Shri Vishwanath P. G. College Kalan, Sultanpur

(Affiliated to)

Dr. RAM MANOHAR LOHIA AVADH UNIVERSITY, AYODHYA

Structure of Syllabus for the Program: M.Sc. (Ag.)

Department of Agricultural Chemistry and Soil Science

SEMESTER-WISE TITLES OF THE PAPERS IN (AGRICULTURAL CHEMISTRY AND SOIL SCIENCE)					
YEAR	**SEME-STER**	**COURSE CODE**	**PAPER TITLE**	**THEORY/ PRACTICAL**	**CREDIT**
DEGREE **IN MASTER OF AGRICULTURE (AGRICULTURAL CHEMISTRY & SOIL SCIENCE)**					
FIRST YEAR	**I**	SSAC-504	Soil Mineralogy, Genesis, Classification & Survey	Theory & Practical	3(2+1)
		SSAC-509	Soil, Water and Air Pollution	Theory & Practical	3(2+1)
		SSAC-511	Analytical Techniques & Instrumental Methods in Soil and Plant Analysis	Practical	2(0+2)
		AS-501	Agricultural Statistics	Theory & Practical	3(2+1)
	II	SSAC-501	Soil Physics	Theory & Practical	3(2+1)
		SSAC-502	Soil Fertility and Fertilizers use	Theory & Practical	4(3+1)
		SSAC-503	Soil Chemistry	Theory & Practical	3(2+1)
		SSAC-506	Soil Biology & Biochemistry	Theory & Practical	3(2+1)
SECOND YEAR	**III**	SSAC-505	Soil Erosion and conservation	Theory & Practical	3(2+1)
		SSAC-510	Remote Sensing & GIS Techniques for Soil, Water and Crop Studies	Theory & Practical	3(2+1)
		SSAC-513	Management of Problematic Soils & Waters	Theory & Practical	3(2+1)
		CA-502	Computer Application in Agriculture	Theory & Practical	2(1+1)
		PGS-501	Library and Information Service	Practical	1(0+1)
	IV	SSAC-591	Master's Seminar	Presentation	1(0+1)
		SSAC-599	Master Research (Thesis)	Research	20
	OR **Special Papers (20 credit) satisfactory/unsatisfactory**				
		SSAC-514	Advanced Organic Chemistry & Plant Biochemistry	Theory & Practical	4(3+1)
		SSAC-515	Advanced Bio-pesticides & Bio-Fertilizers	Theory & Practical	4(3+1)
		SSAC-516	Soil Physical Environment and Plant Growth	Theory & Practical	4(3+1)
		SSAC-517	Soil Testing, Water Quality and fertilizer Recommendations	Theory & Practical	4(3+1)
		SSAC-518	Modeling Soil Plant System	Theory & Practical	4(3+1)

Semester I

SSAC-504: Soil Mineralogy, Genesis, Classification & Survey **3(2+1)**

Objective

To acquaint students with basic structure of alumino-silicate minerals and genesis of clay minerals; soil genesis in terms of factors and processes of soil formation, and to enable students conduct soil survey and interpret soil survey reports in terms of land use planning.

Theory:

Unit –I: Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.

Unit –II: Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils.

Unit –III: Concept and definitions of soil, soil profile; Formation and weathering of rocks and minerals, weathering sequences of minerals, Factors of soil formation, soil forming process.

Unit –IV: Concept of soil individual; soil classification systems–historical developments and modern systems of soil classification with special emphasis on soil taxonomy; application of soil taxonomy.

Unit –V: Soil survey and its types; soil survey techniques-conventional and modern; soil series characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping.

Unit –VI: Landform-soil relationship; major soil groups of India and U.P., land capability and land irrigability classification; land evaluation and land use type (LUT) -concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem**.**

Practical:

- Identification and quantification of minerals in soil fractions.
- Morphological properties of soil profile in different landforms.
- Classification of soils using soil taxonomy.
- Calculation of weathering indices and its application in soil formation.
- Grouping soils using available data base in terms of soil quality.
- Aerial photo and satellite data interpretation for soil and land use.
- Cartographic techniques.
- Land use planning exercises using conventional and RS tools

SSAC-509: Soil, Water and Air Pollution 3(2+1)

Objective:

To make the students aware of the problems of soil, water and air pollution associated with use of soils for crop production.

Theory:

Unit –I: Soil, water and air pollution problems associated with agriculture, nature and extent.

Unit –II: Nature and sources of pollutants–agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

Unit –III: Sewage and industrial effluents–their composition and effect on soil properties / health, and plant growth and human beings; soil as sink for waste disposal.

