

द्वितीय पत्र :-सेवा सम्बन्धी प्राविधिक विषय

पूर्णांक:- १००

**1. Introduction to Soil Sciences**

- 1.1 Definition, concept and use of soil
- 1.2 Soil as a natural body
- 1.3 Soil as a medium for plant growth
- 1.4 Concept of soil fertility and productivity
- 1.5 Soil component and soil water-plant relationship

**2. Soil Physics**

- 2.1 Particles density, bulk density, porosity, particles size
- 2.2 Textural classification of soils and their determination
- 2.3 Structures and their agricultural significance
- 2.4 The dynamic properties of soils-consistency and plasticity
- 2.5 Soil color and aeration
- 2.6 Thermal properties of soil
- 2.7 Soil water retention, movement, infiltration, percolation and permeability, Hydraulic conductivity
- 2.8 Saturation percentage, permanent wilting point and plant available soil water
- 2.9 Soil environment and transient conditions affecting water, air and heat flow in soil
- 2.10 Crop water requirement, evapo-transpiration, irrigation requirements and water balance

**3. Soil Chemistry**

- 3.1 Kind of exchangeable ions (cations and anions) and their exchange phenomena in soils
- 3.2 Nutrient interaction and absorption by plants. Mechanisms and absorption of nutrients by plant roots and nutrient transport phenomena in soil-root system.
- 3.3 Fixation and release of nutrients in soils and its factors
- 3.4 Relationship of Q/I factor in plant nutrient uptake
- 3.5 Nitrogen cycle
- 3.6 Phosphorus cycle and transformation, managing soil phosphorus
- 3.7 Potassium cycle
- 3.8 Role of sulfur, calcium, magnesium, sources and requirement in crop production
- 3.9 Sulfur cycle
- 3.10 General concept of micronutrients (Boron, Copper, Iron, Manganese, Molybdenum, Zinc, Chloride) sources, availability, functions, deficiency and toxicity symptoms and application.
- 3.11 Availability of micronutrients in Nepalese soils. Effect of their deficiency and toxicity of in plants, animals and human health

**4. Soil Acidity and Liming**

- 4.1 Soil pH-definition, role of soil pH on nutrients availability
- 4.2 Buffering of soils and their amendments
- 4.3 Desirable pH ranges for major crops grown in Nepal
- 4.4 Lime requirement, amount, time, methods and factors affecting frequency of lime application
- 4.5 Liming materials and selecting a suitable liming material
- 4.6 Crop response to lime application

## लोक सेवा आयोग

नेपाल कृषि सेवा, स्वायल साइन्स समूह, राजपत्रांकित प्रथम श्रेणीको खुला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- 4.7 Economic and ecological relevance of lime application to raise the productivity of soil of Nepal.
- 4.8 Soil acidity and its effects on productivity
- 4.9 Characteristics and management of acidic, saline and sodic soils
- 4.10 Crop selection for saline and alkaline soils
- 5. Soil Microbiology/Soil Biology**
  - 5.1 General classification of soil organisms, role of bacteria, fungi, algae, actinomycetes, protozoa and virus
  - 5.2 Optimum condition for essential microbial activity in soil, encouraging beneficial microorganisms, composting and crop residue management
  - 5.3 C:N ratio and its significance
  - 5.4 Role of biogas in rural development, soil productivity and global warming
  - 5.5 Activities of micro-organisms in soil atmospheric N-fixation by symbiosis and asymbiosis etc.
  - 5.6 Mycorrhizal-plant association and their significance
  - 5.7 Microbial inoculants and bio-fertilizers
- 6. Soil Fertility and Plant Nutrition**
  - 6.1 Essential plant nutrients and their classification
  - 6.2 Functions of essential plant nutrients in plants
  - 6.3 Nutrient requirements, uptake and balance
  - 6.4 General fertility status of major Nepalese soils
  - 6.5 Role of chelation and coating in availability of plant nutrients
  - 6.6 Importance of isotop in soil and plant research
  - 6.7 Plant nutrients and their interactions between agronomic, tillage and irrigation
- 7. Manures and Fertilizers**
  - 7.1 Sources and types of organic manures
  - 7.2 Farmyard manure (FYM), compost and their preparation, storage and applications
  - 7.3 Bio-fertilizers, inoculants and their use in Nepalese agriculture
  - 7.4 Green manures, their desirable characteristics, benefits and constraints
  - 7.5 Mineral fertilizers and their history in Nepal
  - 7.6 Types of commercial fertilizers (straight, compound complexes, micronutrient) and their nutrient contents and behavior in soils
- 8. Soil Genesis, Classification and Mapping**
  - 8.1 Theories of soil formation, factors and processes of soil formation
  - 8.2 Soil variation due to interrelations between parent materials, vegetation, topography/elevation and climate
  - 8.3 Identification of soil horizons and description of soil profiles
  - 8.4 Role of temperature and moisture in soil classification
  - 8.5 Soil classification system: USDA system and FAO/UNESCO system
  - 8.6 Land Resources Mapping Project (LRMP) approach to land evaluation
  - 8.7 Importance of soil survey and mapping and its types
  - 8.8 Major soils of Nepal, their characteristics and classification using USDA at Great Group levels using USDA system of soil taxonomy
  - 8.9 Use of various base maps: topo, geology and aerial photos in soil survey
  - 8.10 Use of geographic information system (GIS) and remote sensing (RS) in soil resource mapping.
  - 8.11 Inventory of land resources and their assessments for various utilizations
  - 8.12 Preparation of land evaluation, suitability reports for useful planning of land resources

