

**प्रदेश लोक सेवा आयोग**  
**प्रदेश नं. १, विराटनगर**  
**स्थानीय सरकारी सेवा अन्तर्गतका प्राविधिक तर्फ कृषि सेवा, प्लान्ट प्रोटेक्सन, एग्रोनोमी, हर्टिकल्चर, एगू.**  
**एक्सटेन्सन, स्वायल साइन्स, एगू.इको.एण्ड मार्केटिङ्ग समूह, छैटौँ तहका पदको खुला**  
**प्रतियोगितात्मक परीक्षाको पाठ्यक्रम**

**पाठ्यक्रमलाई निम्नानुसार विभाजन गरिएको छः**

<b>प्रथम चरणः-</b>	लिखित परीक्षा (Written Examination)	पूर्णाङ्कः- २००
<b>द्वितीय चरणः-</b>	(क) सामूहिक परीक्षण (Group Test)	पूर्णाङ्कः- १०
	(ख) अन्तर्वार्ता (Interview)	पूर्णाङ्कः- ३०

**परीक्षा योजना (Examination Scheme)**

**प्रथम चरणः-** लिखित परीक्षा योजना (Written Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या x अङ्कभार	समय
प्रथम	General Subject	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न x २ अङ्क	४५ मिनेट
द्वितीय	Technical Subject	१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	८ प्रश्न X ५ अङ्क ६ प्रश्न x १० अङ्क	३ घण्टा

**द्वितीय चरणः-** अन्तर्वार्ता (Interview)

विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०	समूहमा व्यक्तिगत प्रस्तुती र सामूहिक छलफल (Individual Presentation in Group and Discussion)	३० मिनेट
अन्तर्वार्ता (Interview)	३०	मौखिक	-

**द्रष्टव्य :**

- १ लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
- २ प्रथमपत्र र द्वितीयपत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- ३ वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- ४ बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै पनि प्रकारको क्यालकुलेटर (Calculator), मोबाइल फोन वा अन्य विद्युतीय उपकरण प्रयोग गर्न पाइने छैन ।

- ५ विषयगत प्रश्नहरूको हकमा तोकिएको अंकको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुईभन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- ६ द्वितीय पत्रमा (विषयगत प्रश्न हुनेको हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तर पुस्तिकाहरू हुनेछन्। परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको उत्तर पुस्तिकामा लेख्नुपर्नेछ ।
- ७ यस पाठ्यक्रम योजना अन्तर्गतका पत्र तथा विषयका विषयवस्तुमा जे सुकै लेखिएको भएता पनि पाठ्यक्रममा परेका कानून ऐन नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
- ८ प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको सामूहिक परीक्षण र अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- ९ लिखित परीक्षा, अन्तिम चरणको सामूहिक परीक्षण र अन्तर्वार्ताको कुल अङ्क योगका आधारमा अन्तिम परीक्षाफल प्रकाशित गरिनेछ ।
- १० पाठ्यक्रम लागू मिति: २०७७/०९/१६

### विशिष्टीकरण तालिका

क्र.सं.	विषयवस्तु	लामो उत्तर आउने प्रश्न	छोटो उत्तर आउने प्रश्न	अङ्कभार
१	Agriculture Extension	१	१	१५
२	Agricultural Economics	१	१	१५
३	Soil Science	१	१	१५
४	Agronomy	१	१	१५
५	Horticulture	१	२	२०
६	Plant Protection	१	२	२०
<b>जम्मा</b>		<b>६</b>	<b>८</b>	<b>१००</b>

प्रदेश लोक सेवा आयोग

प्रदेश नं. १, विराटगर

स्थानीय सरकारी सेवा अन्तर्गतका प्राविधिक तर्फ कृषि सेवा, प्लान्ट प्रोटेक्सन, एग्रोनोमी, हर्टिकल्चर, एगू. एक्सटेन्सन, स्वायल साइन्स, एगू.इको.एण्ड मार्केटिङ्ग समूह, छैटौँ तहका पदको खुला प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

