मर्स्याङदी गाउँपालिकाको करार सेवामा पदपूर्ती गर्न मितिः २०८०/०५/०६ गते प्रकाशित विज्ञापन नं. ०३/२०८०/८१ कृषि अधिकृत (अधिकृतस्तर छैठौं) पदको परीक्षाको पाठ्यक्रम

द्वितीय पत्र (Paper II): Technical Subject

Section (A)

1. Agricultural Extension

1.1 Extension Education, Training and Leadership Development

1.1.1 Concepts, definition, principles, philosophy and objectives of extension education
1.1.2 Role and scope of extension education in Nepalese agricultural development
1.1.3 History of agricultural extension in Nepal
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 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 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 (explicit and implicit costs, total, average, marginal, variable and fixed costs, economies and diseconomies 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)

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, finger millet, lentil, soybean, chickpea, mungbean, rapeseed, sunflower, groundnut, sugarcane 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
4.3.9 Research design and application

Section (C)

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 acuminate), Apple (Malus pumila), Pear (Pyrus communis) and Kiwi (Actinida deliciosa)
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)
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)

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 Equipments
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 & Biofungicides 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

6.2.2 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 (Nephottetix 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 (Rhynchocoris 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 (Phytophora 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 samoniclor); 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. and Agaricus spp.

6.5 Laboratory Techniques & production
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

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