

SYLLABUS

M.Sc. (Ag.)

SOIL SCIENCE AND AGRICULTURE CHEMISTRY

CODE	COURSE TITLE	CREDITS
(A) MAJOR COURSES		30
SAC 501	SOIL PHYSICS	3 (2+1)
SAC 502	SOIL CHEMISTRY	3 (2+1)
SAC 503	SOIL MINERALOGY, GENESIS AND CLASSIFICATION	3 (2+1)
SAC 504	SOIL BIOLOGY AND BIOCHEMISTRY	3 (2+1)
SAC 505	SOIL FERTILITY AND PLANT NUTRITION	3 (2+1)
SAC 506	AGRICULTURAL BIOCHEMISTRY	3 (2+1)
SAC 507	SOIL SURVEY AND LAND USE PLANNING	3 (2+1)
SAC 508	MANAGEMENT OF PROBLEM SOILS AND WATER	3 (2+1)
SAC 509	MANURES AND FERTILIZERS	3 (2+1)
SAC 510	SEMINAR	3 (0+3)
B) SUPPORTING COURSES		12
PPY 501	PRINCIPLES OF PLANT PHYSIOLOGY	3 (2+1)
AGR 502	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	3 (2+1)
ENT 518	AGRICULTURAL PESTICIDES	3 (2+1)
AG STAT 501	STATISTICS AND COMPUTER APPLICATION	3 (2+1)
(C) Project Work		
SAC 511	Project Work (Viva-Voce and Evaluation)	6(3+3)
	GRAND TOTAL	48

SOIL SCIENCE AND AGRICULTURE CHEMISTRY

SEMESTER WISE DISTRIBUTION

CODE	COURSE TITLE	CREDITS
1ST SEMESTER		
SAC 502	SOIL CHEMISTRY	3(2+1)
SAC 505	SOIL FERTILITY AND PLANT NUTRITION	3 (2+1)
SAC 508	MANAGEMENT OF PROBLEM SOILS AND WATER	3 (2+1)
AGR 502	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	3 (2+1)
	Total	12
2nd SEMESTER		
SAC 501	SOIL PHYSICS	3 (2+1)
SAC 503	SOIL MINERALOGY, GENESIS AND CLASSIFICATION	3 (2+1)
SAC 509	MANURES AND FERTILIZERS	3 (2+1)
AG STATE 501	STATISTICS AND COMPUTER APPLICATION	3 (2+1)
	Total	12
3rd SEMESTER		
SAC 510	SEMINAR	3 (0+3)
SAC 506	AGRICULTURAL BIOCHEMISTRY	3 (2+1)
SAC 507	SOIL SURVEY AND LAND USE PLANNING	3 (2+1)
ENT 518	AGRICULTURAL PESTICIDES	3 (2+1)
	Total	12
4th SEMESTER		
SAC 504	SOIL BIOLOGY AND BIOCHEMISTRY	3 (2+1)
PPY 501	PRINCIPLES OF PLANT PHYSIOLOGY	3 (2+1)
SAC 511	PROJECT WORK (Viva-Voce and Evaluation)	6 (3+3)
	Total	12

SOIL SCIENCE AND AGRICULTURE CHEMISTRY

SAC 501 SOIL PHYSICS

3 (2+1)

Theory

UNIT I: Soil water behaviour-infiltration, redistribution, retention and movements. Soil water potential, soil water balance, soil water management practices.

UNIT II: Soil physical environment and soil fertility relationship, consistence, swelling, shrinking, dispersion and workability of soils. Alleviation of soil physical constraints for crop production.

UNIT III: Soil compaction processes, soil texture, soil structure-genesis-evaluation and management. Puddling and its effect-soil physical behaviour.

UNIT IV: Soil temperature- thermal properties, variations and modifications, soil air-characterization and measurement in relation to plant growth.

Practical

Wet aggregate, modulus of rupture, porosity, moisture content, bulk density-soil strength oxygen-diffusion rate and thermal conductivity. Measurement of soil temperature using thermistors and thermocouples. Determination of infiltration rates. Soil-moisture characteristic curves.

SAC 502 SOIL CHEMISTRY

3 (2+1)

Theory

UNIT I: Chemical composition of soils, soil colloids, Structures, Characteristics and identification of clay minerals.

UNIT II: Thermodynamics and kinetics of chemical reaction. Organic matter and characterization, clay-organic matter interaction in retention-mechanism and chemical and empirical relationships.

UNIT III: Soil reaction and buffering capacity of soil.

UNIT IV: Chemistry of acid and salt affected soils and their reclamation.

