

नेपाल सरकार
नेपाल कृषि अनुसन्धान परिषद्
पदपूर्ति समिति

मुख्य बैज्ञानिक एस. ५ पद/तह सबै उपसमुहको आन्तरिक प्रतियोगितात्मकलिखित परीक्षाको लागि पाठ्यक्रम एवं परीक्षा योजना

यस पाठ्यक्रमलाई दुई चरणमा विभाजन गरिएको छ ।

प्रथम चरण: लिखित परीक्षा (Written Examination)

पुर्णाङ्क: २००

द्वितीय चरण: अन्तरवार्ता (Interview)

पुर्णाङ्क: २०

प्रथम चरण: लिखित परीक्षा योजना (Written Examination Scheme)

Paper	Subject	Marks	Full Marks	Pass Marks	No. Questions and Weightage	Time Allowed
I	Part I: Administrative Manager	50	100	40	6 x 5 = 30 (Short answer) 2 x 10 = 20 (Long answer)	3:00 Hrs
	Part II: Agriculture Research and Development	50			4 x 5 = 20 (Short answer) 3 x 10 = 30 (Long answer)	
II	Technical Subject		100	40	4 x 15 = 60 (Critical Analysis) 2 x 20 = 40 (Problem Solving)	3:00 Hrs

द्वितीय चरण: (Second Phase)

Paper	Subject	Full Marks	Time Allowed
	Interview	20	Oral

द्रष्टव्यः

- लिखित परीक्षाको माध्यमभाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।
- बैज्ञानिक समूहका सबै उपसमुहको लागि प्रथमपत्रको पाठ्यक्रमको विषयवस्तु एउटै हुनेछ । तर द्वितीयपत्र Technical Subjectको पाठ्यक्रम उपसमुह अनुरूप फरक फरक हुनेछ ।
- प्रथमपत्रको लिखित परीक्षा सबै उपसमुहका लागि संयुक्त रूपमा एउटै प्रश्नपत्रबाट एकै दिन वा छुट्टा छुट्टै प्रश्नपत्रबाट छुट्टा छुट्टै दिन पनि सकिनेछ । यसैगरी द्वितीयपत्रको परीक्षा पनि उपसमुह अनुसार अलग अलग छुट्टा छुट्टै प्रश्नपत्रबाट हुनेछ ।
- प्रथमपत्रको Part I र Part IIको उत्तरपुस्तिका छुट्टा छुट्टै हुनेछ भने द्वितीयपत्रको लागि प्रत्येक प्रश्नका उत्तरपुस्तिकाहरू छुट्टा छुट्टै हुनेछन् ।
- पाठ्यक्रममा भएका यथासंभव सबै पाठ्यांशहरूबाट प्रश्न सोधिनेछन् ।
- यस पाठ्यक्रममा जे सूकै लेखिएको भएतापनि पाठ्यक्रममा परेका ऐन, नियमहरू, परीक्षाको मितिभन्दा ३ महिना अगाडी (संशोधन भएका संशोधित भई हटाईएका वा थप गरी शंसोधित भई कायम रहेका) लाई यस पाठ्यक्रममा परेको संझनु पर्दछ ।

**Paper I: General Subject
(Management and General Agricultural Issue)**

Part I: Management

1. Management: concept, principles, functions, scope, role, level and skills of managers.
2. Agriculture Research farm management.
3. Participative Management: concept, advantages, disadvantages , techniques of participation
4. Time management: concept, advantages, disadvantages.
5. Conflict management: concept, approaches to conflict, levels of conflict, causes of conflict and strategies for conflict management.
6. Stress management: Concept, causes and sources of stress, techniques of stress management.
7. Financial management: concept, approaches, budget formulation, and implantation, auditing and topics related to fiscal management.
8. Human resources management: concepts, functions, and different aspects.
9. Leadership: concept, functions, leadership styles, leadership and management effectiveness.
10. Coordination: concept, need, types, techniques and approaches for effective coordination.
11. Motivation: Concept, theories of motivation, reasons for low productivity, techniques of employ motivation.
12. Communication: concept, communication process and barrier to effective communication, techniques for improving communication.
13. Agricultural research project planning: concepts, principles, nature, instruments and steps.
14. Decision making: importance, types, rational process of decision process.