**प्रथम पत्र (Paper I): General Subject**

**1. History and Current Status of Agriculture Sector in Nepal (10 marks)**

- 1.1 History of agricultural research and development in Nepal
- 1.2 Overview of Nepalese agriculture: Current status and scope
- 1.3 Institutional arrangement of agricultural research, extension and education in Nepal
- 1.4 Agriculture Perspective Plan (APP) and its impact in Nepalese agriculture
- 1.5 Devolution of agriculture extension system and its impact in agricultural development
- 1.6 Structure of Agriculture Services at Federal, Provincial & Local levels

**2. Agriculture Research, Extension and Education (10 marks)**

- 2.1 Role of agriculture research in contemporary agriculture
- 2.2 Nepal Agricultural Research Council (NARC) and its vision & functions
- 2.3 Agricultural education systems in Nepal
- 2.4 Academic institutions such as AFU, PU, TU
- 2.5 Technical and Vocational Educational Institutions (CTEVT and its allied institutions)
- 2.6 Major functions of agriculture research, extension and education in Nepal
- 2.7 Linkage and coordination among research, extension and teaching in Nepal
- 2.8 Public, private, NGOs, CBOS, agricultural co-operatives and farmer groups involvement in research, extension and education
- 2.9 Participatory technology development, participatory planning, monitoring, evaluation and feedback

**3. Natural Resource, Environment Conservation, Climate Change and Disaster-Risk Management (20 marks)**

- 3.1 Importance of natural resources conservation, utilization and management with respect to food security, employment generation and livelihood improvement in Nepal
- 3.2 Bio-diversity and agro-biodiversity: Conservation and utilization for sustainable agriculture development
- 3.3 Use of fertilizers and pesticides in agriculture and their implications to environment

- 3.4 Integrated pest, crop and plant nutrient management systems (IPM, ICM, IPNM) and Good Agricultural Practices (GAP)
- 3.5 Environmental issues and sustainability of Nepalese agriculture
- 3.6 Organic agriculture and organic products for export promotion and food safety
- 3.7 General climatic conditions of Nepal, weather observation & instruments in use.
- 3.8 Agricultural Insurance Policies & programs in Nepal.; Implementation status of Crop insurance in Nepal
- 3.9 Climate change and its impact in agriculture sector
- 3.10 Climate change adaptation and mitigation strategies of Nepal
- 3.11 Disaster (landslide, drought, flood, cold spell, earthquake, pest outbreak) management in agriculture
- 3.12 Rapid urbanization and change in land use pattern and their consequences in food security, environment conservation, employment generation and youth migration

#### **4. Legislations, Plan, Policies, Strategies and Global Trade in Agriculture**

**(20 marks)**

- 4.1 Agriculture sector in current constitution
- 4.2 Concept, goals, target and strategies of current periodic plan
- 4.3 Planning, implementation, monitoring and evaluation of agricultural projects
- 4.4 Local Government Operation Act, 2074 and its role in agricultural development
- 4.5 National Agriculture Policy, 2061 (2004)
- 4.6 Agro-biodiversity Promotion Policy, 2063 (2007) (first amendment, 2071)
- 4.7 Agri-business Promotion Policy, 2063 (2006)
- 4.8 Agriculture Development Strategy (ADS), 2015-2035 AD: vision, mission, target, components and its salient features, implementation status of ADS, supporting projects and institutional arrangement
- 4.9 Prime Minister Agriculture Modernization Project (PMAMP) and other agriculture development projects
- 4.10 National Seed Vision (2013-2025) and its implementation status
- 4.11 Nepal Trade Integration Strategy (NTIS), 2016 - Agricultural commodities
- 4.12 Agricultural Extension Strategy, 2061 (2003)
- 4.13 Seeds Act, 2045 (1988) and Seed Rules, 2069 (2013)
- 4.14 Plant Protection Act, 2064 (2007) and Plant Protection Rules, 2066 (2010)
- 4.15 Pesticides Management Act, 2076 (2019) and Regulation
- 4.16 Fertilizer Control Order, 2055
- 4.17 Right to Food and Food Sovereignty Act, 2076 (2019)

