

स्थानिय तहमा कृषि स्तानक प्राविधिक परिचालन कार्यविधि २०७९ बमोजिम कृषि सेवा अधिकृत छैठौं तह पदहरुको खुल्ला प्रतियोगितात्मक परिक्षाको पाठ्यक्रम तथा परिक्षा योजना

परिक्षा योजना

- क) बस्तुगत पूर्णाङ्क : ५०
ख) बिषयगत छोटो उत्तर: ५०
ग) अन्तर्बार्ता: २०

बिषय	परिक्षा प्रणाली	प्रश्न संख्या * अङ्क	पूर्णाङ्क	उतिर्णाङ्क	समय
बस्तुगत	बहुबैकल्पिक प्रश्न	५० प्रश्न* १ अंक	५०	२०	३० मिनेट
बिषयगत	छोटो उत्तर	१० प्रश्न* ५ अंक	५०	२०	१ घण्टा
अन्तर्बार्ता	मौखिक		२०		३० मिनेट

कृषि तर्फको छैठौं तहको पाठ्यक्रम

General subject

History and Current Status of Agriculture Sector in Nepal

- 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
 - 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

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

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) 5

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

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

Technical Subject

- 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) 10

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 (*Pipur 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 13 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 *Amritodus 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 solanacearum*); *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

16 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.

भेटेनरी समूह छैठौं तह तर्फको पाठ्यक्रम

General subject

1. Introduction
 - 1.1 History of livestock and fisheries sector development in Nepal
 - 1.2 Overview of Nepalese livestock sector: current status and scope
 - 1.3 Livestock statistics of Nepal and province 1
 - 1.4 Structure of livestock sector at federal, provincial and local levels
 - 1.5 Role of research in livestock sector development, Nepal Agricultural Research Council (NARC), its vision and functions
 - 1.6 Agricultural education systems in Nepal
 - 1.7 Public, private, NGOs, CBOS, co-operatives and farmer groups involvement in research, extension and education
 - 1.8 Participatory planning, monitoring, evaluation and feedback
 - 1.9 Planning, implementation, monitoring and evaluation of livestock projects
 - 1.10 Climate change and livestock sector
 - 1.11 Gender equity and social inclusion (GESI) and women's role in Nepalese agriculture
 - 1.12 Government planning, budgeting and accounting system
 - 1.13 Formulation process of policy, acts, rules, regulations and standards at local level
2. Legislations, plans, policies, strategies and regulatory functions
 - 2.1 The constitution of Nepal (Provisions related to Livestock)
 - 2.2 Local Government Operation Act, 2074
 - 2.3 Co-operation and inter-relation between Federal, Provincial and Local level governments
 - 2.4 Civil service act and regulation (Federal and provincial)
 - 2.5 Agriculture Development Strategy (ADS) (2015-2035)
 - 2.6 Animal Health and Livestock Services Act, 2055 and its regulation, 2056
 - 2.7 Animal Slaughterhouse and Meat inspection act, 2055 and its regulation, 2057
 - 2.8 Nepal Veterinary Council Act, 2055 and regulation, 2057
 - 2.9 Feed Act, 2033 and regulation, 2041 2.
 - 10 Drug Act, 2035 2.

11 Poultry Policy, 2068

2.12 Bird Flu Control Order, 2064

2.13 Animal transportation standard, 2064

2.15 Livestock insurance policies and programs

2.16 Livestock related national and provincial (province no. 1) periodic plans, policy, programs and projects Page 4 of

2.17 World organization for animal health (OIE), its objectives, structure, function, Terrestrial Animal health code, Aquatic animal health code

2.18 World Trade Organization (WTO): Sanitary and phytosanitary measures (SPS) and Technical barrier to trade (TBT)

3. Clinical subjects

3.1 Veterinary medicine

3.1.1 Normal physiological values like body temperature, rectal temperature, heart rates, respiratory rates, urinary volume and fecal output of different species of animals

3.1.2 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment, control and prevention of common bacterial and viral diseases of livestock, poultry, equine and pets

3.1.3 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment, control and prevention of Transboundary animal disease (TADs)

3.1.4 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment, control and prevention of the common parasitic disease of livestock and poultry

3.1.5 Ecto-parasitism and their treatment, prevention and control

3.1.6 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment, and control of protozoan diseases of livestock and poultry

3.1.7 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment, and control of the common disease caused by Chlamydia, Rickettsia and Fungi in different species of animals

