

Courses Catered by the Department of Agricultural Chemistry and Soil Science in Under Graduate Programme

Agriculture

Semester	Course No.	Name of the course	Credits
1 st Semester	ACSS 103	Fundamentals of Soil Science I	1+1
2 nd Semester	ACSS 153	Fundamentals of Soil Science II	1+1
3 rd Semester	ACGP 203	Agricultural Microbiology	1+1
4 th Semester	ACSS 255	Manures, Fertilizers and Soil Fertility Management	2+1
	EC 261	Production and Use of Biofertilizers	2+1
5 th Semester	ACSS 305	Problematic Soils and their Management	1+1
6 th Semester	EC 361	Agri Waste Management	2+1
	EC 362	Deficiency and Toxicity of elements in Soil, Plant & Water	2+1
8 th Semester	ELP 454	Soil, Plant and Water Testing	0+10
	ELP 459	Biofertilizer Production and Marketing	0+10

Horticulture

Semester	Course No.	Name of the course	Credits
1 st Semester	ACSS 103 (H)	Fundamentals of Soil Science	1+1
	ACGP 203 (H)	Introductory Microbiology	1+1
2 nd Semester	ACSS 158 (H)	Soil Fertility and Nutrient Management	1+1
4 th Semester	ACSS 256 (H)	Soil, Water and Plant Analysis	1+1

Agricultural Engineering

Semester	Course No.	Name of the course	Credits
1 st Semester	SOIL 111	Principles of Soil Science	1+1
2 nd Semester	CHEM 111	Engineering Chemistry	1+1

Agriculture

ACSS 103 Fundamentals of Soil Science I 2 (1+1)

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

ACSS 153 Fundamentals of Soil Science II 2 (1+1)

Theory

Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water– quality of irrigation water and its appraisal. Indian standard for water quality. Use of saline water for irrigation/agriculture. Different approaches for soil fertility evaluation, soil testing–chemical methods, critical levels of nutrients in soil and plants, DRIS method, biological method of soil fertility evaluation. Nutrient use efficiency.

Practical

Principles of analytical instruments and their calibration and applications, colorimetry and flame photometry. Estimation of available N, P, K, S and Zn in Soils, pH, EC, soluble cations and anions in Soil water extracts. Estimation of N, P, K, and S in plants. Rapid test

ACGP 203 Agricultural Microbiology 2(1+1)

Theory

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and sulphur cycles. Biological nitrogen fixation symbiotic,

associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation.

Practical

Introduction to microbiology laboratory and its equipment; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of Rhizobium from legume root nodule. Isolation of Azotobacter from soil. Isolation of Azospirillum from roots. Staining and microscopic examination of microbes.

ACSS 255 Manures, Fertilizers and Soil Fertility Management 3 (2+1)

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of available N in soils. Estimation of available P in soils. Estimation of available K. Estimation of available S in soils. Estimation of available Ca and Mg in soils. Estimation of available Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

ACSS 305 Problematic Soils and their Management 2(1+1)

Theory

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro eco systems.

Practical

pH, EC & ESP of the saturation extract of the saline soil. SAR & Gypsum requirement of sodic soils. Lime requirement and Gypsum requirement of problem soils. Parameters of quality of irrigation water. Determination of lime requirement of acid soils.

EC 261 Production and Use of Bio-fertilizers 3(2+1)

Theory

Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Practical

Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculum production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

EC 361 Agricultural Waste Management 3(2+1)

Theory

Introduction to agricultural waste management, Nature and characteristics of agricultural waste and their impact on the environment, Kinds of wastes, Classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality, Biological processes of waste management, Utilization and Recycling of Agricultural waste, Potential of Recyclable Crop Residues and its management, In-situ management of agriculture waste, Composting and Vermicomposting for bio conservation of biodegradable waste, Biogas Technology, Agricultural waste and water, air and animal resources, Impacts of waste on human, animal health and environment. Management of bedding & litter, wasted feed, run-off from feed lots and holding areas and waste water from dairy parlors, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

Practical

Collection and preparation agricultural waste sample. Determination of pH, EC, CECe, heavy metals, BOD, COD, TSS, TDS, NH_4 , Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Maintenance and safety hazards, computer software and models. Survey of different agri waste from live stock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals, Preparation of compost, Vermicomposting, biogas and analysis of compost.

