SOIL SCIENCE

1. Definition and concept of soil; weathering and soil formation; soil profile development, features of a typical soil profile;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, categories and criteria for soil classification systems. Forest Soils properties and their classification. Role of forest in soil formation, soil fertility and nutrient cycling. Impact of forest management on soil properties. Interaction of humans with forest ecosystems in the interest of sustainable management of forest soil.

2. Mineralogical properties of soil-important primary and secondary minerals and their influence on soil behavior;

3. Physical properties of soil- texture, structure, density, temperature, colour, consistency, air. Soil: water phenomenon-retention and release of moisture, water holding capacity, field capacity, wilting point, available water capacity, management of soil moisture for optimizing plant growth, methods of measurement of soil moisture.

4. Chemical properties of soil- formation of organic and inorganic soil colloids, types of clay minerals, clay : humus complex. soil pH, cation and anion exchange capacity, role of clay. availability of nutrient ions to plants, dynamic ion exchange equilibrium and sustainable nutrient uptake by plant, soil pH in relation to nutrient availability, optimum soil pH for availability of most nutrients, management/reclamation of acid soil, saline soil, sodic soil, sick soil.

5. Biological properties of soil- Role of macro- and micro organisms and their influence on soil conditions, important microflora involved in mineralization of nutrient elements, biological nitrogen fixation and role of associated microbes (for both symbiotic and non-symbiotic processes), role of mycorhhiza in mineralization of nutrients in degraded soil, decomposition of organic matter, C:N ratio and state of decomposition, humus, terms associated with mineralization, immobilization, nitrification and nitrogen losses, role of organic matter in improving soil behavior especially in organic farming.

6. Concept of chemical analysis, Solution reactions, titrimetric analysis, concept of standard solution, Indicators: theory and applications. 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; Geiger Muller counter, solid and liquids scintillation counters.

7. Mineral nutrition-essential nutrient elements for plant growth as per Arnon's essentiality criteria, Macro- and micro-nutrients and their role in plant growth and development, deficiency symptoms, nutrient deficiency induced plant ailments such as khaira disease of rice, heart rots in fruits and vegetables, Lime induced iron chlorosis, major organic and inorganic sources of nutrients for environment friendly biomass production cultures; soil fertility, management of soil fertility for sustainable yields under different climatic conditions, poly houses, minimum tillage cultures. permaculture, assessment/evaluation of soil fertility for optimum/balanced use of nutrients, methods of soil analysis, soil testing. importance of soil health card in evolving best practices for different land uses. Soil erosion, runoff loses, land degradation, watershed management; Soil pollution, nature and extent, preventive measures, management alternatives.

8. 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, lime potential; Irrigation water quality - EC, SAR, RSC and specifications. Fertility status of major soil groups of India. Concept and application of soil health and soil quality.

9. Application of statistics for experimental designs, analysis of variance, correlations for data interpretations.

10. Soil survey and classification-Types of soil survey, basis for selection of suitable method of survey. soil classification, important soil orders. importance of modern nomenclature for understanding nature of soil behavior. Study of base maps: cadastral maps, toposheets, aerial photographs and satellite imageries. Use of geographical information system for preparing thematic maps.

11. Organic and inorganic fertilizers, Soil erosion. types and causes of erosion, conservation measures and watershed management.

12. Major constraints of Indian soils for raising biomass productivity and measures for improvement. role of soil in mitigating impact of GHGs, climate change leading to global warming, soil as a source/ sink for carbon and carbon cycle.