SCHEME & SYLLABUS

M. Sc. Ag. (Soil Science and Agriculture Chemistry)

Department of Agricultural Sciences

UISH

Sant Baba Bhag Singh University

2020

SANT BABA BHAG SINGH UNIVERSITY, KHIALA -1430030, JALANDHAR

Institute Name:	**UISH**
Department Name:	**Agricultural Sciences**
Programme Name:	**M.Sc. Ag. (Soil Science and Agriculture Chemistry)**
Number of Semetsers	**4**

Vision:

To develop skilled and efficient human resource in the field of Soil Science and Agriculture Chemistry for imparting education to students, undertaking appropriate research on crop and natural resource management on sustainable basis in the plains, extend knowledge and skill to the farmers.

Mission:

1. To achieve excellence in the curriculum planning pertaining to Soil Science and Agriculture Chemistry by periodically updating it in order to provide the students with sound technical knowledge.
2. To strengthen the research activities in Soil Science and Agriculture Chemistry by undertaking innovative and application oriented projects for the development of Agricultural and allied sectors.
3. To stimulate and nurture student's interest in Soil Science and Agriculture Chemistry and achieve their professional goals
4. To generate, disseminate, integrate and apply knowledge which is vital to society and to provide leadership and service to the nation.

Details of Programme Educational Objectives, Program Outcomes, Program Specific Outcomes

S. No.		Programme Educational Objective (PEO) (The Graduate/Undergraduate will….)
1	PEO1.	Train and develop scholars and promote research by providing students with contemporary concepts in various fields of Soil Science and Agriculture Chemistry.
	PEO2.	Generate knowledge through training in cognitive, affective, and psychomotor, which are necessary for productive scholarly research in a selected area of Soil Science and Agriculture Chemistry.
	PEO3	Acquire in-depth knowledge in area(s) of specialization.
	PEO4	Undertake independent research and present results in a coherent and comprehensive manner and hence enrich area(s) of scholarship.
2	**Programme Outcomes (PO) (At the end of Programme/Degree mentioned above , the graduates will be able to ……)**	
	PO1.	Specific knowledge of various branches specialized to their studies.
	PO2.	Detailed knowledge on the subject to improve the farmer's condition by their contributions.
	PO3	Detailed knowledge of soil physics, soil chemistry, soil microbiology, soil classification, soil fertility and fertilizers and importance of all sciences to the farmers.
	PO4	Use appropriate scientific and statistical methods and evaluations for decision making in various sectors of agriculture.
3	**Programme Specific Outcomes (PSO)**	
	PSO1.	Demonstrate use of written and oral communication skills.
	PSO2.	Understanding the basic concepts and theories and terminology of Soil Science and Agriculture Chemistry.
	PSO3	Undertake teaching, research and offer administrative and consultancy services to organizations.
	PSO4	Apply research and expertise in solving or suggesting solutions to problems in the agricultural industry

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S. No	Subject Code	Subject	Semester	Pages
1	AGR551*	Soil physics	**I**	**7-8**
2	AGR553*	Soil chemistry	**I**	**9-10**
3	AGR555*	Soil mineralogy, genesis, classification and survey	**I**	**11-12**
4	AGR557*	Soil biology and biochemistry	**I**	**13-14**
5	AGR559	Radioisotopes in soil and plant studies	**I**	**15-16**
6	AGR561	System approaches in soil and crop studies	**I**	**17-18**
7	AGR563	Management of problematic soils and water	**I**	**19-20**
8	AGR565	Fertilizer technology	**I**	**21**
9	AGR567	Land degradation and restoration	**I**	**22**
10	AGR569	Masters Research	**I**	**23**
11	MAT529	Experimental designs	**I**	**24-25**
12				
13	CSE551	Computer fundamentals and programming	**I**	**26**
14	AGR502	Agronomy of oilseed, fibre and sugar crops	**II**	**28-29**
15	AGR506	Dryland farming	**II**	**30-31**
	AGR550	Soil erosion and conservation	**II**	**32-33**
	AGR552	Soil, water and air pollution	**II**	**34-35**
16	AGR554*	Soil fertility and fertilizer use	**II**	**36-37**
17	AGR556	Geomorphology and geochemistry	**II**	**38**
18	AGR558	Remote sensing and GIS techniques for soil and crop studies	**II**	**39**
20	AGR560	Analytical techniques and instrumental methods in soil	**II**	**40**

		and plant analysis		
21	AGR500	Masters Research	**II**	**41**
22	BOT522	Intellectual property and its management in agriculture	**II**	**42**
23	AGR603	Masters Seminar*	**III**	**44**
24	AGR605	Masters Comprehensive	**III**	**44**
25	AGR601	Masters Research	**III**	**45**
26	EVS601	Disaster management	**III**	**46-47**
27	LIB501	Library and information services	**III**	**48-49**
28	AGR600	Masters Research	**IV**	**50**
29	AGR602	Technical writing and communications skills	**IV**	**51**
30	AGR604	Human rights and constitutional duties	**IV**	**52-53**
31	AGR606	Agriculture research, research, ethics and rural development programme	**IV**	**54-55**

*Compulsory for Master's program

List of Courses Offered

Sr. No	Subject Code	Subject	Credits	Semester
Major Courses				
1	AGR551*	Soil physics	**2+1**	**I**
2	AGR553*	Soil chemistry	**2+1**	**I**
3	AGR555*	Soil mineralogy, genesis, classification and survey	**2+1**	**I**
4	AGR557*	Soil biology and biochemistry	**2+1**	**I**
5	AGR559	Radioisotopes in soil and plant studies	**1+1**	**I**
6	AGR561	System approaches in soil and crop studies	**2+1**	**I**
7	AGR563	Management of problematic soils and water	**2+1**	**I**
8	AGR565	Fertilizer technology	**1+0**	**I**
9	AGR567	Land degradation and restoration	**1+0**	**I**
10	AGR569	Masters Research	**0+4**	**I**
11	AGR554*	Soil fertility and fertilizer use	**3+1**	**II**
12	AGR556	Geomorphology and geochemistry	**2+0**	**II**
13	AGR550	Soil erosion and conservation	**2+1**	**II**
14	AGR552	Soil, water and air pollution	**2+1**	**II**
15	AGR558	Remote sensing and GIS techniques for soil and crop studies	**2+1**	**II**
16	AGR560	Analytical techniques and instrumental methods in soil and plant analysis	**0+2**	**II**
17	AGR500*	Masters Research	**0+4**	**II**
18	AGR601*	Masters Seminar	**1+0**	**III**
19	AGR603*	Masters Comprehensive	**0+2**	**III**

