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PART- (E)

(Agricultural Chemistry/ Soil Science/ Soil Conservation)

UNIT I

Definition of soil. Soil profile. Soil taxonomy and major soil groups of India. Physical properties of soil – soil density and porosity, soil texture, soil structure, soil consistency and dispersion, soil compaction, soil crusting, mechanical analysis, puddling and its effect on soil properties, soil water retention, soil water potential, Darcy's law, Poiseuille's law, hydraulic conductivity and permeability, infiltration, SPAC (Soil plant atmospheric continuum), soil air and soil temperature. Soil water- types of soil water, field capacity, water holding capacity and wilting point. Analytical chemistry – standard solution and standardization of acid and base. Indicators used in acid-base titration and redox reaction, expression for concentration of solution- molarity, normality, molality, percentage by weight and ppm.Calcium and magnesium estimation by EDTA titration method. pH and buffer solutions. Principles of pH meter, Spectrophotometer, atomic absorption spectrophotometer, flame photometer, chromatography, inductively couples plasma mass spectroscopy (ICP-MS).

UNIT II

Soil fertility and productivity. Soil quality and soil health. Criteria of nutrient essentiality, classification of essential nutrients. Deficiency symptoms of plant nutrients and their corrections. Nutrient indicator plants. Fertilizer - characteristics of nitrogeneous, phosphatic, potassic, calcium, magnesium and sulphur fertilizers. Fertilizer control order and its specifications. Law of minimum. Mechanism of nutrient absorption and uptake. Mineralization, immobilization, nitrification and denitrification. Critical limits of micro-nutrients in soil and plants. Role of chelates in nutrient availability. Methods of soil fertility evaluation and their interpretation. Fertilizer use efficiency. Integrated nutrient management.

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UNIT III

Soil erosion and its type. Factors affecting soil erosion. Control measures of soil erosion through agronomical and mechanical techniques.Universal soil loss equation. Empirical and quantitative estimation of water erosion. Shifting cultivation and its impact. Soil conservation in relation to waterlogged and wet lands. Land use planning and its objectives. Soil survey and classification. Benchmark soil. Land capability classification. Concept of watershed management and its role in conservation of natural resources. Concept of water harvesting and recycling. Basic concept of remote sensing. Introduction to GIS and GPS. Application of remote sensing in agriculture.

UNIT IV

Weathering of rocks and minerals. Factors and processes of soil formation. Soil colloids and their properties, diffused double layer, zeta potential, coagulation/flocculation and peptization. Structure and classification of silicate and non-silicate clay minerals. Soil organic matter- its fractionation and carbon sequestration. Cation and anion exchange capacity of soil, law of mass action (Gapon's equation and hysteresis). Adsorption isotherm- Langmuir and Freundlich isotherm, donnan membrane equilibrium. Characteristics of salt affected and acid soils, their reclamation and management. Bioremediation of problematic soils through multi-purpose tree species.

UNIT V

Soil microbial biomass. Biotic factors in soil development. Rhizosphere and phyllosphere. Composition and biodegradation of soil organic matter and crop residues. Humus formation and its fractionation. Importance of C:N ratio. Biological transformation of nitrogen, phosphorus and sulphur. Biological nitrogen fixation (symbiotic and asymbiotic) and its mechanism. Biodegradation of organic waste and their use for production of biogas, organic manures and vermicomposting. Role of biofertilizers in crop production. Characteristics of biofertilizers with reference to azolla, blue green algae, VAM and PGPR.

Note: Current general knowledge of scientific advancements in all the above units is deemed to have been included.