Faculty of Agricultural Sciences (IAS)
Siksha 'O' Anusandhan, Deemed to be University

M. Sc. (Ag.) in Soil Science and Agricultural Chemistry

Programme Outcome:

- Enriched knowledge on recent developments in soil and crop management with respect to improvement and productivity, water and nutrient management and their interaction with integrated approach and the disease and pest management in integrated manner. The economic indices on package of practices develop and their transfer to farmers makes the students eligible for advanced studies at doctoral level.
- With specialized knowledge in a particular discipline of agricultural sciences, the students are worth to be absorbed in different fields of academics, research and extension under different organizations.
- Agriculture being the applied science, the skills as developed in the fields of crop improvement, crop production, crop protection and social science fields makes the students an asset for taking up the assignments both at organizational and field level.
- The knowledge, skill and expertise gained during the `study of course curriculum provides an opportunity to take up entrepreneurships holistically as a joint venture.

Programme Specific Objective:

- Agricultural soil science studies the chemical, physical, biological, mineralogical composition of soils, soil hydrology, soil ecology, soil genesis, fertilizer use, soil erosion, radioisotopes, soil conservation, crop studies and biofertilizers as they relate to agriculture.
- M.Sc. (Ag) in Soil Science and Agricultural Chemistry program aims at providing knowledge about developing sustainable and manageable agricultural production strategies.
- The program concentrates on soil significance and importance as well as sustainable resources.
- The broad study and examination help students to understand the soil structure, water crisis, contamination, pollution and changing climatic conditions, soil preservation and to bring out research on the applied and fundamental aspects of the chemical, physical

and biological properties of soil; manures and fertilizers and their communication with soil and plant; improvement and support of soil fertility maintenance at optimum level.

Programme Specific Outcomes:

- The M.Sc. (Ag) in Soil Science and Agricultural Chemistry program is intended to empower candidates to keep pace with recent developments in the concerned territories for present and future requirements.
- The course equips candidates with a strong establishment in soil development and sustainable agricultural production with proper practical exposure.
- An agricultural soil scientist may come up with a plan that can maximize production using sustainable methods and solutions.
- M.Sc.(Ag) in Soil Science and Agriculture Chemistry students have plenty of job offers, can get jobs in public and private organisations, environment consultancies, research establishments, commercial and industrial enterprises, higher education institutes as Soil Scientist, Professor, Soil Pedologist, Ecologist, Environmental Scientist, Geologist, Hydrologist, Scientific Laboratory Technician, Soil Conservation Technician and many more.

MAJOR COURSES

Soils 501 SOIL PHYSICS 2+1

Objective

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

Outcome

- Knowledge on soil physical properties and processes in relation to plant growth.
- Knowledge on soil water management with respect to crop growth.
- Techniques of analysing various physical properties of soil.

Soils 502 SOIL CHEMISTRY 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.

Outcome

• Theoritical informations about chemical properties and processes in relation to soil fertility and plant growth.

• Knowledge on chemistry of acid, salt affected and submerged soils and their management.

• Analysis of various chemical properties of soil, use of instruments.

Soils 503 SOIL, WATER AND AIR POLLUTION 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.

Outcome

• Knowledge on problem of soil, water and air pollution, their nature, estimation techniques for water quality, heavy metal etc.

• Knowledge on remediation of contaminated soils.

• Ability to conduct various qualitative and quantitative tests for waste samples collected from the locality

Soils 504 ANALYTICAL TECHNIQUES AND INSTRUMENTAL 0+2

METHODS IN SOIL AND PLANT ANALYSIS

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.

Outcome

• Working knowledge on the principles of commonly used instruments in the laboratory

• Practical exposure on preparations of common analytical reagents for qualitative and quantitative analysis of both soil and plant samples, electro-chemical tritartion of clays, analysis of soil extraction and irrigation water.

• Ability to analyse different essential nutrients in plant and soil samples

Soils 505 PLANT BIOCHEMISTRY 2 + 1

Objective

Detailed information about biochemical and molecular basis of various plant processes and plant growth regulatory substances.