20	AGR605*	Masters Research	**0+4**	**III**
21	AGR600*	Masters Research	**0+8**	**IV**
Minor Courses				
22	AGR502	Agronomy of oilseed, fibre and sugar crops	**2+1**	**II**
23	AGR506	Dryland farming	**2+1**	**II**
Supporting Courses				
24	MAT529	Experimental designs	**2+1**	**I**
25	LIB601	Library and information services	**0+1**	**III**
26	CSE551	Computer fundamentals and programming	**2+1**	**I**
Interdisciplinary Courses				
27	EVS601	Disaster management	**1+0**	**III**
28	BOT522	Intellectual property and its management in agriculture	**2+0**	**II**
29	AGR602	Technical writing and communications skills	**0+1**	**IV**
30	AGR604	Human rights and constitutional duties	**1+0**	**IV**
31	AGR606	Agriculture research, research, ethics and rural development programme	**1+0**	**IV**

*Compulsory for Master's program

M. Sc. Ag. (Soil Science and Agriculture Chemistry)
Course scheme

I. Theory Subjects

SEMESTER-I							
Sr. No.	**Subject Code**	**Type of Course**	**Subject Name**	**Credits (L:T:P)**	**Contact Hours (L:T:P)**	**Total Contact Hours**	**Total Credit Hours**
1	AGR551	CR	Soil physics	2:0:1	2:0:2	4	3
2	AGR553	CR	Soil chemistry	2:0:1	2:0:2	4	3
3	AGR555	CR	Soil mineralogy, genesis, classification and survey	2:0:1	2:0:2	4	3
4	AGR557	CR	Soil biology and biochemistry	2:0:1	2:0:2	4	3
5	AGR569	CR	Masters Research	0:0:4	0:0:8	8	4
6	MAT 529	SC	Experimental designs	2:0:1	2:0:2	4	3
7	CSE 551	SC	Computer fundamentals and programming	2:0:1	2:0:2	4	3

Total Contact hrs: 32
Total Credit Hours: 22

CR-Core Courses
SC- Supporting Courses

SEMESTER-II							
Sr. No.	**Subject Code**	**Type of Course**	**Subject Name**	**Credits (L:T:P)**	**Contact Hours (L:T:P)**	**Total Contact Hours**	**Total Credit Hours**
Theory Subjects							
1	AGR552	DSE	Soil, water and air pollution	2:0:1	2:0:2	4	3
2	AGR550	DSE	Soil erosion and conservation	2:0:1	2:0:2	4	3
3	AGR554	CR	Soil fertility and fertilizer use	3:0:1	3:0:2	5	4
4	AGR502	MC	Agronomy of oilseed, fibre and sugar crops	2:0:1	2:0:2	4	3
5	AGR506	MC	Dryland farming	2:0:1	2:0:2	4	3
6	AGR500	CR	Masters Research	0:0:4	0:0:8	8	4
7	BOT522	IC	Intellectual property and its management in agriculture	2:0:0	2:0:0	2	2

Total Contact hrs: 31
Total Credit Hours:22

CR-Core Courses
IC- Interdisciplinary Courses
DSE- Discipline Specific Elective
MC- Minor Courses

SEMESTER-III							
S No.	**Sub Code**	**Type of Course**	**Subject Name**	**Credits (L:T:P)**	**Contact Hours (L:T:P)**	**Total Contact Hours**	**Total Credit Hours**
Theory Subjects							
1	AGR563	DSE	Management of problematic soils and water	2:0:1	2:0:2	4	3
2	AGR603	CR	Masters Seminar	1:0:0	1:0:0	1	1
3	AGR605	CR	Masters Comprehensive	0:0:2	0:0:4	4	2
4	AGR601	CR	Masters Research	0:0:4	0:0:4	8	4
5	EVS601	IC	Disaster management	1:0:0	1:0:0	1	1
6	LIB601	SC	Library and information services	0:0:1	0:0:2	2	1

Total Contact hrs: 20
Total Credit Hours: 12

CR-Core Courses
IC- Interdisciplinary Courses
DSE- Discipline Specific Elective
SC- Supporting Courses

SEMESTER-IV							
S No.	**Sub Code**	**Type of Course**	**Subject Name**	**Credits (L:T:P)**	**Contact Hours (L:T:P)**	**Total Contact Hours**	**Total Credit Hours**
Theory Subjects							
1	AGR600	CR	Masters Research	0:0:8	0:0:16	16	8
2	AGR602	IC	Technical Writing and communications skills	0:0:1	0:0:2	2	1
3	AGR604	IC	Human rights and constitutional duties	1:0:0	1:0:0	1	1
4	AGR606	IC	Agriculture research, research, ethics and rural development programme	1:0:0	1:0:0	1	1

Total Contact hrs: 20
Total Credit Hours: 11

CR-Core Courses
IC- Interdisciplinary Courses

Semester	L	T	P	Contact hrs/wk	Credits	Training
1	12	0	20	32	22	
2	13	0	18	31	22	
3	4	0	16	20	12	
4	2	0	18	20	11	
Total	**31**	**0**	**72**	**103**	**67**	

CREDIT LOAD FOR MASTERS PROGRAM		
I	**MAJOR CREDITS**	**25**
II	**MINOR CREDITS**	**06**
III	**SUPPORTING**	**07**
IV	**INTERDISCIPLINARY CREDITS**	**06**
V	**MASTERS COMPREHENSIVE**	**02**
VI	**MASTERS RESEARCH**	**20**
TOTAL I to V		**45**
TOTAL		**46+ 20=66**

SEMESTER I

SEMESTER-I

Course Code	**AGR551**	
Course Title	**Soil Physics**	
Type of course	Theory and Practical	
L T P	2 :0:1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To teach the students about physical properties of soil and different processes involved in it.	
Course Outcomes	CO1	Upon completion of this course, student will be able to apply the knowledge about the various physical processes and properties
	CO2	Students will be able to understand soil structure-genesis, types, characterization and management soil structure
	CO3	Students will able to use various techniques used to analyze the physical properties.

Syllabus

Theory

UNIT I

Scope of soil physics and its relation with other branches of soil science, soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence, dispersion and workability of soils, soil compaction and consolidation, soil strength, swelling and shrinkage - basic concepts.

