

Syllabus For B Sc (Ag)

DEPARTMENT OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Course Code	Course Title	Credit Hours
AG-103	Fundamentals of Soil Science	3(2+1)
AG-202	Fundamentals of Plant Biochemistry	3(2+1)
AG-304	Agricultural Microbiology	2(1+1)
AG-404	Problematic Soils and their Management	2(1+1)
AG-511	Geo-Informatics, Nano Technology	2(1+1)
AG-603	Manures, Fertilizers and Soil Fertility Management	3(2+1)

**SOIL SCIENCE & AGRICULTURAL CHEMISTRY**

**1. Fundamentals of Soil Science**

**3(2+1)AG-103**

**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 of soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange problem and plant growth. Soil temperature; source, amount and flow of heat in soil: effect on plant growth. Soil reaction-pH, EC, 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; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties. Soil pollution-behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

**Suggested books**

Subject	Books	Authors name	Publishers
Fundamental of soil science (AG-103). 3(2+1)	1. Introductory Soil Science 2. A Text book of Soil Science 3. Fundamental of soil science	1. D.K. Das 2. T.D. Vishwash and Mukherjee 3. H.D. Foth 4. V.N. Sahai 5. V.N. Sahai	1. Kalyani Publishers 2. Tata McGraw Hill Publishing Company 3. Willey 4. Kalyani

	4. Soil At A Glance 5. Fundamental of soil science 6. Fundamental of soil science	6. ISSS	Publishers 5. Kalyani Publishers 6. ISSS
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### 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 method. Determination of soil pH and electrical conductivity. Study of soil map. Estimation of organic matter content of soil. Estimation of  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$  in soil water.

### 2. Agricultural Microbiology

2(1+1) AG-304

#### Theory

Introduction of 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 a symbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: biofertilizers, biopesticides, biofuel production and biodegradation. Microbial degradation of organic matter in soil. Cellulose decomposing microbes for compost preparation & vermicompost. Soil organisms: macro and micro organisms, their beneficial and harmful effects.

#### Suggested books

Subject	Books	Authors name	Publishers
Agriculture microbiology (AG-304), 2(1+1)	1. Soil microbiology 2. Agriculture microbiology 3. Agriculture microbiology	1. N.S. Subbarao 2. G. Rangaswami and D.J. Bagyaraj 3. R.P. Pareek	1. Science Publishers 2. Prentice Hall India Learning pvt. ltd. 3. Scientific Publishers

## Practical

Introduction to microbiology laboratory and its equipments; principles of microscopy. 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. Isolation of BGA. Staining and microscopic examination of microbes.

## 3. Fundamentals of Plant Biochemistry

3(2+1) AG-202

### Theory

Biochemistry-introduction, scope and Importance in agriculture. Carbohydrate: Importance and classification of Monosaccharides, Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; lipids. Proteins: Importance of proteins and classification; Structures. Amino acid-definition, classification and important function. Structural organization of proteins. Enzymes: Classification; General properties; and their mechanism of action; Introduction to allosteric enzymes. Vitamin; classification, structure, role and its deficiency symptoms. Nucleic acids: Importance and classification; Structure of Nucleotides. Metabolism of carbohydrates.

### Suggested books

Subject	Books	Authors name	Publishers
Fundamental of plant Biochemistry(AG-202), 3(2+1)	1. Fundamental of plant Biochemistry and Biochemistry 2. Fundamental of plant Biochemistry and Biochemistry 3. Fundamental of Biochemistry	1. N.K.Gupta 2. Rajan Katoch 3. AC Deb	1. Kalyani Publishers 2. Kalyani Publishers 3. NCBA

## Practical

Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/proteins. Titration methods for estimation of amino acids/lipids, Paper chromatography Monosaccharides. Estimation of Ca, CaO and CaCO<sub>3</sub> in HCl extract. Estimation of reducing and non reducing in cane sugar and jaggary.