Outcome

• Theoritical experience on biochemical and molecular basis of various plant processes and plant growth regulatory substances.

• Extraction and estimation of carbohydrates and aminoacids, ascorbic acid

• techniques of isolation and purification of enzymes, estimation of DNA and RNA.

• Practical excellence in determining the important biomolecules through different analytical methods.

Soils 506 SOIL FERTILITY AND FERTILIZER USE 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.

Outcome

• Knowledge on essential plant nutrients for soil fertility and its control, role of fertilizers and manures in supplying nutrients to plants .

• Evaluation soil fertility by using suitable methods and integrated nutrient management for fertilizer use efficiency.

• Analysis and recommendation some of the essential nutrients in soil and plants.

Soils 507 SOIL MINERALOGY, GENESIS, CLASSIFICATION AND SURVEY 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.

Outcome

• Knowledge on basic structure of alumino-silicate minerals and genesis of clay minerals in soils.

• Knowledge on soil formation, classification of soil, soils of India and soil profile study.

• Appraisal on soil survey and land capability classification.

Soils 508 RADIOISOTOPES IN SOIL AND PLANT STUDIES 1+1

Objective

To train students in the use of radioisotopes in soil and plant research

Outcome

• Knowledge on atomic structure, radioactivity and radioisotopes

• Appraisal on various radiation monitoring instruments and application of isotopes in various studies on soil and plant

• Practical experience in handling radioactive substances and using them for various experiments relating to soil fertility and water management

Soils 509 SYSTEM APPROACHES IN SOIL AND CROP STUDIES 2+1

Objective

To train the students in concepts, methodology, technology and use of systems simulation in soil and crops studies.

Outcome

• Brief knowledge on system concept, simulation models: its design and analysis

• Basic information on application of simulation models in understanding system behaviour for soil, crop studies and decision support system.

• Practical experience on use of simulation model programmes under different soil, water, nutrient, climatic and cultural conditions.

Soils 510 MANAGEMENT OF PROBLEM SOILS AND WATERS 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.

Outcome

• Knowledge about distribution, characterization and management of problem soils.

• Understanding the quality and standards of irrigation water and management of brackish water for improved irrigation.

• Estimation techniques of cations and anions in problematic soils and ground water, characterization on base of soil reaction and recommendation.

Soils 511 INTRODUCTION TO AGROCHEMICALS 2+1

Objective

To give an overview of pesticides with reference to their classification, structure, mode of action, synthesis and formulations and pesticide residue analysis.

Outcome

• Appraisal of students about agrochemicals, their type and role in agriculture, management of agrochemicals for sustainable agriculture.

• Knowledge of pesticides with reference to their classification, structure, mode of action, synthesis and formulations and pesticide residue analysis.

• Testing of common pesticides and herbicides.

Soils 512 SOIL EROSION AND CONSERVATION 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.

Outcome

• Understanding soil, water and wind erosion to conserve soil and water.

• Knowledge on soil erodibility indices and management of watersheds for conservation.

• Computation of kinetic energy of falling rain drops and rainfall erosivity index.

Soils 513 SOIL BIOLOGY AND BIOCHEMISTRY 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.

Outcome

• Understanding the basics of soil biology and biochemistry, including biogeochemical cycles, plant growth promoting rhizobacteria, microbial interactions in soil, plants and other soil activities.

• Knowledge on importance of biofertilizers and biodegradation of pesticides as an irreplaceable function of soil microorganisms.

• Determination of soil microbial population, soil microbial process and rhizosphere effect.

Soils 514 GEOMORPHOLOGY AND GEOCHEMISTRY 2+0

Objective

To impart knowledge about the landforms, physiography and morphology of the earth surface, and distribution and weathering elements in the earth crust.

Outcome

• A brief knowledge on geology and geochemistry, major and minor morphogenic and genetic landforms with special reference to India.

• Knowledge on methodology of geomorphology, weathering and erosion

• Learning the geochemistry of major and micronutrients and trace elements .

Soils 515 REMOTE SENSING AND GIS TECHNIQUES FOR SOIL, WATER AND CROP STUDIES 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.

