65 SOIL SCIENCE/SOIL SCIENCE & AGRICULTURAL CHEMISTRY

Unit 1: Pedology

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; Pedon, polypedon, soil profile, horizons and their nomenclature. Soil Taxonomy - epipedons, diagnostic subsurface horizons and other diagnostic characteristics, soil moisture and temperature regimes, Interpretation of soil survey data for land capability and crop suitability classifications, Fertility Capability Classification- Nutrient indexing. Macro-morphological study of soils. Application and use of global positioning system for soil survey. Soil survey- types **and** techniques. Soil series characterization and procedure for establishing soil series, benchmark soils and soil correlations. Study of base maps: cadastral maps, toposheets, aerial photographs and satellite imageries. Use of geographical information system for preparing thematic maps. Application of Remote Sensing in soil survey and mapping. Soils of India

Unit 2: Soil Physics

Significance of soil physical properties. Soil texture – Stoke's Law- textural classes. Soil structure – classification, soil aggregation and significance, soil consistency, 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- saturated and unsaturated flow- Darcy's law - hydraulic conductivity - 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 physical constraints affecting crop production and their management strategies.Methods of soil analysis - particle size distribution, bulk and particle density, moisture constants. Soil erosion - types, effects,. Rain erosivity and soil erodibility. Runoff - methods of measurement, factors and management. Soil conservation measures. Characterization and evaluation of soil and land quality indicators; Causes of land degradation; Management of soil physical properties for prevention/restoration of land degradation; management of waste lands; Concept of watershed – its characterization and management.

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. Inorganic and organic colloids- surface charge characteristics, diffuse double layer, zeta potential. Soil organic matter fractionation, humus formation and theories clay-organic interactions. Cation exchange – Hysteresis-definition. Nitrogen, potassium, phosphorus and ammonium fixation in soils and management aspects.

Unit 4: Soil Fertility

Essential elements in plant nutrition; Nutrient cycles in soil; Transformation and movement of nutrients (Macro and micro nutrients) in soil; Manures and fertilizers; Fate and reactions of fertilizers in soils; Slow release fertilizers and nitrification retarders- Soil fertility evaluation- Concepts and approaches ;. FCO Soil fertility evaluation – soil testing, plant and tissue tests and biological methods; Common soil test methods for fertilizer recommendation; Nutrient Management concepts- INM, IPNS, SSNM- Soil test-crop response correlations; Fertilizer application methods- Nutrient use efficiency- Macro and micronutrients. Nature, properties and development of acid, acid sulphate, saline and alkali soils and their management; Lime and gypsum requirements of soils; Irrigation water quality - EC, SAR, RSC. Fertility status of soils of India. Pollution: types, causes, and management. Carbon sequestration and carbon trading. 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 5: 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.

Unit 6: Statistics

Experimental designs for pot culture and field experiments; Statistical measures of central tendency and dispersion; Correlation and regression; Tests of significance - t and F tests; Computer use in soil research, Geostatistics.