problem soils and their reclamation
- Soil factors affecting greenhouse gas emission

6. Soil and Water Conservation

- Soil conservation
- Integrated watershed management
- Soil erosion and its management; Dryland agriculture and its problems
- Technology for stabilizing agriculture production in rain-fed areas
- Water-use efficiency in relation to crop production
- Criteria for scheduling irrigations
- Ways and means of reducing runoff losses of irrigation water
- Rainwater harvesting
- Drip and sprinkler irrigation
- Drainage of waterlogged soils
- Quality of irrigation water
- Effect of industrial effluents on soil and water pollution
- Irrigation projects in India

7. Agricultural Economics

- Farm management, scope, importance, and characteristics; farm planning
- Optimum resource use and budgeting
- Economics of different types of farming systems
- Marketing management - strategies for development, market intelligence
- Price fluctuations and their cost; role of co-operatives in agricultural economy
- Types and systems of farming and factors affecting them
- Agricultural price policy
- Crop Insurance

8. Agricultural Extension

- Agricultural extension, its importance, and role

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- Methods of evaluation of extension programmes
- Socio-economic survey and status of big, small, and marginal farmers and landless agricultural labourers
- Training programmes for extension workers
- Role of Krishi Vigyan Kendra's (KVK) in dissemination of Agricultural technologies
- Non-Government Organization (NGO) and self-help group approach for rural development

Paper-II

1. Cell Biology

- Cell structure, function, and cell cycle
- Synthesis, structure, and function of genetic material
- Laws of heredity
- Chromosome structure, chromosomal aberrations
- Linkage and cross-over, and their significance in recombination breeding
- Polyploidy, euploids, and aneuploids
- Mutations - and their role in crop improvement
- Heritability, sterility, and incompatibility; classification and their application in crop improvement
- Cytoplasmic inheritance, sex-linked, sex-influenced, and sex-limited characters

2. Plant Breeding

- History of plant breeding
- Modes of reproduction, selfing, and crossing techniques
- Origin, evolution, and domestication of crop plants; centre of origin; law of homologous series; crop genetic resources conservation and utilization
- Application of principles of plant breeding; improvement of crop plants
- Molecular markers and their application in plant improvement
- Pure-line selection, pedigree, mass, and recurrent selections; combining ability and its significance in plant breeding
- Heterosis and its exploitation
- Somatic hybridization
- Breeding for disease and pest resistance
- Role of interspecific and intergeneric hybridization
- Role of genetic engineering and biotechnology in crop improvement
- Genetically modified crop plants

3. Seed Production and Technology

- Seed production and processing technologies
- Seed certification, seed testing, and storage

- DNA fingerprinting and seed registration
- Role of public and private sectors in seed production and marketing
- Intellectual Property Rights (IPR) issues, WTO issues, and their impact on Agriculture

4. Plant Physiology

- Principles of Plant Physiology with reference to plant nutrition, absorption, translocation, and metabolism of nutrients
- Soil-water-plant relationship
- Enzymes and plant pigments
- Photosynthesis - modern concepts and factors affecting
- C3, C4, and CAM mechanisms
- Factors affecting aerobic and anaerobic respiration
- Carbohydrate, protein, and fat metabolism
- Growth and development; photoperiodism and vernalization
- Plant growth substances and their role in crop production
- Physiology of seed development and germination; dormancy
- Stress physiology - drought, salt, and water stress

5. Horticulture and Landscape Gardening

- Major fruits, plantation crops, vegetables, spices, and flower crops
- Package of practices of major horticultural crops
- Protected cultivation and high-tech horticulture
- Post-harvest technology and value addition of fruits and vegetables
- Landscaping and commercial floriculture
- Medicinal and aromatic plants
- Role of fruits and vegetables in human nutrition

6. Plant Protection

- Diagnosis of pests and diseases of field crops, vegetables, orchard, and plantation crops and their economic importance
- Classification of pests and diseases and their management
- Integrated pest and disease management
- Storage pests and their management
- Biological control of pests and diseases
- Epidemiology and forecasting of major crop pests and diseases
- Plant quarantine measures
- Pesticides, their formulation, and modes of action

7. Food Production and Nutrition Management

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- Food production and consumption trends in India
- Food security and growing population - vision 2020
- Reasons for grain surplus
- National and international food policies
- Production, procurement, distribution constraints
- Availability of food grains, per capita expenditure on food
- Trends in poverty, Public Distribution System (PDS), and Below Poverty Line (BPL) population; Targeted Public Distribution System (TPDS); policy implementation in the context of globalization
- Processing constraints
- Relation of food production to National Dietary Guidelines and food consumption pattern
- Food-based dietary approaches to eliminate hunger
- Nutrient deficiency:
    - Micro-nutrient deficiency, Protein Energy Malnutrition (PEM) or Protein Calorie Malnutrition (PCM)
    - Micro-nutrient deficiency and Human Resource Development (HRD) in the context of work capacity of women and children
- Food grain productivity and food security

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Detailed Breakdown of Paper-I

Paper-I focuses on practical and socio-economic aspects of agriculture, making it accessible to candidates with a general understanding of the subject. Below is a summary of its key sections, with preparation tips:

Topic	Description	Preparation Tips
Ecology	Covers ecological principles, resource management, and climate change impacts.	Study international conventions like the Paris Agreement and GIS applications via ISRO resources.
Agronomy	Focuses on cropping patterns, farming systems, and crop cultivation practices.	Analyze agro-climatic zones and organic farming trends using ICAR reports.
Weed Science	Examines weed characteristics and control methods.	Learn integrated weed management techniques from agricultural journals.
Forestry	Includes forest types, products, and conservation.	Review social forestry initiatives and afforestation policies.
Soil Science and Nutrient Management	Addresses soil properties, fertility, and nutrient management.	Use soil science textbooks and focus on bio-fertilizers and nitrogen fixation.
Soil and Water Conservation	Covers soil erosion, irrigation, and watershed management.	Study drip irrigation and rainwater harvesting case studies.
Agricultural Economics	Discusses farm management, marketing, and crop insurance.	Review schemes like PMFBY for crop insurance insights.
Agricultural Extension	Highlights KVKs, NGOs, and extension program evaluation.	Study KVK roles and self-help group models in rural development.

Detailed Breakdown of Paper-II

Paper-II is more technical, requiring a deeper understanding of biological and horticultural sciences. Below is a summary of its key sections:

Topic	Description	Preparation Tips
Cell Biology	Covers cell structure, heredity, and mutations.	Study genetics basics using standard biology textbooks.
Plant Breeding	Includes breeding techniques, heterosis, and GM crops.	Focus on molecular markers and biotechnology applications.

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Topic	Description	Preparation Tips
Seed Production and Technology	Discusses seed certification, storage, and IPR issues.	Review seed policies and WTO regulations.
Plant Physiology	Examines photosynthesis, respiration, and stress physiology.	Create flowcharts for physiological processes like C3/C4 mechanisms.
Horticulture and Landscape Gardening	Covers cultivation of fruits, vegetables, and floriculture.	Study protected cultivation and post-harvest technology.
Plant Protection	Focuses on pest/disease management and IPM.	Learn IPM strategies and pesticide formulations.
Food Production and Nutrition Management	Addresses food security, policies, and nutrient deficiencies.	Analyze India's PDS and Vision 2020 documents.

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