UNIT II

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 III

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. 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 VI

Infiltration, internal drainage and redistribution, evaporation, hydrologic cycle, field water balance, soil-plant-atmosphere continuum, hypotheses of soil water availability. Composition of soil air, renewal of soil air - convective flow and diffusion, measurement of soil aeration, aeration requirement for plant growth, soil air management. 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:

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

Recommended Books:

S. No	Name	Author(S)	Publisher
1.	Text Book of Soil Physics.	Saha A.K.	Kalyani publishers
2.	Principles of Soil Physics.	Lal R & Shukla MK.	Marcel Dekker.
3.	Soil Physics.	Oswal MC.	Oxford & IBH.

Course Code	AGR553	
Course Title	**Soil Chemistry**	
Type of course	Theory and Practical	
L T P	2: 0:1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To enable the students to understand the various processes occurred during chemical reactions in soil	
Course Outcomes	CO1	Describe the chemical (elemental) composition of the earth's crust and various chemical processes involved in soil
	CO2	Understand the ion exchange processes in soil, cation exchange- theories based on law of mass action
	CO3	Describe the chemistry of salt-affected soils and amendments and chemistry and electrochemistry of submerged soils.

Syllabus

UNIT I

Chemical (elemental) composition of the earth's crust. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. 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, electrometric properties of soil colloids, sorption properties of soil colloids, soil organic matter – characterization of organic matter, fractionation of soil organic matter and different fractions, clay-organic interactions.

UNIT II

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, Different approaches to describe cation exchange equilibria, law of mass action and solubility product, factors affecting cation exchange equilibria in soils, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

UNIT III

Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption, precipitation-dissolution equilibria, management aspects.Chemistry of acid soils and their management, active and potential acidity, lime potential, sub-soil acidity.

UNIT VI

Chemistry of salt-affected soils and amendments, soil pH, ECe, ESP, SAR and important relations, soil management and amendments. Chemistry and electrochemistry of submerged soils.

Practical:

1. Determination of CEC and AEC of soils.
2. Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh-pH meter and conductivity meter
3. Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method
4. Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm
5. Determination of titratable acidity of an acid soil by $BaCl_2$-TEA method
6. Determination of lime requirement of an acid soil by buffer method
7. Determination of gypsum requirement of an alkali soil.

Recommended Books:

S. No.	Name	Author(S)	Publisher
1	Soil Chemistry	Tolanur, Shivanandan	International Book Distributing Co. Lucknow
2	Introduction to Clay Colloid Chemistry.	Van Olphan H.	John Wiley & Sons.
3	Principles of Soil Chemistry	Tan, K.H.	John Wiley & Sons.

Course Code	AGR555	
Course Title	**Soil mineralogy, genesis, survey and classification**	
Type of course	Theory and Practical	
L T P	2:0:1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study fundamentals of soil mineralogy, genesis, survey and classification.	
Course Outcomes	CO1	Describe the identification techniques, amorphous soil constituents and other non-crystalline silicate minerals
	CO2	Understand the factors of soil formation, soil formation models and soil forming processes.
	CO3	Describe the soil survey and its types, soil survey techniques - conventional and modern

Syllabus

Theory

UNIT I

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.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 II

Factors of soil formation, soil formation models, soil forming processes, weathering of rocks and mineral transformations, soil profile, weathering sequences of minerals with special reference to Indian soils.Concept of soil individual, soil classification systems – historical developments and modern systems of soil classification with special emphasis on soil taxonomy, soil classification, soil mineralogy and soil maps–usefulness.

UNIT III

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, thematic soil maps, cartography, mapping units, techniques for generation of soil maps.

UNIT VI

Landform – soil relationship, major soil groups of India with special reference to respective states, land capability classification and land irrigability classification, land evaluation and land

use type (LUT) – concept and application, approaches for man aging soils and landscapes in the framework of agro-ecosystem.

Practical:

1. Identification and quantification of minerals in soil fractions
2. morphological properties of soil profile in different landforms
3. Classification of soils using soil taxonomy calculation of weathering indices and its application in soil formation
4. Grouping soils using available data base in terms of soil quality
5. Aerial photo and satellite data interpretation for soil and land use
6. Cartographic techniques for preparation of base maps and thematic maps; processing of field sheets
7. Compilation and obstruction of maps in different scales; land use planning exercises using conventional and RS tools.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Pedogenesis and Soil Taxonomy: II. The Soil Orders.	Wilding LP & Smeck NE.	Elsevier.
2	Pedology - Concepts and Applications.	Sehgal J.	Kalyani
3	Introductory Pedology: Concepts and Applications.	Sehgal J.	New Delhi

Course Code	AGR557	
Course Title	**Soil biology and biochemistry**	
Type of course	Theory and Practical	
L T P	2 : 0 : 1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study the physiochemical properties of soil and its microflora.	
Course Outcomes	CO1	Students will learn about the soil biota, soil microbial ecology, types of organisms in different soils and soil microbial biomass
	CO2	Students will know how the microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil takes place.
	CO3	Students will be able to understand the biodegradation of pesticides, organic wastes and their use for production of biogas and manures.

Syllabus

Theory

UNIT I

Soil biota, soil microbial ecology, types of organisms in different soils, soil microbial biomass, microbial interactions, un-culturable soil biota. 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, cycles of important organic nutrients.

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.Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost.

UNIT VI

Biofertilizers – definition, classification, specifications, method of production and role in crop production.

Practical

1. Determination of soil microbial population
2. Soil microbial biomass; elemental composition
3. Fractionation of organic matter and functional groups

4. Decomposition of organic matter in soil; soil enzymes
5. Measurement of important soil microbial processes such as ammonification; nitrification
6. N_2 fixation and S oxidation
7. P solubilization and mineralization of other micronutrients;
8. Study of rhizosphere effect.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Soil Biochemistry	Jenkinson,D.S. and Ladd,J.N.	Marcell Dekkar, New York
2	Principles and Applications of Soil Microbiology.	Sylvia DN.	Pearson Edu
3	Soil Biochemistry. Vol. VIII.	Stotzky G & Bollag JM.	Marcel Dekker.