3.1.8 Metabolic and production diseases and their prevention and control

3.1.9 Nutritional deficiencies disease

3.1.10 Diagnosis, treatment and management of different form of poisonings and snake bite

3.1.11 Prospects and constrains of animal and poultry vaccine production in Nepal, their uses and abuses

3.2 Veterinary surgery

3.2.1 Antiseptics and disinfectants

- 3.2.2 Sterilization of surgical materials and instruments.
- 3.2.3 Inflammations, Abscess, Tumors, Cysts, Hematoma, Hernia and their treatment
- 3.2.4 Different types of wounds and their treatment
- 3.2.5 Gangrene, Burn, Scald, Frost bite and their treatment
- 3.2.6 Fractures and dislocations, their diagnosis and treatment
- 3.2.7 Special surgery: Caesarian section, Ovario-hysterectomy, Stringhalt, Neutering
- 3.3 Veterinary obstetrics and gynecology
 - 3.3.1 Normal reproductive cycle of different farm animals and dogs
 - 3.3.2 Detection of heat
 - 3.3.3 Artificial insemination
 - 11 3.3.4 Pregnancy diagnosis
 - 3.3.5 Embryo transfer
 - 3.3.6 Infertility and sterility
 - 3.3.7 Diagnosis and treatment of silent estrus, an-estrus, repeat breeders metritis, endometritis and pyometra
 - 3.3.8 Dystocia and its correction
 - 3.3.9 Prolapse of uterus, bladder and vagina
 - 3.3.10 Use of hormones and prostaglandins
 - 3.3.11 Infectious disease causing abortions
- 3.4 Epidemiology, veterinary public health, animal welfare, one health
 - 3.4.1 Surveillance and monitoring of disease
 - 3.4.2 Different types of epidemiological studies
 - 3.4.3 Outbreak investigation
 - 3.4.4 Epidemiological reporting practices in Nepal
 - 3.4.5 Cost analysis of the disease control programs
 - 3.4.6 Risk analysis
 - 3.4.7 Diagnosis, surveillance and control of various zoonotic disease
 - 3.4.8 Milk hygiene 3.4.9 Concept of HACCP (Hazard analysis and critical control point)
 - 3.4.10 Concept and strategies of One health

3.4.11 Animal welfare

3.5 Veterinary extension

3.5.1 Classification of extension teaching methods

3.5.2 Public private partnership

3.6 Clinical pathology and parasitology

3.6.1 Materials to be sent to laboratory for different disease diagnosis

3.6.2 Hematological and biochemical examination of sample for disease diagnosis

3.6.3 Liver and kidney functions tests

3.6.4 Urine analysis

3.6.5 Blood and urine culture and antibiotic sensitivity tests

3.6.6 California mastitis tests (CMT)

3.6.7 Important diagnostic tests: Different staining procedures, Tuberculin tests in animals, Test for pullorum disease (Rapid stained antigen), Brucellosis tests (RBPT and milk ring test), Test for rabies (Negri bodies test)

3.6.8 Postmortem examination of different animal species

3.6.9 Clinical parasitology (Examination of feces: direct smear method, concentration method and floatation method)

3.6.10 Examination of skin scrapping

3.6.11 Bacterial, Viral and Fungal serological techniques

3.6.12 Enzyme Linked Immunosorbent Assay (ELISA)

4. Para-clinical subjects

4.1 Veterinary microbiology

4.1.1 Bacterial genetics, mutation and variations associated with virulence

4.1.2 Antigenicity; Drug resistance

4.1.3 Principles of antiseptics, sterilization and disinfection

4.1.4 Resistance and immunity, antigen-antibody reaction and methods of detection Cell mediated and humoral immunity and immune mechanism. Immune system and its development, Antigen-antibody reactions.