Part II: Agricultural Research and Development Related Issues:

1. Present constitution of Nepal: Food, agriculture and natural resources related issues.
2. National Agricultural policies and plans : National Agriculture Policy-2061, Agricultural biodiversity policy-2063, National tea policy-2057, National coffee policy, 2060, Poultry policy 2068, Pasture policy 2068, Floriculture promotion policy, 2068, Climate change policy 2067, Agriculture Development Strategy (ADS), Long term seed vision, and agriculture related issues in current development plan.
3. Structure and responsibilities of Nepal Agricultural Research Council (NARC) in relation to other national and international relevant organizations/institutions.
4. International Agricultural Research Organizations – CGIAR and IARCS : CIAT, CIMMYT, CIP, ICRISAT, ICARDA, World Fish, ICRAP, IFPRI, IITA, ILRI, Bioversity, IRRI, IWMI, AVRDC, ICIMOD, IFDC, IFAD, FAO.
5. Agricultural Innovation System: concept, actors, relationship between actors and accountability to stakeholders.
6. National Agricultural Research Systems: in global and national perspectives.
7. Agricultural research project management and its linkage with technology users.
8. External openness and partnership of Nepal Agricultural Research Council with that of national organizations, international organizations, civil societies, entrepreneurs and agri-business.

Sub Faculty - AGRONOMY

Part II: Technical Subject:

1 Crop Production

Study on rice, maize, wheat, finger millet, barley, buckwheat, amaranthus, lentil, soybean, chickpea, pigeon pea, mungbean, rapeseed, mustard seed, groundnut, sugarcane, jute, cotton, with respect to:

- 1.1 Introduction, origin and distribution.
- 1.2 Botany, physiology, morphology and growth stages .
- 1.3 Climate and soil.
- 1.4 Released, Recommended and Registered varieties and pipe-line cultivars.
- 1.5 Cultivation practices: land preparation, seed treatment, planting methods, planting time, seed rate, inter-culture and harvesting indices (maturity), package of practices
- 1.6 Organic manures and chemical fertilizers: recommended doses, method of application, time of application, increasing fertilizer efficiency
- 1.7 Water management: time and frequency of water application during critical stages, irrigation methods, water requirement and drainage.
- 1.8 Plant protection measures: major insects and diseases of crops, causal agents, symptoms and control/management practices, IPM, ICM, use of safe chemical pesticides/ non-chemical pesticides, pesticides residues, storage pests
- 1.9 Harvesting, post-harvest technologies, cleaning, transportation, storage, marketing intelligence
- 1.10 Economics of crop production of major crops, cost-benefit ratio
- 1.11 Precision farming, GIS, GPS, Remote sensing, Satellite and Drone uses in agriculture,
- 1.12 Organic farming and certification
- 1.13 Agro-industry and commercialization
- 1.14 National food production, requirement and balance

2 Climate, Land Resources and Agro-Biodiversity

- 2.1 Climate: temperature, humidity, wind pressure, rainfall, effective rainfall, sunshine hours, solar radiation
- 2.2 Climate of Nepal – climatic zones, their features and vegetation.
- 2.3 Physiographic distribution of Nepal.
- 2.4 Land capability and irrigation suitability.
- 2.5 Soils of Nepal and their classification, soil carbon sequestration
- 2.6 Himalayan region as a center of crop plants origin.
- 2.7 Importance of agro-biodiversity and approaches for its conservation and utilization, Gene bank
- 2.8 Climate change and challenges in food security
- 2.9 Global Greenhouse gas (GHGs) emission, approaches to mitigate methane gas emission from paddy fields in Nepal, Climate smart agriculture and its application in Nepal
- 2.10 Adaptation and Mitigation measures and strategies concerning the climate change

3 Soil and Plant Nutrition Management

- 3.1 Soil formation and morphology
- 3.2 Soil physical properties: soil sampling, soil texture, particle density, porosity and friability, etc.
- 3.3 Soil chemical properties: cation exchange, soil reaction (pH), organic carbon and available nitrogen, phosphorus and potassium, clay minerals, organic colloids (humus), soil testing etc.