Course Code	AGR559	
Course Title	**Radioisotopes in soil and plant studies**	
Type of course	Theory and Practical	
L T P	1 : 0 : 1	
Credits	2(1+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To familiarize the students about the different radioisotopes involved in soil and plant studies	
Course Outcomes	CO1	Students will learn about the atomic structure, radioactivity and units and radioisotopes
	CO2	Students will know how the principles and use of radiation monitoring instruments
	CO3	Students will be able to understand the Isotopic dilution techniques used in soil and plant research

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Theory

UNIT I

Atomic structure, radioactivity and units, radioisotopes - properties and decay principles, nature and properties of nuclear radiations, interaction of nuclear radiations with matter.

UNIT II

Principles and use of radiation monitoring instruments - proportional, Geiger Muller counter, solid and liquid scintillation counters, neutron moisture meter, mass spectrometry, auto radiography.

UNIT III

Isotopic dilution techniques used in soil and plant research, use of stable isotopes, application of isotopes in studies on organic matter, nutrient transformations, ion transport, rooting pattern and fertilizer use efficiency, carbon dating.

UNIT IV

Doses of radiation exposure, radiation safety aspects regulatory aspects, collection, storage and disposal of radioactive wastes

Practical

1. Storage and handling of radioactive materials
2. Determination of half life and decay constant
3. Preparation of soil and plant samples for radioactive measurements
4. Setting up of experiment on fertilizer use efficiency and cation exchange equilibria using radioisotopes
5. Determination of A, E and L values of soil using $^{32}P/^{65}Zn$
6. Use of neutron probe for moisture determination

7. Sample preparation and measurement of ^{15}N enrichment by mass spectrophotometery/emission spectrometry.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Introduction to Nuclear Techniques in Agronomy and Plant Biology	Peter B. Vose	Pergamon International Library of Science
2	Radioisotopes in biology and agriculture, principles and practice	Comar, C. L.	New York, McGraw-Hill

Course Code	AGR561	
Course Title	**System approaches in soil and crop studies**	
Type of course	Theory and Practical	
L T P	2 : 0 : 1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To familiarize the students with the concept of system, models and simulation of different models and evaluation in different aspects of agriculture	
Course Outcomes	CO1	Students will be aware about the systems concepts - definitions, general characteristics and general systems theory
	CO2	Students will be aware about the model, definition and types-empirical and mechanistic and mathematical models.
	CO3	Students will understand the application of simulation models in understanding system behavior.

Syllabus

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UNIT I

Systems concepts - definitions, general characteristics, general systems theory, systems thinking, systems dynamics, systems behavior and systems study.

UNIT II

Model, definition and types-empirical and mechanistic, mathematical models and their types, modeling, concepts, objectives, processes, simulation models, their verification and validation, calibration, representation of continuous systems simulation models - procedural

UNIT III

Simulation - meaning and threats, simulation experiment, its design and analysis.

UNIT IV

Application of simulation models in understanding system behavior, optimizing system performance, evaluation of policy options under different soil, water, nutrient, climatic and cultural conditions, decision support system, use of simulation models in decision support system.

Practical

1. Use of flow chart in the program writing
2. Writing a small example simulation model program
3. Conducting simulation experiments in DSSAT
4. Conducting simulation experiments in WOFOST
5. Conducting simulation experiments in EPIC with requirement of report and conclusion; computation of fertilizer equations using STCR Model.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Handbook of Agriculture	=======	Indian Council of Agricultural research (ICAR)
2	Principles and Practice of Soil Fertility and Nutrient Management	SS Rana	CSK HPKV, Palampur (India)

Course Code	AGR563	
Course Title	**Management of problematic soils and water**	
Type of course	Theory and Practical	
L T P	2 : 0 : 1	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study the physiochemical properties of different problematic soil and water and their management.	
Course Outcomes	CO1	Students will be know about the problem soils – acidic, saline, sodic and physically degraded soils
	CO2	Students will be aware about management of salt-affected soils, salt tolerance of crops-mechanism and ratings
	CO3	Students will understand the quality of irrigation water, management of brackish water for irrigation

Syllabus

Theory

UNIT I

Area and distribution of problem soils – ac idic, 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, Acid sulphate soils and their management, calcareous soils-problems and management and waterlogged soils-problems and 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

1. Characterization of acid, acid sulfate, salt-affected and calcareous soils
2. determination of cations (Na^+, K^+, Ca^{++} and Mg^{++}) in ground water and soil samples

3. determination of anions (Cl^-, SO_4^{--}, CO3--and HCO3-) in ground waters and soil samples
4. lime and gypsum requirements of acid and sodic soils.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Management of Problem Soils in Arid Ecosystems	A. Monem Balba	CRC Press
2	Management of Problem Soils Principles and Practices	Shrivastva VC	Agribios Publications

Course Code	AGR565	
Course Title	**Fertilizer technology**	
Type of course	Theory	
L T P	1 : 0 : 0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study about the different manufacturing processes, recent developments and new emerging issues in fertilizer technology.	
Course Outcomes	CO1	Students will understand the fertilizers production, consumption and future projections
	CO2	Students will be aware about manufacturing processes for different fertilizers using various raw materials
	CO3	Students will be know about the recent developments in secondary and micronutrient fertilizers and their quality

Syllabus

Theory

UNIT I

Fertilizers – production, consumption and future projections with regard to nutrient use in the country and respective states, fertilizer control order.

UNIT II

Manufacturing processes for different fertilizers using various raw materials, characteristics and nutrient contents.

UNIT III

Recent developments in secondary and micronutrient fertilizers and their quality control as per fertilizer control order.

UNIT IV

New and emerging issues in fertilizer technology – production and use of slow and controlled release fertilizers, supergranules fertilizers and fertilizers for specific crops/situations, fortified and customized fertilizers.

Recommended books:

S. No.	Name	Author(S)	Publisher
1	Fertilizers	RK Basak	Kalyani Publishers
2	Manures and Fertilizers	PC Das	Kalyani Publishers

Course Code	**AGR567**	
Course Title	**Land degradation and restoration**	
Type of course	Theory	
L T P	1 : 0 : 0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study about the different factors and processes involved in land degradation, restoration, conservation and their management.	
Course Outcomes	CO1	Describe the factors and processes of soil land degradation and its impact on soil productivity
	CO2	Understand the land restoration and conservation techniques in erosion control.
	CO3	Describe the extent, diagnosis and mapping of land degradation by conventional and modern RS-GIS tools

Syllabus

Theory

UNIT I

Type, factors and processes of soil land degradation and its impact on soil productivity, including soil fauna, biodegradation and environment.

UNIT II

Land restoration and conservation techniques - erosion control, reclamation of salt-affected soils, mine land reclamation, afforestation, organic products.