Outcome

• Basic knowledge on fundamentals of remote sensing, different remote sensing equipment and their practical utility in relation to soil, water and crop studies.

• Hands-on skill on use of different remote sensing database and image processing softwares.

• Experience on handling of GIS software and GPS hardware for creating thematic maps.

Soils 516 LAND DEGRADATION AND RESTORATION 1+0

Objective

To impart knowledge related to various factors and processes of land degradation and their restoration techniques.

Outcome

• Knowledge on various factors and processes of land degradation

• Appraisal on different techniques of land restoration and conservation.

• Learning the methods of monitoring and mapping of land degradation

Soils 517 BIOFERTILIZER TECHNOLOGY AND USE 1+1

Objective

To familiarize the students and farmers with mass scale production of different agriculturally important microorganisms which are being used as biofertilizers for maintaining the soil and plant health for sustaining crop productivity and their importance in organic farming.

Outcome

• Knowledge on different groups of agriculturally important beneficial microorganisms to be used as biofertilizers

• Knowledge on microorganisms for recycling of organic waste, improving crop productivity , soil & plant health

• Learning the techniques for isolation of beneficial microorganisms to be used as biofertilizer and their production and quality control.

Soils 518 FERTILIZER TECHNOLOGY 1+0

Objective

To impart knowledge about how different fertilizers are manufactured using different kinds of raw materials and handling of fertilizers and manures.

Outcome

• Knowledge on manufacturing processes of fertilizers and their handling for maintenance of quality of the fertilizers as per fertilizer control order.

• Knowledge on Recent developments in secondary and micronutrient fertilizers

• Learning the modern techniques for production and use of slow and controlled release fertilizers, supergranules fertilizers and fertilizers for specific crops/situations.

MINOR COURSES

PP 503 PHYSIOLOGICAL AND MOLECULAR 2+1

RESPONSES OF PLANTS TO ABIOTIC STRESSES

Objective

To apprise the students regarding abiotic stress to plant and its molecular basis.

Outcome

• Knowledge on physiological and molecular responses to various abiotic stresses.

• Study of different physiological processes and molecular responses to stress.

• Measurement and screening of stress parameters and behaviour towards tolerance.

Agron 506 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 2+1

Objective

To study the principles and practices of organic farming for sustainable crop production.

Outcome

• Students can adopt the practices related to organic farming can demonstrate the preparation of organic formulations in crop, cropping systems and farming systems along with the procedure used for organic certification.

• Students will develop their skill to prepare organic products and their application.

• Develop skills through practical orientation to organic production technologies.

PP 510 MINERAL NUTRITION 2+1

Objective

To impart knowledge about physiological and molecular aspects of carbon reduction cycle and nitrogen assimilation

Outcome

• Mechanism of nutrient availability near the root, nutrient uptake by root cells and its transportation.

• Molecular mechanism of ion uptake functions and regulations.

• Physiological and molecular mechanisms underlying differential nutrient efficiency in crop genotypes and toxicity.

SUPPORTIVE COURSES

STAT-510 EXPERIMENTAL DESIGNS 2+1

Objective

This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Outcome

• It will enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

• The knowledge of design will significantly affect about pair-wise comparison of treatments.

• The inference about certain treatment from the pair-wise comparison will cost less with more output.

• Varietal development leads for job creation.

NON-CREDIT COMPULSORY COURSES

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Outcome

• Identify library services and availability of resources in order to develop a realistic overall plan for research to achieve a manageable focus appropriate to the assignment criteria, available resources, and evidence needed to support thesis.

• Identify keywords, synonyms and related terms in order to flexibly search information resources including: Internet, electronic library catalogs, and print materials

• Identify the range of information source types available (such as peer-reviewed journals, newspaper articles, books, reference sources, etc.), their distinguishing characteristics and intended audiences, in order to select those appropriate based on the information need.

• Identify the features and content of different research tools (such as databases, catalogs and websites) in order to search those most appropriate to the information need.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.

To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Outcome

• Develop skills that will enable to produce clear and effective scientific and technical documents.