- 3.4 Decomposition of organic matter, Vermicompost
- 3.5 Benefits of soil organic matter.
- 3.6 Macro and Micro nutrients deficiency symptoms and their corrections.
- 3.7 Balancing the plant nutrients. INM, IPNS, soil health (quality)
- 3.8 Bio-fertilizers, green manures for soil improvement.
- 4 Soil Water and Water Management for Plants**
 - 4.1 Soil water classification for water management.
 - 4.2 Water flow into and through soils and water uptake by plants.
 - 4.3 Reducing water losses and managing drainage problems in field crops.
 - 4.4 Water requirements of crops, water table, water-harvesting
 - 4.5 Innovative irrigation techniques.
 - 4.6 Land drainage: drainage systems and benefits.
 - 4.7 Water-saving technologies
- 5 Tillage, Weeds and Weed Management/Control**
 - 5.1 Resource conservation technologies (RCTs), Conservation agriculture (CA)
 - 5.2 Classification of weeds and their problems in crop production.
 - 5.3 Pattern of weed distribution and common weeds found in major field crops.
 - 5.4 Herbicides: types of herbicides, herbicide formulation, application, mode of action, physiology of herbicides, herbicides use in Nepal.
 - 5.5 Weed management in important crops: rice, maize, wheat, finger millet, lentil, soybean, etc.
 - 5.6 Economic use of herbicides.
- 6 Sustainable Agriculture and Agro-ecologies**
 - 6.1 Definitions of sustainable agriculture and agro-ecologies
 - 6.2 Traditional and modern sustainable agriculture
 - 6.3 Environmental-friendly technologies.
 - 6.4 Positive and negative aspects of sustainable and modern agriculture.
 - 6.5 Pros and cons of green revolution.
 - 6.6 Technology generation and adoption for sustainability in agriculture.
 - 6.7 Indigenous varieties and technologies of Nepal in crop production.
- 7 Seed Technology**
 - 7.1 Pollination, seed development and seed maturation.
 - 7.2 Principles and practices of seed production.
 - 7.3 Seed quality and seed categories.
 - 7.4 Seed certification procedures and certification standards in major crops in Nepal.
 - 7.5 Seed and fertilizer distributing agency and legislation.
 - 7.6 Concept of plant breeding and its application in agriculture.
 - 7.7 Scope of hybrid and genetically modified seeds for Nepal.
 - 7.8 Seed Act 2045 and Seed Vision-2025.
- 8 Crop Physiology**
 - 8.1 Growth and development: cell division, enlargement and differentiation., crop growth stages, LAI, HI
 - 8.2 Photoperiodism, Photosynthesis, Photorespiration, Transpiration, Absorption and translocation and stress physiology: cold and heat stresses, low and high moisture stresses, etc.
- 9 Farming System and Outreach Research**
 - 9.1 Crop rotation, relay cropping, cropping intensity, farming system
 - 9.2 Socio-economic and institutional aspects of farming system

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- 9.3 On-farm farming system research methodology, characteristics of FSR, and diagnostic phase of FSR (RRA, agro-ecosystem analysis, RRA, conventional survey, etc.)
- 9.4 Gender perspective of technology generation and adoption

10 Agri-mechanization and its allied subjects

- 10.1 Agri-mechanization for Terai and Hills.
- 10.2 Promotion of agri-mechanization for women and young farmers through capacity development.

11 Research Management

- 11.1 Preparation of research project proposal and reporting.
- 11.2 Planning, monitoring and evaluation.
- 11.3 Research station management vision and motivation for the scientist.
- 11.4 Work plan and job description.
- 11.5 Types of agricultural research in collaboration and partnership.
- 11.6 Prioritization of crops and researchable problem areas in cereals, legumes, oilseeds and other commercial farming.
- 11.7 Revenue generation/management.
- 11.8 National, Regional and International Centers and their co-ordination.

12 Biological Statistics

- 12.1 Probability and simple statistics.
- 12.2 Estimate of error – replication and randomization.
- 12.3 Control of error – blocking, field plot technique and data analysis.
- 12.4 Different statistical design for field crops (RCBD, LS, Split Plot Design and other factorial experiment).
- 12.5 Comparison – pair comparison by least significant difference (LSD) and Duncan's Multiple Range Test (DMRT), group comparison between groups and within group, trend comparison, factorial comparison, and interpretation of results.
- 12.6 Regression and correlation and their use in agricultural research.