UNIT III

Extent, diagnosis and mapping of land degradation by conventional and modern RS-GIS tools, monitoring land degradation by fast assessment, modern tools, landuse policy, incentives and participatory approach for reversing land degradation, global issues for twenty first century, USLE equation and its importance

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Soil Degradation, Conservation and Remediation	Khan Towhid Osman	Springer
2	Assessment of Land Degradation	Kiran Kumari Singh	VDM Verlag

Course Code	**AGR569**	
Course Title	**Masters Research**	
Type of course	Practical	
L T P	0:0:4	
Credits	4(0+4)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To familiarize the students about the data collection, analyze data and interpretation.	
Course outcomes	CO1	This program will provide students the theoretical and research backgrounds necessary to design, implement, and manage different cropping system.
	CO2	Students will conduct field trials.
	CO3	Collect, summarize and interpret data.

Course Code	MAT529	
Course Title	**Experimental Designs**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To enable the students to understand the concepts involved in planning, designing their experiments and analysis of experimental data.	
Course outcomes	CO1	Valuate the suitability of the models treated in the course, for different experimental situations.
	CO2	Present the planning, implementation and analysis of a conducted experiment, in oral and written form.
	CO3	Analyse experimental data with suitable software.

Syllabus

Theory

UNIT-I

Need for designing of experiments, characteristics of a good design, basic principles of designs - randomization, replication and local control. Uniformity trials, analysis of variance and interpretation of data, transformations, orthogonality and partitioning of degrees of freedom.

UNIT-II

Completely randomized design, randomized block design and Latin square design, repeated Latin square design, analysis of covariance and missing plot techniques in randomized block and Latin square designs.

UNIT-III

Factorial experiments (symmetrical as well as asymmetrical), confounding in symmetrical factorial experiments, factorial experiments with control treatment.

UNIT-IV

Split plot and strip plot designs, crossover designs, balanced incomplete block design, lattice design-concepts, randomization procedure, analysis and interpretation of results, experiments with mixtures.

Practical

1. Analysis of data obtained from CRD, RBD, LSD.
2. Analysis of factorial experiments with and without confounding.
3. Analysis with missing data; balanced incomplete block design; split plot and strip plot designs.
4. Transformation of data.
5. Analysis of lattice design.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Design and Analysis of Experiments.	RA Fisher	Oliver & Boyd.
2	Handbook on Analysis of Agricultural Experiments	AK Nigam & VK Gupta	IASRI Publication

Course Code	CSE551	
Course Title	**Computer fundamentals and programming**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To impart comprehensive knowledge about the computer fundamentals and programming	
Course outcomes	CO1	Bridge the fundamental concepts of computers with the present level of knowledge of the students.
	CO2	Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet.
	CO3	Understand how logic circuits and Boolean algebra forms as the basics of digital computer.

Syllabus

Theory

UNIT-I

Computer fundamentals-number systems, decimal, octal, binary and hexadecimal, representation of integers, fixed and floating point numbers, character representation, ASCII, EBCDIC. Functional units of computer, I/O devices, primary and secondary memories.

UNIT-II

Programming fundamentals with C - algorithm, techniques of problem solving, flowcharting, stepwise refinement, representation of integer, character, real, data types, constants and variables, arithmetic expressions, assignment statement, logical expression.

UNIT-III

Sequencing, alteration and iteration, arrays, string processing.

UNIT-IV

Sub-programs, recursion, pointers and files. Program correctness, debugging and testing of programs.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Digital logic and computer design	MM Mano	Prentice Hall of India
2	Digital computer electronics	AP Malvino & JA Brown	Tata McGraw Hill

SEMESTER II

SEMESTER-II

Course Code	**AGR502**	
Course Title	**Agronomy of oilseed, fibre and sugar crops**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To teach the crop husbandry of oilseed, fibre and commercial crops.	
Course outcomes	CO1	Planning, seedbed preparation and layout of field experiments.
	CO2	To understand the different growth stages of crop, Intercultural operation in different crops.
	CO3	Estimation of crop yield on the basis of yield attributes.

Syllabus

Theory

UNIT-I

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, nutrition**,** water and cultural requirements, quality components, post-harvest handling and processing of *Kharif* oilseeds - Groundnut, sesame, castor, sunflower, soybean, etc.

UNIT-II

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, nutrition**,** water and cultural requirements, quality components, post-harvest handling and processing of *Rabi* oilseeds – Rapeseed and mustard, linseed, safflower , etc.

UNIT-III

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, nutrition**,** water and cultural requirements, quality components, post-harvest handling and processing of Fiber crops - Cotton, jute, sunhemp, etc.

UNIT-IV

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, nutrition**,** water and cultural requirements, quality components, post-harvest handling and processing of Sugar crops – Sugar-beet and sugarcane.

Practical

1. Phenological studies of important crops
2. Familiarization with planting and growing techniques of sugarcane
3. Estimation of crop yield on the basis of yield attributes

4. Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; computation of growth indices (LER, CGR, RGR, NAR, LAD)
5. Aggressivity; relative crowding coefficient, monetary yield advantage and area-time equivalent ratio (ATER) of prominent intercropping systems
6. Estimation of quality parameters of various crops
7. Planning of field experiments on cultural, fertilizer, weed control and water management aspects
8. Layout of field experiments; intercultural operations in different crops; computation of cost of cultivation of different crops
9. Visit to nearby villages for identification of constraints in crop production

Recommended books:

S. No	Name	Author(S)	Publisher
1	Principles of crop production	SR Reddy	Kalyani publishers
2	Text Book of Field Crop Production	Rajendra Prasad	ICAR
3	Modern Techniques of Raising Field Crops	Chhidda Singh., Prem Singh and Rajbir Singh	Oxford & IBH Publishing Co., New Delhi

Course Code	AGR506	
Course Title	**Dryland farming**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To teach the basic concepts and practices of dryland farming and soil moisture conservation	
Course outcomes	CO1	Understanding of mid season contingent crop plan for aberrant weather conditions.
	CO2	Study of anti-transpirants and their effect on crops.
	CO3	Study of moisture stress effects and recovery behavior of important crops.

Syllabus

Theory

UNIT-I

Definition, concept and characteristics of dry land farming areas/regions, dry land versus rainfed farming, significance and dimensions of dry land farming in Indian agriculture.

UNIT-II

Soil and climatic parameters with special emphasis on rainfall characteristics, constraints of crop production in dry land areas, types of drought, characterization of environment for water availability, contingent crop planning for erratic and aberrant weather conditions.