Unit –IV: Pesticides–their classification, behavior in soil and effect on soil microorganisms.

Unit –V: Toxic elements–their sources, behavior in soils, effect on nutrients availability, effect on plant and human health.

Unit –VI: Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases–carbon dioxide, methane and nitrous oxide.

Unit –VII: Remediation / amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

Practical:

- Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and Plants.
- Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents.
- Heavy metals in contaminated soils and plants.
- Management of contaminants in soil and plants to safeguard food safety.
- Air sampling and determination of particulate matter and oxides of sulphur.
- Visit to various industrial sites to study the impact of pollutants on soil and plants.

SSAC-511: Analytical Techniques & Instrumental Methods in Soil and Plant Analysis 2(0+2)

Objective:

To familiarize the students with commonly used instruments – their working, preparations of common analytical reagents for qualitative and quantitative analysis of both soil as well as plant samples.

Practical:

Unit I: Preparation of solutions for standard curves, analytical reagents, qualitative reagents, indicators and standard solutions for acid-base, oxidation reduction and complex metric titration; soil, water and plant sampling techniques, their processing and handling.

Unit II: Principles of visible, ultraviolet and infrared spectrophotometry, atomic absorption, flame-photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrometry and X-ray defractrometery; identification of minerals by X-ray by different methods.

Unit III: Analysis of soil and plant samples for N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B and Mo; analysis of plant materials by digesting plant materials by wet and dry ashing and soil by wet digestion methods.

AS – 501: AGRICULTURAL STATISTICS 3(2 +1)

Theory

UNIT- 1: Classification tabulation and graphical representation of data. Box-plot. Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation.

UNIT–2: Discrete and continuous probability distribution: Binomial, Poisson, Normal distribution, Concept of sampling distribution chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distribution. Large sample theory.

UNIT –3: Introduction to theory of estimation and confidence-intervals, correlation and regression, Simple and multiple linear regression model, estimation of parameters, predicted value and residuals, correlation coefficient, partial correlation coefficient, multiple correlation coefficient, rank correlation coefficient, test of significance of correlation coefficient and regression coefficient, coefficient of determination.

UNIT – 4: Need for designing of experiments, characteristics of a good design, Basic principles of designs, randomization, replication and local control.

UNIT-5: Uniformity trails, size and shape of plots and blocks, analysis of variance, completely randomized design, randomized block design and Latin squire design, missing plot techniques, split plot design.

UNIT-6: Sampling Techniques - Planning of survey, method of data collection, questionnaire v/s schedule, Problems of sampling frame choice of sample of design, probability sampling, sample space, sampling design, simple random sampling, Estimation of proportion, confidence interval, Determination of sample size, stratified sampling, cluster sampling, multi state sampling, systematic sampling, ratio and regression method of estimation, Non sampling error-source and classification.

Practical

- **Related with the course**

Semester II

SSAC-501: Soil Physics 3(2+1)

Objective:

To impart basic knowledge about soil physical properties and processes in relation to plant growth.

Theory:

Unit I: Scope of soil physics and its relation with other branches of soil science; soil as a three phase system.

Unit II: Soil texture, textural classes, mechanical analysis, specific surface.

Unit III: Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts.

Unit IV: Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting - mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.

Unit V: Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.

Unit VI: Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.

Unit VII: Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum.

Unit VIII: Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management.

Unit IX: Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

Practical

- Mechanical analysis by pipette and international methods.
- Measurement of Atterberg limits
- Aggregate analysis - dry and wet
- Measurement of soil-water content by different methods
- Measurement of soil-water potential by using tensiometer and gypsum blocks
- Determination of soil-moisture characteristics curve and computation of pore-size distribution
- Determination of hydraulic conductivity under saturated and unsaturated conditions
- Determination of infiltration rate of soil
- Determination of aeration porosity and oxygen diffusion rate
- Soil temperature measurements by different methods
- Estimation of water balance components in bare and cropped fields

SSAC-502: Soil Fertility and Fertilizers use **4(3+1)**

Objective

To impart knowledge about soil fertility and its control, and to understand the role of fertilizers and manures in supplying nutrients to plants so as to achieve high fertilizer use efficiency.

Theory:

Unit I: Soil fertility and soil productivity; nutrient sources - fertilizers and manures; essential plant nutrients - functions and deficiency symptoms.

Unit II: Soil and fertilizer nitrogen - sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.

Unit III: Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions.

Unit IV: Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions.

Unit V: Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium- factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.

Unit VI: Micronutrients - critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability.

Unit VII: Common soil test methods for fertilizer recommendations; quantity intensity relationships; soil test crop response correlations and response functions.

