

U.P. HIGHER EDUCATION SERVICES COMMISSION, ALLAHABAD

AGRICULTURAL CHEMISTRY

(Subject Code-86)

Unit-1: Soil Formations

Concept of land, soil and soil science. Composition of earth crust and its relationship with soils; Rocks, minerals and other soil forming materials; Weathering of rocks and minerals; Factors of soil formation; Pedogenic processes and their relationships with soil properties; Soil development; Soil horizons and their nomenclature subsurface horizons and other diagnostic characteristics, soil moisture and temperature regimes.

Unit-2: Soil Physics

Soil physical constraints affecting crop production. Soil texture-textural classes. Soil structure-classification, soil aggregation and significance, soil consistency, soil crusting, bulk density and particle density of soils and porosity, their significance and manipulation. **Soil water-** retention and potentials. Soil moisture constants. Movement of soil water - infiltration, percolation, permeability, drainage and methods of determination of soil moisture. Thermal properties of soils, soil temperature, Soil air- composition, gaseous exchange, influence of soil temperature and air on plant growth. **Soil erosion** by water- types, effects, mechanics. Runoff - methods of measurement, factors and management, runoff farming. Soil conservation measures.

Unit-3: Soil Chemistry

Chemical composition of soil; **Soil colloids**-structure, composition, constitution of clay minerals, amorphous clays and other non-crystalline silicate minerals, oxide and hydroxide minerals; Charge development on clays and organic matter; pH-charge relations; Buffer capacity of soils. Chemical equilibria, electrochemistry and chemical kinetics. **Inorganic and organic colloids**- surface charge characteristics, diffuse double layer theories, zeta potential stability, coagulation/ flocculation, peptization, electrometric and sorption properties of soil colloid. **Soil organic matter**-fractionation, clay-organic interactions. **Cation exchange**- theories, adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, anion and ligand exchange- inner sphere and outer-sphere surface complex formation, fixation of oxyanions, sorption-desorption of oxy-anions and anions. Nitrogen, potassium, phosphate and ammonium fixation in soils and management aspects. Chemistry of acid, salt-affected and submerged soils and management aspects.

Unit-4: Soil Fertility

Essential elements in plant nutrition; Nutrient cycles in soil; Transformation and transport of nutrients (Macro and micro nutrients) in soil; Manures and fertilizers; Fate and reactions of fertilizers in soils; Chemistry of different fertilizers; Slow release fertilizers and nitrification retarders; Quality control of fertilizers.

Soil fertility evaluation – soil testing, plant and tissue tests and biological methods; Common soil test methods for fertilizer recommendation; Soil test-crop response correlations; Integrated nutrient management; Use of isotopic tracers in soil research; Nature, properties and development of acid, acid sulphate, saline and alkali and their management; Lime and gypsum requirements of soils; Irrigation water quality - EC, SAR, RSC and specifications. Fertility status of major soil groups of India.

Pollution: types, causes, methods of measurement, standards and management. Heavy metal toxicity and soil pollution; Chemical and bio-remediation of

contaminated soils; Soil factors in emission of greenhouse gases; Carbon sequestration in mitigating greenhouse effect; Radio-active contamination of soil.

Unit-5: Nitrogen fixation in soil. Nitrification, ammonification and transformation. Availability of nitrogen, phosphorus and potassium. Phosphate fixation and solubilization. Microbial fixation of nitrogen.

Unit-6: Soil Microbiology

Soil biota, soil microbial ecology, types of organisms. Soil microbial biomass, microbial interactions, unculturable soil biota. Microbiology and biochemistry of root-soil interface. Phyllosphere. Soil enzymes, origin, activities and importance. Soil characteristics influencing growth and activity of microflora. Microbial transformations of N, P, K, S, Fe and Zn in soil. **Biochemical composition** and biodegradation of soil organic matter and crop residues. Humus formation. Cycles of important organic nutrients. **Biodegradation of pesticides**, organic wastes and their use for production of biogas and manures. **Biofertilizers** – definition, classification, specifications, method of production and role in crop production. **Methods of soil analysis** - particle size distribution, bulk and particle density, moisture constants, Modern methods of soil, plant and fertilizer analysis; Flame photometry and inductively coupled plasma optical emission spectroscopy; **Spectrophotometry** - visible, ultra-violet and infrared; Atomic absorption spectrophotometry; Potentiometry and conductimetry; X-ray diffractometry; Mass spectrometry.

Unit-7: Soil Plant Relationship

Soil reactivity and plant growth. Factors affecting plant growth. Nutrient management in acid, alkali and saline soil. Their reclamation and protections of crop growth.