- 4.18 Food Safety Policy, 2076 (2019)
- 4.19 Agro Forestry Policy, 2076 (2019)
- 4.20 World Trade Organization (WTO), Sanitary and Phyto-sanitary (SPS), Technical Barriers to Trade (TBT) measures in Nepalese agricultural trade
- 4.21 Comparative advantage, agriculture commercialization and trading of Nepalese agricultural products.
- 4.22 Agreement on South Asian Free Trade Area (SAFTA): their implication and impact in Nepalese agriculture

**5. Agricultural Technology and Management (40 marks)**

- 5.1 Importance of technology generation, verification and dissemination in crop production and management
- 5.2 Variety release and registration system in Nepal, Seed quality assurance: Seed production, laboratory testing, processing, handling, marketing and storage
- 5.3 Food and nutrition security: Concepts, status and dimensions
- 5.4 Importance of pests and pesticides management
- 5.5 Integrated Pest Management (IPM) concepts and strategies/practices
- 5.6 Roles of pollinators in crop production
- 5.7 Importance of microbial agents (fungus, bacteria, nematodes and virus) in plant protection
- 5.8 Importance of crop diversification and commercialization in Nepal.
- 5.9 Precision and protected agriculture: Concepts and technologies
- 5.10 Agricultural crops for agro-forestry and environmental protection
- 5.11 Strategies for commercialization of high value low volume commodities
- 5.12 Concept of soil fertility and productivity
- 5.13 Essential plant nutrients and their sources (manures and fertilizers)
- 5.14 Soil reaction (pH) and soil reaction improvement
- 5.15 Concept of Integrated Plant Nutrient Systems (IPNS) and its significance
- 5.16 Contemporary agricultural extension practices in Nepal (plant clinic, mobile service, training and demonstration farm, farmer to farmer extension)
- 5.17 Role of information and communication technology (ICT) in agriculture development
- 5.18 Agricultural markets and marketing in Nepal
- 5.19 Agricultural Management Information System (AMIS) in Nepal
- 5.20 Agriculture Census, 2068
- 5.21 Linkage of agro-industries with agriculture production and marketing
- 5.22 Role of cooperatives in agriculture development in Nepal
- 5.23 Research methodology in agriculture (basic concepts, common designs)
- 5.24 Trade liberalization and its implication in Nepalese agricultural product

- 5.25 Value chain development: concepts and practices in agriculture
- 5.26 Postharvest management of agricultural commodities
- 5.27 Farming system and sustainable agriculture development
- 5.28 Gender Equity and Social Inclusion(GESI) and women's role in Nepalese agriculture
- 5.29 Conservation agriculture: concept, principles and practices

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### नमूना प्रश्न (Sample Questions)

1. Planned development in Nepal was started in the year  
(A) 1956 A.D. (B) 1977 A.D.  
(C) 1993 A.D. (D) 1957 A.D..
2. Which one of the following is not stakeholder of agriculture development ?  
(A) Farmers Group (B) Irrigation Users group  
(C) Women groups (D) Road construction users group
3. Drift is most influenced by  
(A) Pressure of the pump  
(B) Selectivity of the chemical  
(C) Droplet size and wind velocity  
(D) Inversion layer
4. Which Governmental body do not have the primary mandate to carry out agricultural extension service delivery as defined in the Annexes of Nepal's Constitution?  
(A) Federal Government (B) Agricultural Universities  
(C) Local Government (D) Nepal Agriculture Research Council
5. Which is not plantation crop ?  
(A) Rubber (B) Coffee  
(C) Tea (D) Ginger

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स्थानीय सरकारी सेवा अन्तर्गतका प्राविधिक तर्फ कृषि सेवा, प्लान्ट प्रोटेक्सन, एग्रोनोमी, हर्टिकल्चर, एगू.  
एक्सटेन्सन, स्वायल साइन्स, एगू.इको.एण्ड मार्केटिङ्ग समूह, छैटौँ तहका पदको खुला  
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**द्वितीय पत्र (Paper II) : Technical Subject**

**Section (A) - 30 Marks**

**1. Agricultural Extension**

1.1 Extension Education, Training and Leadership Development

1.1.1 History of agricultural extension in Nepal

1.1.2 Role and scope of extension education in Nepalese agricultural development

1.1.3 Concepts, definition, principles, philosophy and objectives of extension education

1.1.4 New direction of agricultural extension (subject matter specialist, privatization, pluralistic, collaborative, gender mainstreaming in agriculture, pocket package strategy, public private partnership)