## 4. Manures, Fertilizers and Soil Fertility Management

3(2+1) AG-603

### Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers and 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.

### Suggested books

Subject	Books	Authors name	Publishers
Manure and fertilizer and Fertility management (603), 3(2+1)	1. A Handbook of Soil, Fertilizer and Manure 2. Soil Fertility and fertilizer 3. Biofertilizer and organic farming 4. Manures and fertilizer	1. P.K. Gupta 2. Samuel L. Tisdale and Nelson 3. Himadri Panda and Dharamvir Hota 4. A K Koyal	1. Agribios 2. PHI Learning Publishers 3. Gene-Tech Book 4. Atlantic

### Practical

Estimation of soil organic carbon, Estimation of available N available P, available K; available S available Ca and Mg and available Zn in soils. Estimation of N, P & K in plants, manures and fertilizers. Elementary idea of determination micro nutrients.

### 5. Problematic Soils and their Management (New) Theory

2(1+1) AG-404

Soil quality and health, Distribution of Waste land and problematic 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 problematic soils. Multipurpose tree species, bio remediation through MPTs of soils. land capability and classification, land suitability classification. Problematic soils under different Agroecosystems.

#### Suggested books

Subject	Books	Authors name	Publishers
Problematic soil and their management (AG-404),2(1+1)	1. Introductory Soil Science 2. Fundamental of soil science 3. Fundamental of soil science	1. D.K. Das 2. V.N. Sahai 3. ISSS	1. Kalyani Publishers 2. Kalyani Publishers 3. ISSS

### Practical

Determination of pH & EC in soil and water. Lime and gypsum requirement in soil, ESP and SAR in Soils. Application of remote sensing and GIS in delineating problematic soil in LIP. Visit problematic soil in U.P.

### 6. Geo-informatics and Nano-technology

2(1+1) AG-511

#### Theory

Geo-informatics- definition concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies: Spatial data and their management in GIS;

Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors. Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

### Suggested books

Subject	Books	Authors name	Publishers
Geo-informatics and Nano technology (AG-511), 2(1+1)	1. Principles of Geo-informatics 2. Geo-informatics and Nano technology	1. P.K. Garg 2. SR. Reddy	1. Khanna book Publishing 2. Kalyani Publishers

### Practical

Introduction to GIS software, Introduction to image processing software. Visual interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

## ELECTIVE COURSES

### 1. Agrochemicals

3(2+1) AGE-52

#### Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health. merits and demerits of their uses in agriculture. management of agrochemicals for sustainable agriculture. Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Fungicides-Classification-Inorganic fungicides- characteristics, preparation and use of sulphur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carbox in, oxycarboxin, Metalaxyl, Carbendazim. Characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides

Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids. Biorationals. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feed stocks and Manufacturing of ammonium sulphate. ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility-preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

### Suggested books

Subject	Books	Authors name	Publishers
Agrochemicals 3(2+1) AGE-52	The Agrochemicals Handbook	Hartley & Douglas	-

### Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble P<sub>2</sub>O<sub>5</sub> and citrate soluble P<sub>2</sub>O<sub>5</sub> in single super phosphate. Estimation of potassium in-Murite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

## 2. Biopesticides & Biofertilizers

3(2+1) AGE-56

### Theory

History and concept of biopesticides. Importance. scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationals. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and

Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, 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. FCC 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.

### Suggested books

Subject	Books	Authors name	Publishers
<b>Biopesticides &amp; Biofertilizers</b> <b>3(2+1) AGE-56</b>	1. Hand book of biofertilizers and biopesticides	1. A M Deshmukh, R MKhobragade & P P Dixit	-
	2. Biofertilizers: Commercial production technology and quality control	2. Dr P Hyma	-
	3. Hand book of biofertilizers and biopesticides	3. Rajaram Choyal	-

### Practical

Isolation and purification of important biopesticides: Trichoderma, Pseudomonas, Bacillus, Metarhizium etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. 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.