4.1.5 Immunization of animals

4.1.6 Hypersensitivity-allergy

4.1.7 Bacteriophage, their description and application

4.1.8 Laboratory techniques for bacterial, viral, fungal culture and identification

4.1.9 Important diseases of domesticated animals caused by bacteria, viruses, rickettsia, chlamydia and fungi

4.2 Veterinary parasitology

4.2.1 Parasites and parasitism, types of parasitism, host-parasite relationship

4.2.2 Importance of immunity against parasitic diseases

4.2.3 Classification and nomenclature of parasites and characteristics of different classes of parasites

4.2.4 Parasite development in the host system

4.2.5 Antiparasitic and anthelmintic medication, their use and abuse. anthelmintic resistance

4.2.6 General description, classification, morphological characteristics and diseases caused by helminthes, arthropods, insects and arachnids of domesticated animals and birds and their epidemiology, effects and methods of controlling them

4.2.7 Protozoon parasites of domesticated animals and birds, their classification, morphology and the diseases caused by them with epidemiology, effects and control strategies

4.2.8 Identification of different parasites and the methods of their culture and laboratory growth

4.3 Veterinary pathology

4.3.1 Pathological responses of body to infection

4.3.2 Inflammation, classification and changes in inflammatory responses

4.3.3 Pathological disturbances and responses in circulatory system, cell metabolism, pigment metabolism

4.3.4 Disturbances in growth, neoplasm and cancer

4.3.5 Healing, fever

4.3.6 Uroliths, choleliths, sialoliths, pancreoliths, enteroliths

4.3.7 Immune reactions, hypersensitivity and auto immunity

4.3.8 Pathological changes in diseases caused by bacteria, viruses, fungus and parasites of domesticated animals and birds

4.4 Veterinary pharmacology and toxicology

4.4.1 Anesthetics, hypnotics, sedatives, tranquilizers, analgesics, analeptics, antipyretics, histamines and antihistamines

4.4.2 Anesthetics, neuromuscular blocking agents, peripheral and central muscle relaxants

4.4.3 Drugs acting on autonomic nervous system, neurohumoral transmission, adrenergic antagonists, cholinergic antagonists

4.4.4 Drugs acting on cardiovascular system, digestive system, respiratory system, urogenital system and skin and mucus membrane

4.4.5 Endocrine pharmacology

4.4.6 Vitamins

4.4.7 Antibacterial agents, antifungal agents, antiviral and anticancer agents, antiprotozoal agents and Anthelmintics

4.4.8 Cytotoxic and immunosuppressive drugs

4.4.9 Hormones, prostaglandins, corticosteroids

4.4.10 Toxicity caused by metals and non-metals, plants, commonly used drugs, agrochemicals, venomous bites and stings, environmental toxicity

5. Pre- clinical subjects

5.1 Veterinary anatomy

5.1.1 Gross anatomy of skeletal system, muscular system, nervous system, digestive system, urogenital system, circulatory system, respiratory system, reproductive system, glandular system and sense organs of domesticated animals and poultry

5.1.2 Introduction to cell structure, cell division and basic tissue of body. Histology of the organs of musculoskeletal, digestive, respiratory, urinary, reproductive, nervous, cardiovascular, endocrine, lymphoid, sense organs of domesticated animals and birds

5.1.3 General embryology, gametogenesis, fertilization, and development of fetus and body organs in domesticated animals and birds

5.2 Veterinary physiology

5.2.1 General function and mechanism of action of various organs of circulatory, digestive, respiratory, urinary, reproductive, nervous, sensory system, endocrine system of domesticated animals and birds

5.2.2 Composition and function of tissue fluids

5.2.3 Mechanism of respiration and gaseous exchange

5.3 Biochemistry

5.3.1 Biochemistry of respiration, renal function and acid base balance

5.3.2 Biochemistry of digestion and metabolism of carbohydrate, fat, protein, nucleic acid, minerals and trace elements

5.3.3 Basal and energy metabolism

5.3.4 Biochemistry of hormones and enzymes

5.3.5 Diagnostic biochemistry

5.3.6 Immunochemistry

5.3.7 Biochemistry of cellular and sub cellular components

5.3.8 Biochemistry of carbohydrate, lipids, proteins

5.4 Animal nutrition

5.4.1 Animal feed classification, nutritional requirements, feeding system and feeding standards of farm animals and birds

5.4.2 Functions of various nutrients and process of digestion in ruminants, non-ruminants and birds

5.4.3 Ration formulation for farm livestock and birds

5.5 Livestock production and management

5.5.1 Care and management of farm livestock and poultry during different production and growth stages

5.5.2 Housing system for animals and birds

5.5.3 Indigenous and exotic breeds of livestock and poultry

5.5.4 System of breeding and selection in farm livestock and poultry birds

5.5.5 Dairy and poultry production

Technical subject

1. Introduction

1.1 History and current status of veterinary services in Nepal

1.2 Livestock statistics of Nepal and province

1.3 Indigenous and exotic breeds of livestock and poultry and their characteristics

1.4 Role of public and private sector in the promotion of veterinary services in national, provincial and local level

1.5 National and provincial policies and plans related to veterinary services and livestock development

1.6 Agriculture Development Strategy (ADS)(2015-2035)

2. Planning and management of veterinary services

2.1 Planning and management of veterinary services, livestock production services and livestock product marketing services at province and local level