UNIT-III

Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies, preparation of appropriate crop plans for dry land areas, mid season contingent crop plan for aberrant weather conditions.

UNIT-IV

Tillage, tilth, frequency and depth of cultivation, compaction with soil tillage, concept of conservation tillage, tillage in relation to weed control and moisture conservation, techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics), anti-transpirants, soil and crop management techniques, seeding and efficient fertilizer use for increasing water use efficiency. Watershed- concept, resource management, problems, approach and components.

Practical

1. Seed treatment, seed germination and crop establishment in relation to soil moisture contents
2. Moisture stress effects and recovery behaviour of important crops; estimation of moisture index and aridity index
3. Spray of anti-transpirants and their effect on crops

4. Collection and interpretation of data for water balance equations; methods of increasing water use efficiency
5. Preparation of crop plans for different drought conditions
6. Study of field experiments relevant to dryland farming
7. Visit to watershed projects

Recommended books:

S. No	Name	Author(S)	Publisher
1	Principles of agronomy	Reddi and Reddy	Kalyani publishers
2	Principles of agronomy	SR Reddy	Kalyani publishers
3	Dryland Agriculture	SC Panda	Kalyani publishers

Course Code	AGR550	
Course Title	**Soil erosion and conservation**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	1. To teach the basic concepts of soil erosion and its management. 2. To learn about the soil conservation practices and watershed management.	
Course outcomes	CO1	Students will be aware about the concept, causes factors affecting erosion and its management strategies.
	CO2	Students will understand Watershed management - concept, objectives and its approach and also Socioeconomic aspects of watershed management.
	CO3	Students will be familiarized about the role of remote sensing in assessment and planning of watersheds.

Syllabus

Theory

UNIT-I

History, distribution, identification and description of soil erosion problems in India. 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-II

Wind erosion- types, mechanism and factors affecting wind erosion, extent of problem in the country. Principles of erosion control, erosion control measures – agronomical and engineering, erosion control structures - their design and layout.

UNIT-III

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-IV

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

1. Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio and raindrop erodibility index.
2. Computation of kinetic energy of falling rain drop.
3. Computation of rainfall erosivity index using rain gauge data.
4. Visits to a watershed.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Soil erosion and conservation	RPC Morgan	Wiley Blackwell
2	Principles and Practices of Agronomy	Balasubramaniyna	Agribios
3	Principles of Agronomy	SR Reddy	Kalyani publishers

Course Code	AGR552	
Course Title	**Soil, water and air pollution**	
Type of course	Theory and Practical	
L T P	2:0:2	
Credits	3(2+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To teach the basic concepts of pollution problems associated with agriculture.	
Course outcomes	CO1	Students will understand about the concept, causes factors affecting air pollution.
	CO2	Students will understand the procedures to determine the chemical and biochemical oxygen demand, nutrients and heavy metals that are being polluting our environment.
	CO3	Students will learn about the management of pollution.

Syllabus

Theory

UNIT-I

Soil, water and air pollution problems associated with agriculture, nature and extent. 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-II

Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings, soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms.

UNIT-III

Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil, emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

UNIT-IV

Remediation/amelioration of contaminated soil and water, remote sensing applications in monitoring and management of soil and water pollution.

Practical

1. Sampling of sewage waters; sewage sludge, solid/liquid industrial wastes, polluted soils and plants
2. Estimation of dissolved and suspended solids, chemical oxygen demand (COD) and biological oxygen demand (BOD)
3. Estimation of nitrate and ammonical nitrogen and phosphorus
4. Estimation of heavy metal content in effluents

5. Estimation of heavy metals in contaminated soils and plants.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Environmental pollution and control	NH Gopaldutt	Neelkamal
2	Pollution causes and control	RM Harrson	RSC Publishing

Course Code	AGR554	
Course Title	**Soil fertility and fertilizer use**	
Type of course	Theory	
L T P	3 : 0 : 2	
Credits	4(3+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	• To familiarize the students about the soil fertility and productivity. • To study about the different mechanisms occurred in various nutrient transformations, their availability and different fertilizer technologies	
Course Outcomes	CO1	Describe the soil fertility and soil productivity, nutrient sources
	CO2	Understand soil and fertilizer nitrogen – sources, forms and various processes involved.
	CO3	Describe fertilizer use efficiency and blanket fertilizer recommendations

Syllabus

Theory

UNIT I

Soil fertility and soil productivity, nutrient sources – fertilizers and manures, essential plant nutrients – functions and deficiency symptoms, laws of soil fertility.

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, leaf colour chart for N recommendations

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. Sulphur - source, forms, fertilizers and their behavior in soils, calcium and magnesium– facto rs affecting their availability in soils, management of sulphur, calcium and magnesium fertilizers.

UNIT V

Micronutrients – critical limits in soils and plants, factors affecting their availability and correction of their deficiencies in plants, role of chelates in nutrient availability. : Common soil test methods for fertilizer recommendations, quantity intensity relationships, soil test crop response correlations and response functions.

UNIT VI

Fertilizer use efficiency, blanket fertilizer recommendations – usefulness and limitations, site-specific nutrient management,plant need based nutrient management,integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests, soil quality in relation to sustainable agriculture.

Practical

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

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Soil fertility and Fertilizer Use	SS Rana	CSK HPKV, Palampur (India)
2.	Fertilizer Technology and Management	Brahma Mishra	I K International Publishing House
3.	Soil Fertility and Fertilizers: An Introduction to Nutrient Management	John L. Havlin and Samuel L. Tisdale	Tata McGraw Hill

Course Code	**AGR556**	
Course Title	**Geomorphology and geochemistry**	
Type of course	Theory	
L T P	2 : 0 : 0	
Credits	2(2+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To study about the different methodologies in geomorphology and geochemistry and their applications.	
Course Outcomes	CO1	Students will be acquainted about the general introduction to geology and geochemistry
	CO2	Students will be know about the methodology of geomorphology, its agencies, erosion and weathering
	CO3	Students will understand the geochemical classification of elements,

Syllabus

Theory

UNIT I

General introduction to geology and geochemistry, major and minor morphogenic and genetic landforms, study of schematic landforms and their elements with special reference to India.

UNIT II

Methodology of geomorphology, its agencies, erosion and weathering, soil and physiography relationships, erosion surface of soil landscape.