Unit VIII: Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management.

Unit IX: Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Practical

- Principles of colorimetry
- Flame-photometry and atomic absorption spectroscopy
- Chemical analysis of soil for total and available nutrients
- Analysis of plants for essential elements

SSAC-503: Soil Chemistry **3(2+1)**

Objective

To introduce the classical concepts of soil chemistry and to familiarize students with modern developments in chemistry of soils in relation to using soils as a medium for plant growth.

Theory:

Unit I: Chemical (elemental) composition of the earth's crust and soils.

Unit II: Elements of equilibrium thermodynamics, chemical equilibrium, electrochemistry and chemical kinetics.

Unit III: Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, clay-organic interactions.

Unit IV: Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange – inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

Unit V: Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibria; step and constant-rate K; management aspects.

Unit VI: Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.

Unit VII: Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments.

Unit VIII: Chemistry and electrochemistry of submerged soils.

Practical

- Determination of CEC and AEC of soils
- Analysis of equilibrium soil solution for pH, EC, E h by the use of E h-pH meter and conductivity meter
- Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method
- Potentiometric and conduct metric titration of soil humic and fulvic acids
- (E 4/E 6) ratio of soil humic and fulvic acids by visible spectrophotometric studies and the (E 4/E 6) values at two pH values
- Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm
- Construction of adsorption envelope of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved
- Determination of titratable acidity of an acid soil by BaCl 2-TEA method
- Determination of lime requirement of an acid soil by buffer method
- Determination of gypsum requirement of an alkali soil.

SSAC-506: Soil Biology & Biochemistry **3(2+1)**

Objective

To teach students the basics of soil biology and biochemistry, including biogeochemical cycles, plant growth promoting rhizobacteria, microbial interactions in soil and other soil activities.

Theory:

Unit I: Soil biota, soil microbial ecology, types of organisms in different soils; soil microbial biomass; microbial interactions; un cultivable soil biota.

Unit II: Microbiology and biochemistry of root-soil interface; phyllosphere; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora.

Unit III: Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation.

Unit IV: Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil.

Unit V: Preparation and preservation of farmyard manure, animal manures, rural and urban composts and Vermicompost.

Unit VI: Bio- fertilizers - definition, classification, specifications, method of production and role in crop production.

Practical

- Determination of soil microbial population
- Soil microbial biomass
- Elemental composition, fractionation of organic matter and functional groups
- Decomposition of organic matter in soil
- Soil enzymes
- Measurement of important soil microbial processes such as ammonification, nitrification, N 2 fixation, S oxidation, P solubilization and mineralization of other micro nutrients
- Study of rhizosphere effect.

Semester III

SSAC-505: Soil Erosion and conservation 3(2+1)

Objective

To enable students to understand various types of soil erosion and measures to be taken for controlling soil erosion to conserve soil and water.

Theory:

Unit I: History, distribution, identification and description of soil erosion problems in India.

Unit II: Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity - estimation as EI30 index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in
relation to soil properties and precipitation.

Unit III: Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country.

Unit IV: Principles of erosion control; erosion control measures - agronomical and engineering; erosion control structures - their design and layout.

Unit V: Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.

Unit VI: Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.

Practical

Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index

- Computation of kinetic energy of falling rain drops
- Computation of rainfall erosivity index (EI 30) using rain gauge data
- Visits to a watersheds

SSAC-510: Remote Sensing & GIS Techniques for Soil, Water and Crop Studies 3(2+1)

Objective

To impart knowledge about the basic concepts of remote sensing, aerial photographs and imageries, and their interpretation; application of remote sensing in general and with special reference to soil, plants and yield forecasting; to impart knowledge about geo-statistical techniques with special reference to krigging, and GIS and applications in agriculture.

Theory:

UNIT I: Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter.

UNIT II: Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretation.

UNIT III: Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.

UNIT IV: Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo-statistical techniques of evolution of soil variability.

UNIT V: Introduction to GIS and its application for spatial and non-spatial soil and land attributes.

Practical

- Familiarization with different remote sensing equipments and data products
- Interpretation of aerial photographs and satellite data for mapping of land resources
- Analysis of variability of different soil properties with classical and geostatistical techniques
- Creation of data files in a database programed
- Use of GIS for soil spatial simulation and analysis
- To enable the students to conduct soil survey and interpret soil survey reports in terms of land use planning.

SSAC-513: Management of Problematic Soils & Waters 3(2+1)

Objective

To educate students about basic concepts of problem soils and brackish water, and their management. Attention will be on management of problem soils and safe use of brackish water in relation to crop production.