1.1.5 Extension teaching methods and factors to be considered for selection of methods

1.1.6 Training need assessment, designing training module and training management

1.1.7 Leadership development and role of local leaders in Agricultural Extension

1.2 Communication, Innovation, Diffusion and Technology Transfer

1.2.1 Role of communication in agricultural extension

1.2.2 Communication models and Communication channels (mass media, inter personal, indigenous)

1.2.3 Information and Communication technologies (ICTs) and Agricultural Extension

1.2.4 Designing effective communication process

1.2.5 Barriers of effective communication

1.2.6 Innovation diffusion process

1.2.7 Adopter's categories and factors affecting rate of adoption

1.2.8 Development and transfer of technology and selection of appropriate technology

1.2.9 Models of transfer of technology (e.g. Conventional, Feedback Model, Farming System Research and Extension, Farmers' Field School)

1.3 Agricultural Extension System & Extension Program Planning

1.3.1 Agriculture extension Systems of Nepal in changing Federal context

- 1.3.2 Role, responsibility and coordination among stakeholders involved in agricultural extension in Nepal
- 1.3.3 Effective extension program planning: Principles, importance and process in Nepalese context
- 1.3.4 Monitoring, Evaluation & Factors to be considered in executing extension program.

## **2. Agricultural Economics**

### 2.1 Principles of Economics

- 2.1.1 Basic concepts on demand and supply
- 2.1.2 Price and income elasticity of demand, cross elasticity of demand
- 2.1.3 Consumer's preference and indifference curve
- 2.1.4 Market classification and price determination under different market condition
- 2.1.5 Principles of production (production function, the law of diminishing return, isoquant, product curves, production possibility curves)
- 2.1.6 Cost of production (total, average, marginal, variable and fixed costs, economies of size and scale)
- 2.1.7 Comparative and competitive advantage

### 2.2 Agricultural Economics

#### 2.2.1 Farm Management

- 2.2.1.1 Scope and importance of farm management
- 2.2.1.2 Farm budgets (total and partial budgeting).
- 2.2.1.3 Cost and return analysis (Major food grains, cash crops and horticultural crops)
- 2.2.1.4 Farm plan (Resources, constraints and optimization).
- 2.2.1.5 Efficiency measure; farm inventory management and valuation
- 2.2.1.6 Time value of money, compounding and discounting techniques
- 2.2.1.7 Income and net-worth statement

#### 2.2.2 Agricultural Marketing and Agri-business

- 2.2.2.1 Concept, scope and role
- 2.2.2.2 Characteristics of agricultural market and problems of marketing in Nepal
- 2.2.2.3 Grading, standardization, quality control and related problems of agricultural commodities
- 2.2.2.4 Value chain development in agriculture



- 2.2.2.5 Business plan preparation
- 2.2.2.6 Marketing of agricultural inputs (fertilizer, seeds, saplings, chemicals) and outputs (cereals, cash crops, fruits and vegetables)
- 2.2.2.7 Global and regional context of agricultural marketing and trade (WTO, SAFTA, Indo-Nepal trade)
- 2.2.2.8 Commodity markets in agriculture
- 2.3 Agricultural Program Planning, Monitoring, Evaluation and Data Management
  - 2.3.1 Concepts of agricultural planning, preparation of programs/projects, budgeting and project cycle
  - 2.3.2 Feasibility studies of agricultural projects and use of B/C Ratio, IRR, Economic and Financial Rate of Return, Net Present Value
  - 2.3.3 Risk and uncertainty
  - 2.3.4 Monitoring and evaluation of agricultural programs/ projects
  - 2.3.5 Logical framework in project planning and monitoring
  - 2.3.6 Statistics and Survey Techniques
    - 2.3.6.1 Frequency distribution and measures of central tendency, bar and pie charts
    - 2.3.6.2 Computation of mean and standard deviation from grouped and ungrouped sets of data
    - 2.3.6.3 Hypothesis testing and confidence interval
    - 2.3.6.4 Regression and correlation analysis
    - 2.3.6.5 Estimate of errors, control of error
    - 2.3.6.6 Agriculture Census: Sample survey and its advantage over census survey
    - 2.3.6.7 Source of sampling and non-sampling error and measures to minimize such errors. Sample design for collecting current agricultural statistics in Nepal
    - 2.3.6.8 Rapid and Participatory Rural Appraisal (RRA and PRA) and crop cutting surveys