EC 362 Deficiency and Toxicity of Elements in Soil, Plant and Water 3(2+1)

Theory

Introduction, Essential nutrients and their criteria. Classification of nutrients. List of nutrient and plant usable forms, Average concentration of nutrient elements in crops. Nutrient movement to plant roots. Growth Laws and approaches used in plant nutrition. Function of nutrients in plant. Evaluation of soil fertility and plant nutrition - Identification of nutrient deficiencies and toxicities, Plant analysis, Soil tests and critical levels of deficiencies, Nutrient management in intensive agriculture, Integrated nutrient management, Increasing nutrient use efficiency

Practical

Collection and preparation of soil samples. Estimation of pH, EC, Organic C, available N, P, K, S, Ca and Mg, Na and micronutrient and heavy metals viz. Pb, Cd, Ni etc. Plant sampling and sample preparation for analysis. Estimation of total C, N, P, K, S and micronutrient content in plant.

Horticulture

ACSS(H) 103: Fundamentals of Soil Science 2(1+1)

Theory

Composition of earth's crust, soil as a natural body – major components. Eluviations and alleviations formation of various soils. Physical parameters; texture – definition, methods of textural analysis, stock's law, assumption, limitations, textural classes, use of textural triangle; absolute specific gravity/particle density, definition, apparent specific gravity/bulk density – factors influencing, field bulk density. Relation between BD (bulk density), AD – practical problems. Pore space – definition, factors affecting capillary and non-capillary porosity, soil colour – definition, its significance, colour variable, value hue and chroma. Munsell colour chart, factors influencing, parent material, soil moisture, organic matter, soil structure, definition, classification, clay prism like structure, factors influencing genesis of soil structure, soil consistency, plasticity, Atterberg's constants. Soil air, air capacity, composition, factors influencing, amount of air space, soil air renewal, soil temperature, sources and distribution of heat, factors influencing, measurement, chemical properties, soil colloids, organic, humus, inorganic, secondary silicate, clay, hydrous oxides. Ion exchange, cation-anion importance, soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, PF scale, measurement, gravimetric – electric and tensiometer methods – pressure plate and pressure membrane apparatus – Neutron probe – soil water movement – classification – aerial photography – satellite of soil features – their interpretation; soil orders; land capability classification; soil of different eco-systems and their properties, Rock & Minerals classification, Pedogenic process. Objectives of soil science research institute in India (NBSS&LUP, ISSS, LTFE & NSSTL). Management of Soil Crusting, Soil Compaction and Soil Compression. Soil Biology benefits and harmful effects. Methods and objective of soil survey, Remote sensing application in soil and plant Studies, Soil degradation.

Practical

Collection and preparation of soil samples, estimation of moisture, EC, pH and bulk density. Textural analysis of soil by Robinson's pipette method. Description of soil profile in the field. Quantification of minerals and their abundance. Determination of Soil colour using Munsell Chart. Estimation of water

holding capacity and hydraulic conductivity of soils. Estimation of Infiltration rate using double ring infiltrometer method. Estimation of soil moisture using gypsum block and neutron probe method. Soil compaction measurement with Penetrometer. Determination of pore space of soil. Determination of field capacity and permanent wilting point of soil. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus. Aggregate size distribution analysis of soil. Air capacity of soil by field method.

ACGP(H) 107: Introductory Microbiology 2(1+1)

Theory

History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Microscopy and Specimen Preparation: The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association. Sterilization methods – Physical and chemical, Isolation of pure cultures and preservation of cultures, Plant growth promoting microorganisms and mushrooms – Economical importance, industrially important microorganisms in large scale production and common microbial fermentations. Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques.