Theory:

UNIT I: Area and distribution of problem soils - acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible**.**

UNIT II: Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties.

UNIT III: Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.

UNIT IV: Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.

UNIT V: Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality.

UNIT VI: Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters.

Practical

- Characterization of acid, acid sulfate, salt-affected and calcareous soils
- Determination of cations (Na , K , Ca and Mg) in ground + + ++ ++ water and soil samples
- Determination of anions (Cl , SO , CO4 soil samples- -- --3 and HCO 3) in ground waters and
- Lime and gypsum requirements of acid and sodic soils

CA-502: Computer Application in Agriculture 2 (1+1)

Theory:

Introduction to computer, operating system, definition and types, application of MS-Office for document creation & editing, data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, database concepts and types, us of DBMS in Agriculture, World Wide Web (WWW), Memory, Hasic Army Computer System. e-Agriculture concepts and applications, Use of ICT in Agriculture 11 Application for computation of water and nutrient requirement of crops computer controlled devices (automated system) for agri-input management, smart phone apps in Agriculture. Decision support systems, concepts components and applications in agriculture.

Practical: Study of computer components, accessories, practice of important DOS Commands Introduction of different operating system such as window, files & folders, file management. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific document. MS-Excel - Creating a spreadsheet, use for statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-Access-Creating database.

PGS- 501: Library and Information Services (Non Gradial Satisfactory & unsatisfactory) 1(0+1)

Practical:

Introduction to library and its services, Role of libraries in education, research and technology transfer. Classification systems and organization of library: Sources of informa tion-primary sources secondary sources and tertairy sources: Intricacies of abstracting and indexing services (Science Citation Index, biological abstracts, chemical abstract, CABI abstracts, etc.), Tracing information from reference sources Literature survey: Citation tech- niques/Preparation of bibliography: Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internal including search engines and its resources, e-resources access methods.

Semester IV

Special Papers

SSAC-514: Advanced Organic Chemistry & Plant Biochemistry **4(3+1)**

Theory:

Unit I: Characteristics of chemical bonds and covalency, classification of organic compounds. Nomenclature and their general properties.
Unit II: Chemistry of functional groups, chemistry of aromatic compounds (Benzene & Phenol). Heterocyclic compounds (Purines & Pyrimidines) organic reaction substance.
Unit III: Elimination & addition. General Chemistry of carbohydrates and photosynthesis of carbohydrates.
Unit IV: General Chemistry of lipids, amino acids, nucleic acids, plant pigments, alkaloids, plant hormones their chemistry & uses.
Unit V: Vitamins, classification and occurrence, chemistry and deficiency symptoms. General Chemistry of proteins & their biosynthesis, their classification, mechanism of their activity.

Practical

Related with course**.**

SSAC-515: Advanced Bio-pesticides & Bio-Fertilizers **4(3+1)**

Theory:

Unit I: History and concept of biopesticides. Importance , scope and potential of biopesticides, Definition concepts and classification of bio-pesticides viz. pathogen technology of bio-pesticides and biorationales. Botanical and their uses.
Unit II: Mass production technology of bio-pesticides. Virulence. Pathogeaicity and symptoms of entomopathogenic pathogens and nematodes.
Unit III: Methods of application of biopesticides, methods of quality control and techniques of bioesticides. Impediments and limitation in production and use of biopesticides.
Unit IV: Biofertilizers- Introduction, status and scope, structure and characteristics features of bacterial biofertilizers. *Azospirllum, azotobacter, bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*. *Cynobacterial biofertilizer-Anahaena, Nostac, Hapalosiphon and funnal biofertilizers-AM mycorrhiza and ectomycorrhiza.* Nitrogen fixation –free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization , K solubilization.
Unit V: Production technology: Strain selection , sterilization growth and fermentation, mass production of carrier based and liquid biofertlizers. FCO specifications and quality control of biofertilizres. Application technology for seeds, seedings, tuders, sets etc. Biofertilizres-storage. Self life. Quality control and marking factors influencing the efficacy of biofertilizres.

Prctical:

Isolation and urification of important biopesticides. Trichuderma Pseudomonas, Bacillus, Metarhyzum etc. and its production, Idendtification of important botanicals. Visit to biopesticides laboratory in nearby area. Field visit to explore naturally infected cadavers, Identification of entomopathogenic entities in filed condition. Quality control of biopesticides,Isolation and Purification of Azospirillum, Azotobactor, Rhizobium. P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizeres. Isolation of AM fungi wet sieving method and sucrose gradient method, Mass production of AM inoculants.