Practical

Analysis of equilibrium soil solution of Eh, pH, EC and partial pressure of CO₂. Determination of ion activity. Common ion effects on solubility. Exchange reactions of Na, K, Ca, Mg in soils. Characterization of acid and salt affected soils. Lime and gypsum requirement.

**SAC 503 SOIL MINERALOGY, GENESIS AND
CLASSIFICATION**

3 (2+1)

Theory

UNIT I: Soil as a natural body and medium for plant growth.

UNIT II: Weathering, classification, structure, characteristics, distribution, origin and alteration of soil minerals.

UNIT III: Genesis and transformation of clay minerals, non-crystalline components of soil, History and systems of soil classification, diagnostic horizon of soils of different orders.

UNIT IV: Taxonomy of soils of India, soil micro-morphology.

Practical

Study of crystal systems and crystal structure of soil minerals. Separation of light and heavy minerals. Minerals identification by conventional and instrumental method. Preparation and study of thin sections, surface area determination, Study of soil profile.

SAC 504 SOIL BIOLOGY AND BIOCHEMISTRY

3 (2+1)

Theory

UNIT I: Soil biota, soil microbial ecology- types of organisms in different soils, soil microbial biomass, microbial interactions.

UNIT II: Microbiology and biochemistry of root soil interface, phyllosphere, biofertilizers, soil enzymes activities and importance.

UNIT III: Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in the soil. Biotic factors in soil development.

UNIT IV: Biochemical composition and biodegradation of soil organic matter and crop residues. Organic waste and their use for production of biogas and manures.

Practical

Determination of soil microbial population; soil microbial biomass. Activities of different enzymes in soil. Biochemical constituents of organic residues- cellulose, hemicellulose, lignin and C: N ratio. Estimation of decomposition rates of different organic residues. Mineralization and immobilization turn-over of nitrogen.

SAC 505 SOIL FERTILITY AND PLANT NUTRITION 3 (2+1)

Theory

UNIT I: Soil fertility concept. Factor effecting of soil fertility. Essential and Beneficial elements.

UNIT II: Nutrients deficiencies and toxicities-recent diagnostic techniques and ameliorative measures.

UNIT III: Nutrients and nutrient water interactions. Balanced use of nutrients. Integrated plant nutrient supply and management.

UNIT IV: Nutrients uptake mechanisms, nutrients release and carry-over effects, quantity- intensity relationship, soil fertility evaluation, soil test crop response correlations.

Practical

Laboratory and greenhouse experiments for evaluation of indices of nutrient availability and their critical value in soils and plant. Determination of different pools of macro and micro nutrients. Quantity-intensity relation of P & K.

SAC 506

AGRICULTURAL BIOCHEMISTRY

3 (2+1)

Theory

UNIT I: Cell and life: General principles of nutrition and growth.

UNIT II: Chemistry of biological compounds: carbohydrates, lipids, protein, amino acids, nucleic acid, purins and pyrimidines.

UNIT III: Monocyclic terpenoid- cholesterol constitution and uses of pyrrolidine and morphine groups of alkaloids.

UNIT IV: Chemistry of chlorophylls, auxins, vitamins and enzymes.

Practical

Determination of crude and true protein in plant sample. Determination of reducing, non-reducing sugar and total sugar. Determination of Fat constant: R M- value, P- value, iodine value and saponification value. Estimation of Ca by EDTA method. Qualitative test of important sugar and proteins. Separation and identification of amino acids by paper chromatography. Estimation of chlorophylls.

SAC 507 SOIL SURVEY AND LAND USE PLANNING 3 (2+1)

Theory

UNIT I: Soil survey procedures, remote sensing techniques including aerial photo interpretations.

UNIT II: Cartography- principles and techniques for preparation of soil and other interpretative maps, processing of field sheets, compilation and abstraction of maps on different scales.

UNIT III: Soil correlation, criteria for classification at different of soil resource information for agricultural and non-agricultural uses.

UNIT IV: Land use planning concepts of benchmark soils for agro-technology transfer in soils. Geographic information systems (GIS) for resource inventorilization.

Practical

Study of soil profiles developed in different moisture and temperature regimes and their classifications. Study of land forms using remote sensing data. Soil survey of a project area using aerial photograph and preparation of soil survey report. Preparation of soil monoliths. Computer use in soil mapping.

SAC 508: MANAGEMENT OF PROBLEM SOILS AND WATER

3(2+1)

Theory

UNIT I: Area and distribution of problem soils ó acidic, saline and sodic soils; origin of problematic soils, and factors responsible. Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties.