UNIT III

Geochemical classification of elements, geo-chemical aspects of weathering and migration of elements, geochemistry of major and micronutrients and trace elements.

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Geochemistry	William M. White	Wiley Blackwell
2	Textbook of Geology	G.B. Mahapatra	CBS Publishers and Distributers Pvt. Ltd

Course Code	**AGR558**
Course Title	**Remote sensing and GIS techniques for soil and crop studies**
Type of course	Theory and Practical
L T P	2:0:1
Credits	3(2+1)
Course prerequisite	B.Sc. (Agriculture)
Course Objectives	To teach the basic concepts of geological information system (GIS), remote sensing and their applications in agriculture

Syllabus

Theory

UNIT I

Introduction and history of remote sensing, sources, propagation of radiations in atmosphere, interactions with matter. Sensor systems - camera, microwave radiometers and scanners, fundamentals of aerial photographs and image processing and interpretations.

UNIT II

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 III

Significance and sources of the spatial and temporal variability in soils, variability in relation to size of sampling, classical and geo-statistical techniques of evaluation of soil variability. Introduction to GIS and its application for spatial and non-spatial soil and land attributes.

Practical

1. Familiarization with different remote sensing equipments and data products
2. Interpretation of aerial photographs and satellite data for mapping of land resources
3. Analysis of variability of different soil properties with classical and geostatistical technique
4. Creation of data files in a database program; use of GIS for soil spatial simulation and analysis
5. To enable the students to conduct soil survey and interpret soil survey reports in terms of land use planning.

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Remote Sensing and GIS	Basudeb Bhatta	Oxford
2.	Fundamentals of Remote Sensing	George Joseph and C. Jeganathan	Universities Press

Course Code	**AGR560**	
Course Title	**Analytical techniques and instrumental methods in soil and plant analysis**	
Type of course	Theory and Practical	
L T P	0:0:2	
Credits	2(0+2)	
Course prerequisite	B.Sc. (Agriculture)	
Course Objectives (CO)	To teach the various analytical techniques and instrumental methods in soil and plant analysis .	
Course Outcomes	CO1	Students will be acquainted about preparation of solutions for standard curves and analytical reagents
	CO2	Students will be know about the principles of visible, ultraviolet and infrared spectrophotometery
	CO3	Students will understand the electrochemical titration of clays

Syllabus

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

Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium, estimation of phosphorus, ammonium and potassium fixation capacities of soils.

UNIT III

Principles of visible, ultraviolet and infrared spectrophotometery, 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 IV

Electrochemical titration of clays, determination of cation and anion exchange capacities of soils, estimation of exchangeable cations (Na, Ca, Mg, K), estimation of root cation exchange capacity.

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Manual On Soil, Plant And Water Analysis	Dhyan Singh	Aone publishers
2	Practical Manual of elements of Soil Science	JS Sawhney, US Sadana and HS Jassal	Department of Soil Science, PAU, Ludhiana

MASTER'S RESEARCH

Course Code	**AGR500**	
Course Title	**Masters Research**	
Type of course	Practical	
L T P	0:0:4	
Credits	4(0+4)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To familiarize the students about the data collection, analyze data and interpretation.	
Course outcomes	CO1	This program will provide students the theoretical and research backgrounds necessary to design, implement, and manage different cropping system.
	CO2	Students will conduct field trials.
	CO3	Collect, summarize and interpret data.

Course Code	BOT522	
Course Title	Intellectual property and its management in agriculture	
Type of course	Theory	
L T P	2:0:0	
Credits	2(2+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	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.	
Course outcomes	CO1	Students will be aware about of intellectual property right.
	CO2	Students will get aware about the protection of various types of intellectual properties.
	CO3	Students will be aware about international treaty on plant genetic resources for food and agriculture.

Syllabus

Theory

UNIT-I

Historical perspectives and need for the introduction of Intellectual Property Right regime. TRIPs and various provisions in TRIPS Agreement. Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs.

UNIT-II

Indian Legislations for the protection of various types of Intellectual Properties. Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection

UNIT-III

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection. National Biodiversity protection initiatives. Convention on Biological Diversity.

UNIT-IV

International Treaty on Plant Genetic Resources for Food and Agriculture. Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Law related to intellectual property	Dr. B.L. Wadehra	Universal law publishing
2	Law relating to intellectual property rights	V.K. Ahuja	Universal law publishing

SEMESTER III

SEMESTER-III

MASTER'S SEMINAR

Course Code	**AGR603**	
Course Title	**Masters Seminar**	
Type of course	Theory	
L T P	1:0:0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To familiarize the students about their way of presentation, collection of data for thesis.	
Course outcomes	CO1	Students will demonstrate the ability to collaborate with others as they work on intellectual projects (reading, writing, speaking, researching...).
	CO2	Students will demonstrate the ability to follow discussions, oral arguments, and presentations, noting main points or evidence and tracking threads through different comments.
	CO3	Further, students will be able to challenge and offer substantive replies to others' arguments, comments, and questions, while remaining sensitive to the original speaker and the classroom audience.

MASTER'S COMPREHENSIVE

Course Code	**AGR605**	
Course Title	**Masters Comprehensive**	
Type of course	Practical	
L T P	0:0:2	
Credits	2(0+2)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To understand the basic knowledge of the discipline.	
Course outcomes	CO1	It will improve strong analytical, problem-solving and critical thinking abilities
	CO2	Depth knowledge of the discipline.
	CO3	Ability to communicate knowledge of the discipline

MASTER'S RESEARCH

Course Code	**AGR601**	
Course Title	**Masters Research**	
Type of course	Practical	
L T P	0:0:4	
Credits	4(0+4)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To familiarize the students about the data collection, analyze data and interpretation.	
Course outcomes	CO1	This program will provide students the theoretical and research backgrounds necessary to design, implement, and manage different cropping system.
	CO2	Students will conduct field trials.
	CO3	Collect, summarize and interpret data.