- End -

Sub Faculty - Pomology

- 1. Concepts in basic horticulture and physiology:**
 - 1.1 Opportunities and potentialities for different fruits and plantation crops.
 - 1.2 Constraints and remedies for production and marketing.
 - 1.3 Area coverage, production and trade situation.
 - 1.4 Physiological aspects of seed germination, dormancy, flowering, fruiting and ripening.
 - 1.5 Plants growth regulators and their application.
 - 1.6 Causes and mitigation measures of unfruitfulness in fruits and plantation crops.

- 2. Orchard management and Production technology of native and exotic fruit and plantation crop species**
 - 2.1 Environmental requirement and varieties.
 - 2.2 Soil and water management practices.
 - 2.3 Canopy management.
 - 2.4 Nutrient management.
 - 2.5 Weed management.
 - 2.6 Disease and insect pest management.
 - 2.7 Abiotic and biotic stresses and their management.
 - 2.8 High density planting; concepts, techniques, applications and constraints.
 - 2.9 Organic production of fruits and plantation crops.
 - 2.10 Precision horticulture; concepts, application and technologies in fruits and plantation crops.
 - 2.11 Pollination management.

- 3. Conservation and varietal improvement of perennial crops.**
 - 3.1. Genetic diversity of fruits and plantation crops in Nepal.
 - 3.2 Collection, conservation and use of germplasm.
 - 3.3. Nature and strategies for variety improvement of fruits and plantation crop.
 - 3.4. Propagation techniques.
 - 3.5. Root stocks and their effects.
 - 3.6. Use of biotechnology in horticulture.

- 4. Climate change and environmental issues**
 - 4.1. Climate change and its causes.
 - 4.2. Impact of climate change on fruits and plantation crops.
 - 4.3. Mitigation of adverse effect of climate change with special reference to fruits and plantation crops.

- 5. Postharvest Management and marketing**
 - 5.1. Postharvest physiology of fruits and plantation crops.
 - 5.2. Maturity indices, ripening and harvesting techniques.
 - 5.3. Factors affecting postharvest losses and their management.
 - 5.4. Packing house operation; sorting, grading, curing, washing, waxing, de-greening, ripening, fumigation, disinfection, irradiation, heat treatment, packaging etc.
 - 5.5. Pre-cooling and cold-chain movement.
 - 5.6. Different methods of storage.
 - 5.7. Management of postharvest disease pest and physiological disorders.
 - 5.8. Processing and preservation techniques.

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- 5.9. Sanitization, sanitary and phytosanitary requirements.
- 5.10. Market value chain management.

6. Research and development

- 6.1 Fruit and plantation crop research and development programs in Nepal- critical review.
- 6.2 Organizational structures for effective technology generation and its delivery.
- 6.3 Research and development programs of Government on fruits and plantation crop: a critical review.
- 6.4 Linkages between extension and research for technology generation and delivery system.
- 6.5 Strategies for import substitution and export promotion fruits and plantation crops.
- 6.6 Opportunities and challenges of WTO and SAFTA for Nepalese fruits and plantation crops.
- 6.7 Experimental design, data analysis and interpretation of results.

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Sub Faculty - Plant Breeding and Genetics

- 1 General:
 - a. Role of Research in Agriculture.
 - B. Agricultural Research: who pays and who benefits.
 - C. APP and 10th Five Year Plan: current research priorities In agriculture and their status.
 - D. Status of plant breeding activities in Nepal in cereals, grain-legumes, oilseeds, potato, vegetables, fruits, spices, etc.
 - E. Collaboration with IARCs In crop improvement: their scope and limitations.
 - F. Bio-Technology Revolution: Implications for Agriculture.
 - G. Bio-Technology Policy: Public Perception, Participation and the Low.
 - H. International Dimensions of Bio-technology.