• Use visual items in effectively constructing meaning in communication situations.

• Create clear, concise technical documents that effectively use style and grammar and information structure in ways that create meaning with the reader.

• Collaborate effectively in various writing situations, including planning, creating, and managing, evaluating, editing and revising document production

PGS 503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1+0

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Outcome

• Exposure to various types intellectual property rights.

• Idea on various acts and organization related to IPR.

• Knowledge on protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, and farmers rights.

PGS 504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 0+1

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Outcome

• A brief knowledge on the safety protocols to be followed in a laboratory and handling of various equipments present in the laboratory.

• Knowledge on preparations of several standard solutions, agro-chemical doses, buffers,etc for laboratory and field purposes.

• Testing the seed viability, pollen viability and description of flowering plants.

PGS 505 AGRICULTURAL RESEARCH, RESEARCH ETHICS 1+0

AND RURAL DEVELOPMENT PROGRAMMES

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Outcome

• By the end of this course scholars will be sensitize about the basic issues related with agricultural research, ethics in research as well as rural development.

• The scholars will be also educated about principles and philosophy of rural development and various ongoing rural and community development programmes and policies.

• Students will also be motivated towards practising and promoting ethics in

research and developmental endeavours.

PGS 506 DISASTER MANAGEMENT 1+0

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Outcome

• A brief knowledge on nature and effects of different natural disasters and their management

• Knowledge on different types of man-made disasters and their management

• Appraisal on different organizations involved in disaster management at national and global level

Course name	Course Code		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
Soil Physics	Soils 501*	CO1		✓				✓	✓	
		CO2		✓				✓	✓	
		CO3	✓		✓		✓			✓
Soil Chemistry	Soils 502*	CO1	✓	✓			✓			
		CO2		✓				✓	✓	
		CO3			✓					✓
Soil, Water and Air Pollution	Soils 503	CO1	✓	✓			✓			
		CO2		✓				✓	✓	
		CO3			✓					✓

Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	Soils 504	CO1		✓						✓
		CO2			✓			✓		✓
		CO3			✓					✓
Plant biochemistry	Soils 505	CO1	✓	✓			✓			✓
		CO2			✓				✓	
		CO3		✓			✓			✓
		CO4			✓					✓
Soil Fertility and Fertilizer Use	Soils 506*	CO1	✓	✓			✓			
		CO2		✓				✓	✓	
		CO3			✓				✓	✓
Soil Mineralogy, Genesis, Classification and Survey	Soils 507*	CO1	✓	✓			✓			
		CO2		✓	✓			✓	✓	
		CO3		✓						✓
Radioisotopes in soil and plant studies	Soils 508	CO1	✓	✓			✓			
		CO2		✓					✓	
		CO3			✓					✓

System Approaches In Soil and Crop Studies	Soils 509	CO1	✓	✓			✓			
		CO2		✓				✓		
		CO3			✓					✓
Management of Problematic Soils and Waters	Soils 510	CO1	✓	✓			✓			
		CO2		✓				✓	✓	
		CO3			✓					✓
Introduction to agrochemicals	Soils 511	CO1	✓	✓			✓			
		CO2		✓				✓		
		CO3			✓					✓
Soil Erosion and Conservation	Soils 512	CO1	✓	✓			✓			
		CO2		✓				✓		✓
		CO3			✓			✓		
Soil Biology and Biochemistry	Soils 513*	CO1	✓	✓			✓			
		CO2		✓				✓	✓	
		CO3			✓			✓		✓
Geomorphology and geochemistry	Soils 514	CO1	✓	✓			✓			
		CO2			✓			✓		✓
		CO3		✓					✓	
Remote Sensing and GIS Techniques for Soil and Crop Studies	Soils 515	CO1	✓	✓			✓			
		CO2			✓			✓		✓
		CO3	✓		✓		✓			✓

