RAJASTHAN PUBLIC SERVICE COMMISSION

Syllabus for Screening test for the Post of

Agriculture Research Officer (Agriculture Chemistry)

Agriculture Department

Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium, thermodynamics, chemical equilibria, electrochemistry, chemical kinetics and Electrode potential.

Soil Colloids : Inorganic and organic colloids-origin of charge concept of point of zerocharge (PZC), diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids: electrometric properties of soil colloids; adsorption properties of soil colloids; soil organic matter – fractionation of soil organic matter and different fractions, clay organic interactions.

Ion exchange processes in soil; cation exchange-theories based on law of mass action, adsorption isotherms, donnan-membrane equilibrium concept, schofield's ratio law, ion selectivity coefficient. Clay membrane electrode and ionic activity measurement.

AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition. Soil reaction and its influences on nutrient availability. Potassium, phosphate and ammonium fixation in soils. Chemistry of acid soils; active and potential acidity; lime potential; sub-soil acidity.

Chemistry and electrochemistry of submerged soils (Redox potential, oxidation-reduction potential), soil pesticide interaction.

Structural chemistry, classification of minerals, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; amorphous soil constituents and other non-crystalline silicate minerals; clay minerals in Indian soils.

Soil morphology and micromorphology, factors of soil formation, soil forming processes; weathering of rocks and mineral transformation; soil profile; weathering sequences of minerals with special reference to Indian soils. Concept of soil individual; soil classification system-historical developments and modern system of soil classification with special emphasis on soil taxonomy; soil classification, soil mineralogy and soil maps.

Soil survey and its types; soil survey techniques, soil survey interpretations, soil mapping, cartography, mapping units, techniques for generation of soil maps.

Landform- major soil groups of India with special reference to Rajasthan, land capability classification and land irrigability classification, land evaluation and land use type (LUT) – concept and applications; approaches for managing soils and landscape in the framework of agro-ecosystem. Remote sensing and GIS techniques of soil and water and crop studies.

Soil physical properties : soil texture, structure, aggregates, soil consistency, soil colour, soil air and soil temperature. Influence of soil temperature and air on plant growth; soil moisture: classification, constants, energy relationship, movement in saturated and unsaturated condition and management.

Soil fertility and soil productivity; nutrient sources – fertilizers and manures, essential plant nutrients- functions and deficiency symptoms. Sources; forms, immobilization and mineralization of N,P,K, and S. Micronutrients; critical limits in soil and plants; factor effecting their availability and correction of their deficiencies in plants, role of chelates in nutrient availability. Manufacturing processes for different fertilizers using various raw materials, characteristics and nutrient contents.

Common soil test methods for fertilizer recommendations; quantity intensity relationships; soil test crop response correlations and response functions. Fertiliser use efficiency; fertilizer recommendations – usefulness and limitations; site-specific nutrient management, plant need based nutrient management; integrated nutrient management, soil fertility evaluation-knowledge of conduct of field trails/ experiments, soil health, indicators for determining soil health, soil quality management and sustainability.

Soil organic matter and humus, function, structure, formation, C:N ratio, recycling of agricultural and industrial wastes, biological nitrogen fixation and bio-fertilizers. Chemical composition of FYM, Vermicompost, poultry manure and common organic manures.

Area, distribution and management of salt affected soils and poor quality waters, Acid soils, highly and slowly permeable soils. Soil erosion, extent, type and effects, soil conservation techniques, water harvesting techniques and watershed management, remote sensing for soil and watershed management.

Soil, water and air pollution problems associated with agriculture, nature and extent. Remediation/ amelioration of contaminated soil and water.

Principles of pH meter, EC meter, colorimeter, visible, ultraviolet and infrared spectrophotometry, atomic absorption, flame-photometry, inductively coupled plasma spectrometry, chromatographic techniques, mass spectrometry and x-ray defractometry, identification of minerals by different methods.

Preparation of solutions for standard curves, analytical reagents, qualitative reagents, indicators and standard solutions for acid-base. Oxidation-reduction and complaxometric titration.

Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium, estimation of phosphorus, ammonium and potassium fixation capacities of soils. Electrochemical titration of clays; determination of cation and anion exchange capacities of soils, estimation of exchangeable cations, estimations of root cation exchange capacity. Analysis of soil and plant samples for essential nutrients.

* * * * *

Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 100
3. Number of Questions : 100
4. Duration of Paper : Two Hours
5. All Questions carry equal marks
6. There will be Negative Marking

* * * * *