- 2 Plant Genetic Resources and Ecosystems:
 - a. Plant Distribution and their limiting factors.
 - b. Origin of cultivated plants and the ecotype concept.
 - c. Crop Germplasm Conservation, Evaluation and their Utilization.
 - d. Crop ecosystem.

- 3 Plant Genetics:
 - a. Reproductive systems:
 - Sexual Reproduction
 - Asexual Reproduction
 - b. Male Sterility, Self-incompatibility and Techniques of Artificial Hybridization.
 - c. Genetic basis of Plant Breeding.
 - Variation
 - Environmental Variations
 - Agroecotypic Variations
 - Ecotypes
 - Heredity
 - Inheritance of Qualitative Characters
 - Inheritance of Quantitative Characters
 - Methods of Estimating Genetic Parameters
 - d. Heterosis.
 - e. Selection.
 - Natural Selection
 - Directional Selection
 - Genetic Advance under Selection
 - f. Interspecific and intergeneric hybridization.

- 4 Methods of Plant Breeding:
 - a. Pure-Line Selection.
 - b. Pedigree Method.
 - c. Bulk Population Method.
 - d. Backcross Method.
 - e. Population Improvement.
 - Intrapopulation methods
 - Interpopulation methods

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- f. Recurrent Selection.
 - g. Composite and Synthetic Varieties.
 - h. Asexually Propagated Crops.
 - i. Apomictic Grasses.
 - j. Maize Hybrids.
 - k. Hybrid Varieties.
 - l. Mutation Breeding.
 - m. Polyploid Breeding.
 - n. Disease Resistance Breeding.
 - o. Insect Resistance Breeding.
 - p. Abiotic Stresses.
 - q. breeding for Specific Traits.
 - r. Plant Tissue Culture.
 - Micropropagation
 - Production of Virus free plants.
 - Embryo Culture
 - Anther culture
 - Ovule culture
 - s. Genetic Engineering.
 - Gene Cloning
 - Gene transfers in plants.
 - Application and use of genetic engineering in plant breeding.
- 5 National Seed Production System:
- a. Plant variety release, National Seed Act and National Agricultural Extension System.
 - b. Plant Varieties diffusion through Private sector: current status and future scope.
 - c. Plant Variety Protection.
 - d. Hybrid Seed Production.

Sub Faculty - Soil Science

Paper II: Technical

- 1 Scientific and Technical knowledge related to Soil science
- 2 General knowledge related to administration and Agricultural Research Management
- 3 Knowledge about National and International Research and development Policy on Soil Science

1 Scientific and Technical knowledge related to Soil Science:

- 1.1 Importance of surface soil and sub-soil as a natural body.
- 1.2 Soil morphology, methods of studying it, colour, constitution, habits of profile, depth of the profile and thickness of the respective horizons, texture, structure, consistency, concretions, their importance in Agriculture.
- 1.3 Classification of Soil and land use planning.
- 1.4 Soil genesis, the process of weathering, factors of soil formation, soil forming processes.
- 1.5 The water in soils - where and how the water is held, suction and pF curves for soils, movement of water in soils, permeability, field capacity, evaporation, the transfer of water from soil to plant, amount of water used by different crops.
- 1.6 Soils of Nepal and their classification.
- 1.7 Plants food and their sources.
- 1.8 Classification of elements on the basis of their functions.
- 1.9 Deficiency symptoms of elements on the crops..
- 1.10 Forms of element utilized by plants.
- 1.11 Inorganic fertilizer, composition, formula and their transformation from fertilizer to available form of element.
- 1.12 The absorption process of nutrients by plant roots.
- 1.13 Plant nutrients - losses from soil.
- 1.14 Determination of nutrients requirement of crops.
- 1.15 Amount of nutrients removed by plants.
- 1.16 Response of major and trace elements in major crops in Nepalese soils.
- 1.17 The nitrogen cycle in the soil - mineralisation and nitrification.
- 1.18 Soil reaction (soil pH), its measurement, liming material their response when applied in soil.
- 1.19 The composition of soil organic matter, nutrient content of different animal dung, humus, composition of humus colloids, carbon - nitrogen (C/N) ratio, its importance in nutrient uptake, properties of soil humus, the clay - humus complex, decomposability of soil humus.