### **Section (B) - 30 Marks**

### **3. Soil Science**

#### 3.1 General Introduction

- 3.1.1 Definition of soil
- 3.1.2 Soil forming process
- 3.1.3 Physical properties of soils (texture, structure, density, porosity, consistency)

- 3.1.4 Chemical properties of soils (soil reaction, electric conductivity, cation exchange capacity, percentage base saturation, fertilizers and reclamation of problematic soil: Acidic & alkaline)
- 3.1.5 Biological properties of soils (algae, fungi, actinomycetes, soil bacteria)
- 3.1.6 Role of soil microorganisms in ammonification, nitrification, denitrification, biological nitrogen fixation (symbiotic and non-symbiotic)
- 3.1.7 Soil organic matter and carbon nitrogen ratio
- 3.2. Soil Fertility and Plant Nutrition
  - 3.2.1 Plant Nutrition
    - 3.2.1.1 Essential plant nutrients and their functions
    - 3.2.1.2 Visual symptoms of nutrient deficiencies and nutrient disorders
    - 3.2.1.3 Nutrient cycle (C, N, P and S) and its component
    - 3.2.1.4 Nutrient requirements, uptake mechanism
    - 3.2.1.5 General soil fertility status of Nepal and major causes of declining soil fertility
    - 3.2.1.6 Soil testing, plant analysis and diagnostic techniques for improved soil fertility management
    - 3.2.1.7 Integrated Plant Nutrient Systems and its significance in sustainable soil management in the Nepalese context
  - 3.2.2 Manures and Fertilizers
    - 3.2.2.1 Different types of chemical fertilizers and their application
    - 3.2.2.2 Sources and types of organic manures
    - 3.2.2.3 Bio-fertilizers, inoculants and their use in Nepalese agriculture
    - 3.2.2.4 Fertilizers available in Nepalese market and their use
    - 3.2.2.5 Fertilizer regulation, marketing and quality control mechanism in Nepal
- 3.3 Soil survey and Water conservation
  - 3.3.1 Soil Survey
    - 3.3.1.1 Importance of soil survey and types
    - 3.3.1.2 General soil classification
    - 3.3.1.3 Major soils of Nepal and their characteristics (suborder/great group levels of USDA taxonomy).
    - 3.3.1.4 Soil fertility mapping and tools used
  - 3.3.2 Soil , Water and Plant Relationship
    - 3.3.2.1 Hydrological cycle
    - 3.3.2.2 Water infiltration and percolation
    - 3.3.2.3 Soil permeability and Hydraulic conductivity

- 3.3.2.4 Saturation percentage, permanent wilting point, field capacity and plant available soil water
- 3.3.2.5 Soil moisture retention curve
- 3.3.2.6 Crop water requirements, evapo-transpiration and irrigation requirements, water balance
- 3.3.2.7 Soil water management, water stress (drought, water logging)
- 3.3.2.8 Soil Erosion, Slopping Agriculture Land Technology (SALT) and terracing

#### **4. Agronomy**

##### 4.1 Basics of crop production

###### 4.1.1 Farming system

- 4.1.1.1 Introduction, system approach in agriculture, component determinants of farming system
- 4.1.1.2 Farming System Research Methodology (FSR)
- 4.1.1.3 Framework of FSR methodology

###### 4.1.2 Resource conservation technologies (RCT) in crop production

###### 4.1.3 Tillage

- 4.1.3.1 Objective, significance and importance of tillage in crop production
- 4.1.3.2 Zero tillage, minimum tillage and optimum tillage
- 4.1.3.3 Condition of soil suitable for cultivation

