



NAGALAND UNIVERSITY
(A Central University)

School of Agricultural Sciences & Rural Development
Medziphema: Campus - 797 106. Nagaland (India)
Department of Agricultural Chemistry and Soil Science

Syllabus of Ph. D.

ACS - 601 Advances in Soil Physics

(2+1)

Theory

Soil water, movement under unsaturated condition. Darcy's law and development of differential equations, soil water capillary conductivity and diffusivity, limitations of Darcy's law, theories of horizontal and vertical infiltration under different boundary conditions, movement of water in soil-plant atmosphere system, movement of salts in soils. Consistency of soils; consistency limits, liquid limit, plastic limit, shrinkage limit, consistency index. Soil temperature, factors effecting soil temperature, heat capacity and specific heat, flow in soil, thermal conductivity diffusivity of soils.

Practical

Measurement of soil moisture, soil temperature. Determination of consistency, hydraulic conductivity and intrinsic permeability of soil, determination of specific heat of soil.

ACS - 602 Advances in Soil Fertility

(2+1)

Theory

Modern concepts of nutrient availability; soil solutions and plant growth; nutrient response function and availability indices. Nutrient movement in soils; nutrient absorption by plants; mechanistic approach to nutrient supply and uptake by plants; models for transformation and movement of major micronutrient in soils. Chemicals equilibria(including solid-solution equilibria) involving nutrient ions in soils, particularly in submerged soils. Modern concepts of fertility evaluation, nutrient use efficiency and nutrient budgeting, Modern concepts in fertilizers application; soil fertility evaluation techniques; role of soil test in fertilizer use recommendations; site-specific nutrient management for precision agriculture. Monitoring physical, chemical and biological changes in soils; permanent manurial trials and long-term fertilizer experiments; soil productivity under long term intensive cropping; direct, residual and cumulative effect of fertilizers use.

Practical

Determination of macro and micronutrients in soil and plants.

ACS - 603 Soil Genesis and Micropedology**(2+1)****Theory**

Pedogenic evolution of soils; soil composition and characterization. Weathering and soil formation-factors and pedogenic processes; stability and weathering sequences of minerals. Assessment of soils profile development by mineralogical and chemical analysis. Micro - pedological features of soil- their structure, fabric analysis, role in genesis and classification.

Practical

Practical should be conducted based on theory syllabus.

ACS - 604 Physical Chemistry of Soil**(2+1)****Theory**

Colloidal chemistry of inorganic and organic components of soils-their formation, clay organic interaction. Predictive approaches for cation exchange equilibria thermodynamics, empirical and diffuse double layer theory (DDL)-relationship among different selectivity coefficients; structures and properties of diffuse double layer. Thermodynamics of nutrients transformation in soils; cationic and anionic exchange and their models, molecular interaction. Adsorption/desorption isotherms- Langmuir adsorption isotherm, Freundlich adsorption isotherms, normalized exchange isotherms, BET equations; selective and non-selective adsorption of ions on inorganic surfaces and organic surfaces of soil materials (citation of utility in agricultural system). Common solubility equilibria – carbonates, iron oxide and hydroxides, aluminum silicate, aluminum phosphate; electrochemical properties of clays (citation of examples from agricultural use).

Practical

Practical should be conducted based on theory syllabus.

ACS - 605 Biochemistry of Soil Organic Matter**(2+1)****Theory**

Organic matter pools in soil; composition and distribution of organic matter in soil and its functions; environmental significance of humic substances; decomposition of organic residues in soil in relation to organic matter pools. Biochemistry of the humus formation; different pathways for humus synthesis in soil; soil carbohydrates and lipids. Nutrients transformation -N,P,S; trace metal interaction with humic substances, significances of chelation reaction in soils. Reactive functional groups of humic substances, adsorption of organic compounds by clay and role of organic substances in pedogenic soil aggregation processes; clay-organic matter complexes. Humus-pesticides interaction in soil, mechanism.

Practical

Practical should be conducted based on theory syllabus.

ACS - 606 Land Use Planning and Water Shed Management**(2+1)****Theory**

Concept and techniques of land use planning; factors governing present land use. Land evaluation methods and soil-site suitability evaluation for different crops; land capability classification and constraints in application. Agro-ecological regions/sub-regions of India and their characteristics in relation to crop production. Water harvesting- concept, significances, types, methodology; use of harvested water in agriculture to increase water productivity. Watershed development/management concept, objectives, characterization, planning, execution, community participation and evaluation;

rehabilitation of watershed; PRA; developing economically and ecologically sustainable agro-forestry system for watershed; case studies.

Practical

Practical should be conducted based on theory syllabus.

ACS - 607 Manures and Fertilizers

(2+1)

Theory

Role of manures in sustainable agriculture; rural and urban compost and vermicompost- preparation, preservation and mechanisms of their decomposition under different moisture regimes; effect of C:N ratio on decomposition of organic manures; concentrated manures and their preparation: industrial effluents as manures and pollutants, biofertilizers and their potential: enriched manures-their production and preservation ; problems associated with the preparation, storage, transport and application of simple and enriched organic manures; fertilizer production, consumption and agricultural production in India; future projection; chemistry; characteristic and use of different nitrogenous, phosphatic and potassic fertilizers; methods of use of low grades rock phosphates on different types of soils. Recent developments in secondary and micronutrient fertilization; liquid and suspension fertilizer-their merits and demerits. Factor affecting fertilizer use efficiency with reference to N,P,K,S and Zn: long term effects of fertilizers on soil productivity. Quality control of fertilizers and fertilizers control order.

Practical

Analysis of manures and fertilizers.

ACS - 608 Soil Resource Management

(2+1)

Theory

Conceptual ideas of sustainability in general advances of soil management to sustainable agriculture; soil resources of India; soil related constraints in crop production in different parts of India; sustainable and management practices. Agro-ecological regions of India: potentialities and limitations of different regions. Land evaluation and rationalizing land use, decision support system with relation to land management; soil degradation problems and their management for sustainable agriculture, national soils policy-need, recognition, objectives and implementation.

Practical

Preparation of soil monolith, chemical characterization of soil of different land use.

ACS - 609 Soil Testing, Water Quality & Fertilizer Recommendation

(2+1)

Theory

Soil-testing-its scope and significance for sustainable agriculture; historic background and development of soil test in India and future challenges; soil, plant and water sampling: soil test methods- principles and development; critics, nutrient concepts; soil testing for secondary and micronutrients; diagnosis of problem soil. Water quality evolution, factors affecting use of poor quality irrigation water for crop production; targeted yield and multiple regression in soil test crop responses; soil test summaries and soil fertility maps; interpretation of soil test data; formulation of fertilizer dose for different types of crops and cropping systems including cereals, vegetables, ornamental and horticultural crops, fertilizer recommendation for rain fed conditions.

Practical

Interpretation of soil testing, water quality parameters and fertilizers recommendations.