UNIT II: 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 III: 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 IV: Quality of irrigation water; management of brackish water for irrigation; characterization of brackish waters; relationship in water use and quality.

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_4^- , CO_3^- and HCO_3^-) in ground waters and soil samples.

SAC 509 MANURES AND FERTILIZERS

3 (2+1)

Theory

UNIT I: Role of manures in sustainable agriculture, rural urban enriched composts preparation, preservation and mechanisms of their decomposition under different moisture regimes.

UNIT II: Fertilizer production, future projections and consumption in India. Production, characteristics and use of different fertilizers. Fertilizer interaction in soils. Use of low grade phosphate rocks on different types of soils.

UNIT III: Recent development in secondary and micronutrients fertilization, factors affecting fertilizer use efficiency.

UNIT IV: Integrated nutrient management for sustainable agriculture. Long term effects of manures and fertilizers on soil productivity, quality control of fertilizers and Fertilizers control order.

Practical

Determination of moisture, nitrogen, phosphorus and potassium in fertilizers. Composition and analysis of composts for C: N and C: S ratios.

Theory

UNIT I: Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane structure and functions. Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells.

UNIT II: The role of mineral nutrients in plant metabolism: Essential elements, classification based on function of elements in plants. Uptake of mineral elements in plants óMechanisms of uptake-translocation of minerals in plants.

UNIT III: Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO₂ reduction in Calvin cycle, supplementary pathway of C fixation in C₄ and CAM plants and its significance.

UNIT IV: Growth and differentiation. Hormonal concept of growth and differentiation, plant growth hormones and their physiological role synthetic growth regulators, growth retardants., Apical dominance, senescence, fruit growth, abscission.

Practical

Measurement of soil water status: Theory and principle of pressure plate apparatus. Measurement of plant water status: Relative water content. Measurement of transpiration rate. Deficiency symptoms of nutrients. Separation and quantification of chlorophylls, O₂ evolution during photosynthesis. Bioassays for different growth hormones- Auxins, Gibberellins, Cytokinins, ABA and ethylene.

**AGR 502 PRINCIPLES AND PRACTICES OF SOIL
FERTILITY AND NUTRIENT MANAGEMENT**

3 (2+1)

Theory

UNIT I: Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions. Criteria of essentiality of nutrients; Essential plant nutrients ó their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

UNIT II: Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management.

UNIT III: Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions.

UNIT IV: Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermi-compost and residue wastes in crops.

Practical

Determination of soil pH, EC_e, organic C, total N, available N, P, K and S in soils. Determination of total N, P, K and S in plants. Interpretation of interaction effects and computation of economic and yield optima.

ENT 518

AGRICULTURAL PESTICIDES

3(2+1)

UNIT I: Definition and scope of Pesticides; history of chemical control; pesticide use and pesticide industry in India.

UNIT II: Classification of insecticides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organo-chlorines, organophosphates, carbamates, pyrethroids, insect growth regulators and botanicals insecticides.

UNIT III Classification of Rodenticides and their uses. Nematicides and their uses. Mode of Action of some common Fungicides and weedicide.

UNIT V: Insecticide residues, their significance and environmental implications. Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

PRACTICAL

Insecticide formulations and mixtures; quality control of pesticide formulations; evaluation of insecticide toxicity and joint action. Toxicity to beneficial insects. Pesticide Equipments. Working out doses and concentrations of pesticides; visit to toxicology laboratories. Collection of different type of Pesticides.

AG.STAT& CA 501: STATISTICS AND COMPUTER APPLICATION 3(2+1)

Unit I: Agriculture statistics: Area, Production and Yield statistics; Agency and method of Collection of Area and yield statistics in U.P.; Crop Cutting experiment; Agriculture and Livestock Censuses; Sources of Official Agriculture statistics.

Unit II.: Planning and designing of experiments, Basic principles of Design of Experiments, uniformity trials, Fairfield Smith's law, Shape and size of plots and blocks. Elements of linear estimation. Variance stabilizing transformations. Analysis of variance and covariance. Completely randomized, Randomized block and Latin square designs. Mutually orthogonal Latin squares

Unit III: Introduction to computer. A brief history of computing. Use, Definition, Anatomy, Components, Classification of Computers, Capabilities and limitation of a computer.

Unit IV: Introduction to MS-Office ó Word, Excel, Power Point, Fundamental of computer network ó LAN, MAN & WAN, Introduction of Internet, Email, surfing & browsing

Practical: Crop cutting methods, CRD, RBD and Latin square designs, Introduction of MS Paint, MS Note pad, Introduction of MS Word, Excel, Power Point, Introduction of internet, Browser, E-mail.