###### 4.1.4 Seed Technology

- 4.1.4.1 Seed formation, development and physiology of seed
- 4.1.4.2 Seed quality and seed classes
- 4.1.4.3 Principles and practices of seed production
- 4.1.4.4 Seed processing, handling and storage
- 4.1.4.5 Seed testing principles
- 4.1.4.6 Seed certification procedures and seed standards of major crops in Nepal
- 4.1.4.7 Importance of Varietal Replacement and Seed Replacement Rate
- 4.1.4.8 Seed self-sufficiency and seed production programs in Nepal

##### 4.2 Crop production technology

- 4.2.1 Production practices of rice, maize, wheat, Barley, finger millet, Buck wheat, lentil, soybean, chickpea, mungbean, rapeseed, sunflower, groundnut, sugarcane, jute with respect to:
  - 4.2.1.1 Importance, distribution, origin and classification
  - 4.2.1.2 Morphology and growth stages
  - 4.2.1.3 Recommended varieties

- 4.2.1.4 Climate and soil
- 4.2.1.5 Cultural practices and post-harvest technology
- 4.2.2 Underutilized crops and their importance in food and nutritional security
- 4.3 Plant breeding and research design
  - 4.3.1 Definition, importance, history and achievement of plant breeding
  - 4.3.2 Methods of crop improvement and breeding methods in field crops
  - 4.3.3 Classification of crops according to mode of pollination
  - 4.3.4 Germplasm collection, characterization, evaluation and utilization
  - 4.3.5 Variety development procedure in Nepal
  - 4.3.6 Maintenance breeding of varieties/germplasms.
  - 4.3.7 Hybrid variety development and hybrid seed production.
  - 4.3.8 Use of biotechnology in plant breeding including GMOs/LMOs.
  - 4.3.9 Research design and application

### Section (C) - 20 Marks

#### 5. Horticulture

- 5.1 Cultivation practices of major horticultural crops
  - 5.1.1 Fruits: Citrus (*Citrus spp.*), Mango (*Mangifera indica*), Litchi (*Litchi chinensis*), Banana (*Musa acuminata*), Apple (*Malus pumila*), Pear (*Pyrus communis*), Kiwi (*Actinida deliciosa*) and Avocado (*Persea americana*)
  - 5.1.2 Vegetables: Potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*), chili (*Capsicum frutescens*), cucumber (*Cucumis sativus*), cauliflower (*Brassica oleracea var botrytis*), radish (*Raphanus sativus*), beans (*Phaseolus vulgaris*), onion (*Allium cepa*), Pea (*Pisum sativum*) and broad leaf mustard (*Brassica juncea var rugosa*)
  - 5.1.3 Spice crops: Ginger (*Zingiber officinale*), Turmeric (*Curcuma longa*) and Cardamom (*Ammomum subulatum*), Black pepper (*Piper nigrum*), Areca nut (*Areca catchu*)
  - 5.1.4 Flower: Rose (*Rosa spp.*), carnation (*Dianthus caryophyllus*), gladiolus (*Gladiolus spp.*) and Gerbera (*Gerbera jamesonii*)
  - 5.1.5 Plantation crops: Tea (*Camellia sinensis*) and Arabica coffee (*Coffea arabica*),
- 5.2 Vegetable Seed production technology
  - 5.2.1 Vegetable seed production zones of Nepal
  - 5.2.2 Classification and types of seeds (breeder, foundation, certified and improved; Open pollinated, hybrids, True Potato Seed and Pre-basic Seed)
  - 5.2.3 Hybrid seed production of tomato in Nepal and seed production of

open pollinated crops (cauliflower, radish, cucumber, and onion)

### 5.3 Postharvest management of horticultural crops

- 5.3.1 Post harvest physiology: transpiration, respiration and ripening of fruit and vegetables
- 5.3.2 Causes of postharvest loss and their management
- 5.3.3 Storage of potato and fruits : principles, importance and different storage structures
- 5.3.4 Preservation of fruits and vegetables

### 5.4 Nursery management in fruits and vegetables

- 5.4.1 Sexual and asexual propagation techniques of horticultural crops
- 5.4.2 Nursery types and its use in horticultural crop production including hi-tech nurseries
- 5.4.3 Use of rootstocks in horticulture
- 5.4.4 Care and management of plants in nursery