Land degradation and restoration	Soils 516	CO1		✓				✓		
		CO2	✓	✓			✓			✓
		CO3	✓		✓		✓			✓
Biofertilizer technology and use	Soils 517	CO1	✓	✓			✓	✓		
		CO2		✓	✓		✓	✓		
		CO3		✓					✓	✓
Fertilizer Technology	Soils 518	CO1	✓	✓	✓		✓			✓
		CO2		✓			✓		✓	
		CO3			✓		✓			✓
Physiological and Molecular responses of plants to Abiotic stresses	PP 503 (Minor)	CO1			✓				✓	
		CO2			✓				✓	
		CO3		✓		✓		✓		
Principles and Practices of Organic Farming	Agron 506 (Minor)	CO1			✓				✓	
		CO2		✓						✓
		CO3			✓				✓	
Mineral nutrition	PP- 510 (Minor)	CO1		✓						✓
		CO2			✓			✓		
		CO3			✓			✓		
Experimental Design	STAT-510 (supportive)	CO1			✓			✓		
		CO2			✓			✓		
		CO3		✓						✓
		CO1			✓			✓		

Library and Information Services	PGS 501	CO2			✓			✓		
		CO3			✓			✓		
		CO4			✓			✓		
Technical Writing and Communications Skills	PGS 502	CO1			✓			✓		
		CO2			✓			✓		
		CO3			✓			✓		
		CO4			✓			✓		
Intellectual Property and Its Management in Agriculture	PGS 503	CO1			✓			✓		
		CO2			✓			✓		
		CO3		✓						✓
Basic Concepts In Laboratory Techniques	PGS 504	CO1		✓			✓			
		CO2			✓					✓
		CO3			✓		✓			✓
Agricultural Research, Research Ethics and Rural Development Programmes	PGS 505	CO1			✓			✓		
		CO2		✓						✓
		CO3			✓			✓		
Disaster Management	PGS 506	CO1	✓	✓			✓			
		CO2		✓			✓			
		CO3			✓		✓			✓
Master's Seminar	Soils 591	CO1			✓		✓			
		CO2			✓		✓		✓	

Master's Research	Soils 599	CO1			✓		✓			
		CO2			✓		✓			

Mapping of COs vs. Employability/ Entrepreneurship/ Skill development

Name of the Course	Course Code	Employability	Entrepreneurship	Skill development
Soil Physics	Soils 501	Y		Y
Soil Chemistry	Soils 502	Y		Y
Soil, Water and Air Pollution	Soils 503	Y		Y
Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	Soils 504	Y		Y
Plant biochemistry	Soils 505	Y		Y
Soil Fertility and Fertilizer Use	Soils 506	Y		Y
Soil Mineralogy, Genesis, Classification and Survey	Soils 507	Y		Y
Radioisotopes in soil and plant studies	Soils 508	Y		Y
System Approaches In Soil and Crop Studies	Soils 509	Y		Y
Management of Problematic Soils and Waters	Soils 510	Y		Y
Introduction to agrochemicals	Soils 511	Y		Y
Soil Erosion and Conservation	Soils 512	Y		Y
Soil Biology and Biochemistry	Soils 513	Y		Y
Geomorphology and geochemistry	Soils 514	Y		Y
Remote Sensing and GIS Techniques for Soil and Crop Studies	Soils 515	Y		Y
Land degradation and restoration	Soils 516	Y		Y
Biofertilizer technology and use	Soils 517	Y		Y
Fertilizer Technology	Soils 518	Y		Y
Physiological and Molecular responses of plants to Abiotic stresses	PP 503	Y		Y
Principles and Practices of Organic Farming	Agron 506	Y	Y	Y
Mineral nutrition	PP- 510	Y		Y

Experimental Design	STAT-510	Y		Y
Library and Information Services	PGS 501			Y
Technical Writing and Communications Skills	PGS 502			Y
Intellectual Property and Its Management in Agriculture	PGS 503	Y		Y
Basic Concepts In Laboratory Techniques	PGS 504	Y		Y
Agricultural Research, Research Ethics and Rural Development Programmes	PGS 505	Y		Y
Disaster Management	PGS 506	Y		Y
Master's Seminar	Soils 591			Y
Master's Research	Soils 599			Y