**9. Soil Conservation and Watershed management**

- 9.1 Concept of watershed
- 9.2 Characterization of watershed
- 9.3 Upland watershed
- 9.4 Watershed as ecosystem
- 9.5 Highland-lowland linkages
- 9.6 Watershed hydrology
- 9.7 Rainfall-runoff relationships
- 9.8 Mechanics of soil erosion by water and wind
- 9.9 Soil-loss estimation and erosion process and estimation of soil loss
- 9.10 Biological and mechanical measures for soil conservation
- 9.11 Landscape management
- 9.12 Agro-forestry
- 9.13 Watershed related problems and opportunities
- 9.14 Concept of land husbandry
- 9.15 Indigenous technologies
- 9.16 Mechanical or physical protection measures
- 9.17 Diversion and drainage structures
- 9.18 Gully stabilization, stream bank stabilization
- 9.19 Design of conservation structure, terracing etc.
- 9.20 Changing approaches to watershed management
- 9.21 Society and natural resources
- 9.22 Property rights and resource conservation
- 9.23 Common property resources (CPRs) management
- 9.24 Gender role in the use and management of watershed resources
- 9.25 Public participation in watershed development and management
- 9.26 Local institutions for watershed development and management
- 9.27 Decentralized planning
- 9.28 User's groups
- 9.29 Farmer's empowerment

**10. Problems Associated with Green revolution**

- 10.1 Groundwater depletion and pollution
- 10.2 Fertilizer pollution
- 10.3 NO<sub>3</sub> accumulation in drinking water
- 10.4 Green house effect
- 10.5 Eutrophication
- 10.6 Organic matter depletion
- 10.7 Soil productivity decline
- 10.8 Land degradation and soil acidification
- 10.9 Bio-diversity depletion
- 10.10 Pesticide pollution
- 10.11 Soil and environmental degradation
- 10.12 Adverse effect on human and animal health
- 10.13 Global warming and its consequences
- 10.14 Problems of heavy metals
- 10.15 Recent concerns for the mitigation of the above problems

**11. Land Degradation and its Sustainable Development**

- 11.1 Environmental degradation in the Himalayan regions and its regional effects
- 11.2 Resource use and depletion
- 11.3 Concept of sustainable development

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- 11.4 Trend in land degradation and desertification
- 11.5 Effect of land degradation on agriculture, forestry and water regimes
- 11.6 Flooding and silting up of rivers, dams etc
- 11.7 Pollution by industrial wastes
- 11.8 Effect of air pollution on plants, animals and human health
- 11.9 Acid rains-effect on plants, soils and lakes
- 11.10 Integrated watershed management, peoples participation and bottom up approach of watershed management for the mitigation of degraded land
- 11.11 Conservation education, extension and co-ordination

**12. Pollution of Soil Environment:**

- 12.1 A review of impact of human and industrial activity, waste disposal, sewage on environment
- 12.2 Environmental aspect of soil fertility in consideration of soils for accepting essential plant nutrients and potentially toxic, non-essential elements
- 12.3 Use of N-regulators and non-conventional soil additives as fertilizers
- 12.4 Soil in the ecosystem
- 12.5 Chemical pesticides and soil environment
- 12.6 Bio-degradation of pesticides
- 12.7 Irrigation residues and water quality problems
- 12.8 Arsenic in ground- water

**13. Use of Biometrics in agriculture research**

- 13.1 Sampling methods and standard errors
- 13.2 Test of significance of means and their differences
- 13.3 Correlation and regression soil parameters and plant growth variables
- 13.4 Principles of Field experiment and its types such as randomized complete block and incomplete block deigned, factorial deigned, Latin square
- 13.5 Use of computer assisted statistical program
- 13.6 Laboratory techniques in soil studies

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