Course Code	EVS601	
Course Title	**Disaster Management**	
Type of course	Theory	
L T P	1:0:0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To study about the natural disaster and their management.	
Course outcomes	CO1	Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels.
	CO2	Capacity to obtain, analyse, and communicate information on risks, relief needs.
	CO3	Lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Syllabus

Theory

UNIT-I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT-II

Man-made disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, field fires-burning of straw, stables and residues oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT-III

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements;

UNIT-IV

Role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Disaster management future challenges and opportunity	Jagbir Singh	IK International Publishing House Pvt.
2	National hazards and disaster management	RB Singh	UBS

Course Code	LIB601	
Course Title	**Library and information services**	
Type of course	Practical	
L T P	0:0:2	
Credits	1(0+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	1.Educate and assist students in the identification and effective use of information resources 2. Provide current library materials and databases that support the academic curriculum	
Course outcomes	CO1	Identify and use search language, controlled vocabulary or search features appropriate to the research tool in order to retrieve relevant results.
	CO2	Select appropriate means for recording or saving relevant sources in order to retrieve them when needed.
	CO3	Observe and use pointers to additional information (authors, footnotes, bibliographies, controlled vocabulary, etc.) in order to locate additional sources.

Syllabus

Practical

UNIT-I

Introduction to library services; Role of libraries in University education, research, extension and technology transfer

UNIT-II

Classification systems and organization of Library; Sources of informationPrimary Sources, Secondary Sources and Tertiary Sources, with emphasis on reference tools and digital resources; Intricacies of abstracting and indexing, CAS, SDI services, (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts etc.)

UNIT-III

Tracing information from reference sources, information explosion and language barrier; Literature survey; Citation techniques/Bibliographic control and Preparation of bibliography

UNIT-IV

Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-abbreviations like ibid etc

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Manual of Library and Information Services	Bhanu Pratap	STUDERA PRESS

SEMESTER-IV

Course Code	AGR600	
Course Title	**Masters Research**	
Type of course	Practical	
L T P	0:0:16	
Credits	4(0+8)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To familiarize the students about the data collection, analyze data and interpretation.	
Course outcomes	CO1	This program will provide students the theoretical and research backgrounds necessary to design, implement, and manage different cropping system.
	CO2	Students will conduct field trials.
	CO3	Collect, summarize and interpret data.

MASTERS RESEARCH

Course Code	AGR602	
Course Title	Technical Writing and communications skills	
Type of course	Practical	
L T P	0:0:2	
Credits	1(0+1)	
Course prerequisite	B.Sc. (Agriculture)	
Course 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).	
Course outcomes	CO1	Students will be able to know forms of technical writing thesis, technical papers, reviews, manuals .
	CO2	Students will understand the writing of abstracts, summaries, précis, and citations.
	CO3	Students will be able to know phonetic symbols and transcription, accentual pattern, weak forms in connected speech

Practicals:

1. Various forms of scientific writings- thesis, technical papers, reviews, manuals, etc.
2. Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion).
3. Writing of abstracts, summaries, précis, citations etc.
4. Commonly used abbreviations in the theses and research communications.
5. Illustrations, photographs and drawings with suitable captions.
6. Pagination, numbering of tables and illustrations.
7. Writing of numbers and dates in scientific write-ups. Editing and proof-reading.
8. Writing of a review article.
9. Grammar (Tenses, parts of speech, clauses, punctuation marks).
10. Error analysis (Common errors), concord, collocation.
11. Phonetic symbols and transcription, accentual pattern, weak forms in connected speech.
12. Participation in group discussion, facing an interview, presentation of scientific papers.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Technical writing and communication: theory and practices	Deb Dulal Halder, Anjana Neira Dev & Prerna Malhotra	Book age publications

Course Code	AGR604	
Course Title	Human rights and constitutional duties	
Type of course	Theory	
L T P	1:0:0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To study the human rights and its actual status	
Course outcomes	CO1	Students will be aware about human rights its foundational aspects, nature and classification.
	CO2	Students will be aware about the human rights in India. Constitutional-legal framework, fundamental rights, directive principles of state policy governmental institutions for the protection of human rights.
	CO3	Students will understand the role of status of economic social & cultural rights in India.

Syllabus

Theory

UNIT-I

Introduction to human rights. Foundational Aspects: Meaning, Nature, Classification**.** Evolution of the Concept: Magna Carta to Universal Declaration of Human Rights; Generations of Human Rights.

UNIT-II

Conceptual Perspective: Meaning, Nature & Characteristics of Human Duties; Classification of Human Duties; Relevance of Human Duties

Human Duties in India: Fundamental Duties in Indian Constitution Part IV A

(a) To abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
(b) To cherish and follow the noble ideals which inspired our national struggle for freedom;
(c) To uphold and protect the sovereignty, unity and integrity of India;
(d) To defend the country and render national service when called upon to do so;
(e) To promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
(f) To value and preserve the rich heritage of our composite culture;
(g) To protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures;

(h) To develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) To safeguard public property and to abjure violence;

(j) To strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

(k) Who is a parent or guardian to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.)

UNIT-III

Concept of human rights in India. Constitutional-Legal Framework: Fundamental Rights; Directive Principles of State Policy Governmental Institutions for the Protection of Human Rights: Working of National Human Rights Commission; National Commission for Women.

UNIT-IV

Actual status of human rights in India. Status of Economic Social & Cultural Rights in India: Violence against Women; Violation of Child Rights: An Appraisal. State of Civil & Political Rights in India: A study of Jammu & Kashmir and the North-East.

Recommended books:

S. No	Name	Author(S)	Publisher
1	Introduction to Human Rights and Duties	S.N.Shastry	University of Pune Press, 2011
2	Human duties and limits of human right	Eric R Boot	Springer

Course Code	AGR606	
Course Title	Agriculture research, research, ethics and rural development programme	
Type of course	Theory	
L T P	1:0:0	
Credits	1(1+0)	
Course prerequisite	B.Sc. (Agriculture)	
Course objective	To sensitize the scholars about the basic issues related with agricultural research, ethics in research as well as rural development.	
Course outcomes	CO1	Students will be aware research ethics: research integrity, research safety in laboratories, welfare of animals used in research.
	CO2	Students will be aware about connotations of rural development, rural development policies and strategies. rural development programmes, community development programme
	CO3	Students will understand Panchayati Raj, institutions, co-operatives, voluntary agencies/non-governmental organizations

Syllabus

Theory

UNIT-I

History of agriculture in brief. Global agricultural research system: need, scope, opportunities. Role in promoting food security, reducing poverty and protecting the environment. National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions. Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels. International fellowships for scientific mobility.

UNIT-II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT-III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme. Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP).

UNIT-IV

Panchayati Raj, Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Recommended books:

S. No	Name	Author(S)	Publisher
1.	Rural Development- Principles, Policies and Management.	K Singh	Sage Publ.
2.	Manual on International Research and Research Ethics	M.S. Punia	CCS, Haryana Agricultural University, Hisar.