2.2 Herd health management and disease prevention

2.3 Disease control program

2.4 Planning, management, monitoring and evaluation of veterinary projects

2.5 Formulation process of policy, acts, rules, regulations and standards at local level

3. Animal health management

3.1 Etiology, diagnosis and treatment of systemic diseases of farm livestock, pets, equine and poultry

3.2 Definition, etiology, epidemiology, pathogenesis, symptoms, diagnosis, treatment and control of notifiable Transboundary Animal Diseases (TADs)

3.3 Etiology, epidemiology, pathogenesis, symptoms, diagnosis, treatment and control of economically important infectious diseases of farm livestock, pets, equine and poultry

3.4 Etiology, epidemiology, transmission, pathogenesis, symptoms, diagnosis, treatment and control of the common disease caused by chlamydia, Rickettsia and Fungi in different species of animals

3.5 Etiology, epidemiology, pathogenesis, symptoms, diagnosis, treatment and control of economically important of parasitic diseases (ecto and endo parasites) of farm livestock, pets, equine and poultry

3.6 Etiology, epidemiology, pathogenesis, symptoms, diagnosis, treatment and control of protozoan diseases of farm livestock, pets and poultry

3.7 Zoonotic diseases and their diagnosis, surveillance and control

3.8 General control measures against parasitic and infectious diseases of animals and birds

3.9 Management of production and metabolic diseases of farm animals

3.10 Nutritional deficiency disease

3.11 Diagnosis, treatment and management of different form of poisonings and snake bite

3.12 Definition, etiology, diagnosis, treatment and management of sub-fertility, infertility, sterility and abortion in farm animals under Nepalese condition

3.13 Importance of breeding management, artificial insemination, pregnancy diagnosis, estrus synchronization, super-ovulation and embryo transfer

3.14 Reproductive disorder and its management in farm animals

3.15 Current practices and importance of epidemiological reporting and animal health reporting system

3.16 Outbreak investigation and control

3.17 Risk analysis

3.18 Epidemiological concept of disease control

- 3.19 Concept of HACCP (Hazard analysis and critical control point)
- 3.20 Different component and management of slaughterhouse
- 3.21 Hygienic meat and milk production
- 3.22 Laboratory diagnosis of important disease of livestock and poultry
- 3.23 Prospects and constraints of vaccine production and use in Nepal
- 3.24 Veterinary drugs administration, their uses and abuses
- 3.25 Antimicrobial resistance (AMR) and Anthelmintics resistance
- 4. National and international standards, quality and regulation
 - 4.1 Slaughter house management and meat inspection principles and procedures
 - 4.2 Outline of the World Trade Organization (WTO), Sanitary and Phytosanitary measures (SPS), TBT agreement
 - 4.3 World Organization for Animal Health (OIE), its objectives, function, and its role in standard setting
 - 4.4 Role of official veterinary services in international trade of animals, products of animal origin, food safety, import risk analysis, import permit, International veterinary certifications, quarantine inspections and procedures
 - 4.5 Acts and Regulations:
 - 4.5.1 The constitution of Nepal
 - 4.5.2 Local Government Operation Act, 2074
 - 4.5.3 Animal Health and Livestock Service Act, 2055 and regulation, 2056
 - 4.5.4 Animal Slaughterhouse and Meat inspection Act, 2055 and regulation, 2057
 - 4.5.5 Nepal Veterinary Council Act, 2055 and regulation, 2057
 - 4.5.6 Feed Act, 2033 and regulation, 2041
 - 4.5.7 Drug Act, 2035
 - 4.5.8 Poultry Policy, 2068
 - 4.5.9 Bird Flu Control Order, 2064
 - 4.5.10 Animal transportation standard, 2064
 - 4.5.11 Livestock insurance policies and programs

4.6 Legal duties of a veterinarian, examinations of animals for soundness, injuries, and sudden death

4.7 Animal welfare

4.8 Concept and strategies of one health

4.9 Detection of frauds, Malicious poisoning/practice

4.10 Differentiation of different species of blood, serum, semen, hair, hide and bones

4.11 Co-ordination and inter-relation between Federal, provincial and local level government