### 5.5 Modern technologies in horticulture

- 5.5.1 Organic farming, soilless farming, tissue culture technology for tuber and sapling production, high density planting, modern irrigation technologies, use of machineries in horticulture
- 5.5.2 Precision and protected horticultural technology
- 5.5.3 Urban farming technologies (roof top, vertical farming and home garden)
- 5.5.4 Use of plant growth regulators and hormones in horticulture

### 5.6 Plant growth and development

- 5.6.1 Seed germination: mechanism and controlling factors
- 5.6.2 Flowering, pollination, fruit set, fruit drop and fruit maturity
- 5.6.3 Fruit ripening and senescence: mechanism and controlling factors
- 5.6.4 Tuber and bulb formation: mechanism and controlling factors

## Section (D) - 20 Marks

### 6. Plant Protection

#### 6.1 General Plant Protection

- 6.1.1 Importance of crop pests & disease
- 6.1.2 Climate change and implication on crop pest & disease
- 6.1.3 Plant protection principle and approaches
- 6.1.4 Importance, issues, challenges and role of plant quarantine in Nepalese agriculture
- 6.1.5 Importance of pest survey and surveillance in disease/pest

forecasting and early warning

- 6.1.6 Types of sprayers, duster and seed treatment Equipment
- 6.1.7 Use of equipment, calibration, dose calculation
- 6.1.8 Biological control of pests and diseases
- 6.1.9 Tools used for pest monitoring
- 6.1.10 Insect predators, pathogens and parasitoids
- 6.1.11 Biopesticides & Bio-fungicides in pest & disease control
- 6.1.12 Type of Pesticide formulation
- 6.1.13 WHO classification of pesticide by hazard
- 6.1.14 Banned pesticides in Nepal
- 6.1.15 Safe use of pesticides
- 6.1.16 Status of pesticide use in Nepal
- 6.1.17 Symptoms and treatment of pesticide poisoning
- 6.1.18 Different methods of pesticide residue monitoring
- 6.1.19 Weed management
- 6.1.20 Rodents and their management

## 6.2 Entomology

### 6.2.1 Industrial Entomology

- 6.2.1.1 Importance of industrial entomology
- 6.2.1.2 Biology of silkworm and honey bee
- 6.2.1.2 Insects as food.

### 6.2.2 Agricultural Insect Pests of National Importance and their Management

- 6.2.2.1 Cereals: Stem borers (*Chilo partellus*, *Chilo suppressalis*; *Sesamia inferens*, *Scirpophaga incertulas*); Green leaf hopper (*Nephotettix nigropictus*); Brown plant hopper (*Nilaparvata lugens*); Gundhi bug (*Leptocorisa chinensis*); White grubs (*Melolontha spp.*; *Phyllophaga spp.*, *Holotrichia spp.*); white fly in rice, Fall Armyworm (*Spodoptera frugiperda*)
- 6.2.2.2 Vegetables: Cutworm (*Agrotis ipsilon*; *A. segetum*); Pumpkin fruit fly (*Bactrocera cucurbitae*); Aphids (*Myzus persicae*; *Aphis fabae*; *A. gossypii*; *A. craccivora*; *Brevicoryne brassicae*); Red ants (*Dorylus orientalis*); Shoot and fruit borer (*Leucinodes orbonalis*); Large white butterfly (*Pieris brassicae nepalensis*); Fruit borer (*Helicoverpa armigera*); Tobacco caterpillar (*Spodoptera litura*); Potato tuber moth (*Phthorimaea operculella*); Diamondback moth (*Plutella xylostella*); White fly (*Bemisia tabaci*); South american leaf miner (*Tuta absoluta*)
- 6.2.2.3 Cash Crops
  - 6.2.2.3.1 White stem borer of coffee (*Xylotrechus quadripes*)
  - 6.2.2.3.2 Sugarcane plassey borer (*Chilo tumidicostalis*)

6.2.2.3.3 Pink bollworms (*Pectinophora gossypiella*)

6.2.2.4 Fruits

6.2.2.4.1 Sub-tropical fruits: Citrus fruit fly (*Bactrocera spp.*); Scale insects (*Aspidiotus destructor*, *Aonidiella aurantii*); Citrus green stinkbug (*Rhynchoscoris poseidon*)