SSAC-516 Soil Physical Environment and Plant Growth 4(3+1)

Theory:

UNIT I: Introduction: Effect of soil physical properties on plant growth - soil water, soil air, soil temperature, mechanical impedance and tillage practices.

UNIT II: Soil water: Soil moisture – plant water relations, available water, newer concepts of water availability, least limiting water range, soil-plant-atmosphere system as a physical continuum, plant uptake of soil moisture, evaporation, transpiration and evapotranspiration, dynamics of water in the soil plant- atmosphere continuum.

UNIT III: Root growth – germination and seedling emergence, hydraulic properties of roots, characterization of root growth parameters, water balance of the root zone, soil physical properties and root growth, flow of water to roots.

UNIT IV: Soil temperature – effect of soil temperature on plant growth, soil temperature management, thermal regimes, mulching, Radiation – heat budget and energy balance in the field, radiation use efficiency, radiation exchange in the field, exchange of heat and vapour to the atmosphere.

UNIT V: Aeration – critical oxygen concentration and factors affecting.

UNIT VI: Field water balance: Field water balance, irrigation and water use efficiency, consumptive use, plant uptake of soil moisture.

UNIT VII: Nutrients: Nutrient uptake and use by plants, managing soil physical condition for improved nutrient use efficiency, integrated nutrient management in relation to soil physical condition.

UNIT VIII: Resource conservation technologies: Bed planting and zero-tillage - types, suitability and effect on soil physical properties, other resource conservation technologies and the impact (short and long term) on soil health.

UNIT IX: Modelling: Interactions of soil, management and climatic factors on plant growth, and development of sustainability indices.

Practical's:

Measurement of penetration resistance and LLWR; plant water potential; field saturated hydraulic conductivity; transpiration using porometer; root length density, root diameter, root weight using root scanner; germination percentage as affected by temperature; estimation of evapo-transpiration losses under different management options; measurement/estimation of consumptive water use, production functions, field water balance components, and water uptake by plants.

SSAC-517 Soil Testing, Water Quality and fertilizer Recommendations 4(3+1)

Theory:

UNIT I: Soil testing – its scope and significance in sustainable agriculture; historical background and development of soil testing in India and future challenges; SWOT analysis of soil testing service; soil, plant and water sampling and processing techniques.

UNIT II: Soil test methods – principles and development; soil testing for primary, secondary and micronutrients; diagnosis and amelioration of problem soils; interpretation of soil test data; soil test summaries and soil fertility maps.

UNIT III: Sources of soluble salts and other impurities in water; quality of different water resources in India; interaction of ionic constituents in water with soil; leaching and salt movement through soil; water quality evaluation; factors affecting use of poor quality irrigation water for crop production; management practices for using saline-sodic waters; sewage and industrial effluents for irrigation.

UNIT IV: Different approaches of fertilizer recommendation; critical nutrient concept; targeted yield and multiple regression techniques in soil test crop response studies; formulation of fertilizer dose for different types of crops and cropping systems including cereals, vegetables, ornamental and horticultural crops on normal and problem soils; fertilizer recommendations for rain-fed conditions, integrated plant nutrient supply systems.

UNIT V: Emerging concepts of fertilizer application; synchronizing nutrient supply with plant demand; site-specific nutrient management.

Practicals:

Collection of soil and plant samples from agricultural and horticultural crops; sample processing; handling of laboratory instruments; determination of pH, EC and organic carbon; available nutrients (N, P, K, S, B, Zn, Cu, Fe and Mn); estimation of non-exchangeable K; lime requirement of acid soils and gypsum requirement of sodic soils; assessment of irrigation water quality; use of leaf colour chart in real-time N management; calculation of fertilizer doses.

SSAC-518: Modeling Soil Plant System 4(3+1)

Theory:

UNIT I: Introduction, terms and definitions; classification of models; steps of modelling; Taylor series; numerical methods of differentiation and integration; convergence and stability of models.

UNIT II: High level computer language - FORTRAN its commands and usage; testing and evaluation of model.

UNIT III: Description of spatially homogeneous models; K transformation model; model on carbon, nitrogen and phosphorus dynamics in soil.

UNIT IV: Spatially heterogeneous models; equation of continuity; simulation of water flow through soil; explicit and explicit-implicit method; simulation of solute movement through soil by explicit method and with variable moisture flux by explicit-implicit method.

UNIT V: Nutrient uptake models; water uptake models; sensitivity analysis, parameter ranking and model simplification.

Practicals:

Testing and usage of FORTRAN commands; writing, compiling, linking and execution of FORTRAN modules on K transformation and equilibrium in soils, C, N and P transformation in soils, water and salt movement in soils, nutrient uptake by plants.