Practical

Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plats, turbid metric estimation of microbial growth, mushroom culture- Spawn production, Culture and production techniques, harvesting, packing and storage.

ACSS(H) 158: Soil Fertility and Nutrient Management 2 (1+1)

Theory

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils – characteristics and management. Soil organic matter, Role of microorganisms in organic matter decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition, soil buffering capacity. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis. Plant nutrient toxicity symptoms and remedies measures. Soil test crop response and targeted yield concept. Biofertilizer. Nutrient use efficiency and management. Secondary and micronutrient fertilizer. Fertilizer control order. Manures and fertilizers classification and manufacturing process. Properties and fate of major and micronutrient in soils. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity.

Practical

Analysis of soil for organic matter, available N, P, K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils. Estimation of organic carbon content in soil. Determination of Boron and chlorine content in soil. Determination of Calcium, Magnesium and Sulphur in soil. Sampling of organic manure and fertilizer for chemical analysis. Physical properties of organic manure and fertilizers. Total nitrogen in urea and farmyard manure. Estimation of ammoniacal nitrogen and nitrate nitrogen in ammoniacal fertilizer. Estimation of water soluble P₂O₅, Ca and S in SSP, Lime and Gypsum. Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate. Visiting of fertilizer testing laboratory.

ACSS(H) 256: Soil, Water and Plant Analysis 2(1+1)

Theory

Methods of soil and plant sampling and processing for analysis. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential. Use of radio tracer techniques in soil fertility evaluation. Soil microorganisms and their importance. Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis values Quality of irrigation water. Radio tracer technology application in plant nutrient studies. Rapid tissue tests for soil and plant. Management of poor-quality irrigation water in crop management. Soil and Water pollution.

Practical

Introduction to analytical chemistry, Collection and preparation of soil, water and plant samples for analysis. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils. Estimation of available macro and micronutrient elements in soils and their contents in plants. Irrigation water quality analysis. Determination of pH and EC in irrigation water samples, Determination of Carbonates and bicarbonates in soil and irrigation water, Determination of Calcium and Magnesium in soil and irrigation water. Determination of N, P, K, Ca, Mg, S and micronutrients in plant samples. Determination of Sodium, Potassium, Chlorine and Boron in irrigation water.

Agricultural Engineering

CHM-111 Engineering Chemistry 2(1+1)

Theory

Phase rule and its application to one and two component systems. Fuels: classification calorific value. Colloids: classification. properties. Corrosion: causes. types and method of prevention. Water: temporary and permanent hardness. disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion. Analytical methods like thermo- gravimetric, nuclear radiation, and analytical applications of radioactive materials. Enzymes and their use in the manufacturing of ethanol and acetic acid by fermentation methods. Lubricants: properties. mechanism. classification and tests. Introduction to IR spectroscopy.

Practical

Determination of temporary and permanent hardness of water by EDTA method: Estimation of chloride in water: Estimation of dissolved oxygen in water: Determination of BOD in water sample: Determination of COD in water sample: Estimation of available chlorine in bleaching powder:

Determination of viscosity of oil: Estimation of activity of water sample: Estimation of alkalinity of water sample: Determination of carbonate and non- carbonate hardness by soda reagent: Determination of coagulation of water and chloride ion content: Determination of V_{max} and verification of Beer Lambert Law: Determination of calorific value of fuel.

SOIL-111 Principles of Soil Science 2(1+1)

Theory

Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, important soil physical properties; and their importance; soil particle distribution; soil inorganic colloids – their composition, properties and origin of charge; ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acidic, saline and sodic soils; quality of irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils. Use of saline and sodic water for crop production, Gypsum requirement for reclamation of sodic soils and neutralising RSC; Liquid fertilisers and their solubility and compatibility.

Practical

Identification of rocks and minerals; Collection of Soil Sample; Determination of bulk density; particle density and porosity of soil; Determination of organic carbon of soil; Determination of Nitrogen, Determination of Phosphorus and Determination of Potassium; Determination of gypsum requirement of sodic soils; Determination of water quality parameters.