6.2.2.4.2 Tropical fruits : Mango hoppers (*Idioscopus clypealis*, *I. nitidulus* and *Amritiodus atkinson*); Banana stem weevil (*Odoiporus longicollis*); Banana rhizome weevil (*Cosmopolites sordidus*); Litchi leaf curl mite (*Aceria litchii*)

6.2.2.4.3 Temperate fruits : Apple wooly aphid (*Eriosoma lanigerum*); San Jose scale (*Quadraspidiotus perniciosus*)

6.2.2.4.4 Ornamental and Flowers: Red Spider Mite (*Tetranychus spp.*)

6.3 Plant Pathology:

6.3.1 Introduction and importance of plant diseases

6.3.2 Mechanism of infection by plant pathogen, Host Plant Resistance

6.3.3 Defense mechanisms of host plants

6.3.4 Genetics and disease resistance in plants

6.3.5 Plant disease epidemiology and forecasting

6.3.6 Agricultural Crop Diseases of National Importance and Their Management

6.3.6.1 Cereals : Rice blast (*Pyricularia oryzae*); Bacterial blight (*Xanthomonas campestris pv oryzae*); Stalk rot (*Erwinia carotovora*); Leaf blight (*Helminthosporium turcicum*); Rusts (*Puccinia graminis tritici*, *P. recondita*, *P. striiformis*); Loose smut (*Ustilago tritici*)

6.3.6.2 Vegetables and spices: Late blight (*Phytophthora infestans*); Bacterial wilt (*Ralstonia solanaceanum*); Alternaria leaf spots (*Alternaria brassicicola*, *A. brassicae*); Damping off of seedlings (*Pythium spp.*, *Fusarium spp.*); Club root (*Plasmodiophora brassicae*); Root knot (*Meloidogyne spp.*); Anthracnose (*Colletotrichum spp.*); Tomato yellow leaf curl virus; Rhizomes rot of ginger and cardamom (*Pythium spp.*, *Fusarium spp.*)

6.3.6.3 Fruits and others: Foot and root rot (*Phytophthora citrophthora*, *P. nicotianae*); Citrus greening (Huanglungbin) - (*Liberibacter asiaticum*); Pink disease (*Pellicularia samonicklor*); Scab (*Venturia inaequalis*); Powdery mildew (*Levullela taurica*); Panama wilt of banana (*Fusarium oxysporum*); Coffee rust (*Hemalia vestatrix*); Septoria blight of marigold (*Septoria apicola*)

6.4 Mushroom cultivation

6.4.1 Cultivated species of mushroom in Nepal

- 6.4.2 Cultivation techniques of *Pluerotus* spp. *Agaricus* spp. Shiitake (*Lentinula edodes*) and Milky white (*Calocybe indica*)
- 6.4.3 Post harvest management and processing of mushrooms
- 6.5 Laboratory Techniques & production of bio control agent
  - 6.5.1 Isolation
  - 6.5.2 Culture and preservation
  - 6.5.3 Mounting & culturing
  - 6.5.4 Sterilization
  - 6.5.5 Different media used
  - 6.5.6 Production technique of *Metarhizium anisopliae*, *Beauveria bassiana* & *Trichoderma harzianum* *T. viridae*
- 6.6 Commercial Bee keeping- and honey processing, honey standards and export requirements of honey.

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### Model Questions

1. Enlist the different extension approaches used by public extension organizations and Explain any two of them. (2+3)
2. What are the various teaching methods used in delivering the agricultural extension services? Briefly describe the factors to be considered in the selection of extension teaching methods. (4+6)
3. What are the major diseases of rice prevalent in province one. Explain the control majors of three most prevalent rice diseases: (3+2.5+ 2.5+2.5)
4. Explain briefly about the importance of agricultural statistics and mention why crop cutting is done in the field with brief description of crop cutting procedure: (5+5)
5. Discuss in brief the effects of low and high temperature stresses on vegetable crops and state the measures to overcome these effects. (5+5)