2 Soil Fertility Management:

- 2.1 Recommended doses of nutrients, method and timing of application.
- 2.2 Effect of imbalanced fertilizer use on soil health and environmental pollution.
- 2.3 The microbial population of the soil, their function, their role on ammonification, nitrification, denitrification.
- 2.4 Function and importance of rhizobium, azotobacter, clastridium, algae, phospho bacterium.
- 2.5 Methods of soil chemical analysis for different elements.
- 2.6 Recommendation of nutrients on the basis of soil chemical analysis.

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- 2.7 The decomposition of plant material, composting, micro-organisms responsible for the decomposition of plant remains, green manuring, desirable characteristics of green manure, plants suitable for green manure, green manuring and the maintenance of soil fertility, constraints of green manuring.
 - 2.8 Knowledge on azolla and biogas plants, the economic value of azolla and the socio-economic importance of biogas plants.
 - 2.9 Saline and alkali soils, their reclamation.
 - 2.10 The principles underlying the control of soil erosion, wind erosion and soil drifting, erosion by run-off water.
 - 2.11 Plant nutrition management in organic farming and its importance in Nepalese context.
- 3 Knowledge about national and international research on soil science:
- 3.1 Knowledge about the researches done on major topics and issues of soil science in NARC, AFU and other local institutions if any.
 - 3.2 Knowledge about the researches carried out on pertinent topics of soil science in international institutions in general and Indian, Pakistani, Bangladeshi and Srilankan agricultural research institutions in particular.
 - 3.3 Soil management and plant nutrition/fertilizer policy stipulated in current 20 years Agritultue Development Strategy (ADS) 2015.

- End -

Sub Faculty - Entomology

1 General

- 1.1 Plant protection organization under the Ministry of Agriculture and Cooperatives.
- 1.2 Plant protection organization under the Nepal Agricultural Research Council.
- 1.3 Pests and pesticide regulations.

2 Crop pests

- 2.1 Bio-ecology of insects, mite and rodent pests of the following crops and stored products:

- (a) Cereals
- (b) Grain legumes
- (c) Oil seed crops
- (d) Vegetable crops
- (e) Fruit crops
- (f) Tobacco, Jute, Cotton, Sugarcane, Tea, Coffee, Potato.
- (g) Stored grains and other products.

3 Integrated pest management

- 3.1 Concepts
- 3.2 Tools
- 3.3 Progress in Nepal

4 Biological control

- 4.1 Parasitoids and predators
- 4.2 Techniques in biological control
- 4.3 Integrated biological control
- 4.4 Commercial production of bio-control agents
- 4.5 Integration with other tactics

5 Microbial control

- 5.1 Concepts
- 5.2 Bacterial pathogens
- 5.3 Fungal pathogens
- 5.4 Viral pathogens
- 5.5 Other pathogens
- 5.6 Potential in IPM

6 Botanical control

- 6.1 Promising plant species
- 6.2 Effects on non-target organisms
- 6.3 Environmental impact
- 6.4 Potential in IPM

7 Synthetic organic pesticides

- 7.1 Major groups of insecticides

- (a) Organochlorines
- (b) Organophosphates
- (c) Carbamates
- (d) Synthetic pyrethroids

- 7.2 Other pesticides
 - (a) Miticides (b) Rodenticides (c) Miscellaneous
- 7.3 Status of pesticide use in Nepal
- 7.4 Selection of insecticides for IPM
- 7.5 Application technology
- 7.6 Environmental impact

8 Biotechnological approaches

- 8.1 Concept
- 8.2 Methodology
- 8.3 Transgenic plants
- 8.4 Pyramiding genes
- 8.5 Potential in IPM

9 Bio-rational and other approaches

- 9.1 Chemicals based on insect cuticle
- 9.2 Chemical based on endocrine system
- 9.3 Chemicals based on communication system
- 9.4 Miscellaneous approaches
 - (a) Light - activated pesticides
 - (b) Propesticides
 - (c) Avermectins
 - (d) Spinosyns
 - (e) Genetic control
 - (f) Chemosterilants
 - (g) Repellents
- 9.5 Current status of biorational use
 - (a) Insect growth regulators
 - (b) Semiochemicals

10 Organization and rules and regulations of NARC.