DAV UNIVERSITY, JALANDHAR

FACULTY OF AGRICULTURAL SCIENCES

COURSE CURRICULUM

FOR

M.Sc. Ag. (Agronomy)

1st to 4th SEMESTER

Examinations 2023-2024 session onwards

Applicable for admissions in 2023

Course Scheme for M.Sc. Agriculture (Agronomy)

Semester I

S. No.	Paper Code	Course Title	Course Type	L	T	P	Cr
1.	AGR501	MODERN CONCEPTS IN CROP PRODUCTION	Core	3	0	0	3
2.	AGR502	PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT	Core	2	0	2	3
3.	AGR503A	PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	Core	2	0	2	3
4.	AGR505	AGRO-METEOROLOGY AND CROP WEATHER FORECASTING	Core	2	0	2	3
5.	AGS551	PRODUCTION TECHNOLOGY OF COOL SEASON VEGETABLE CROPS	Supporting Course	2	0	2	3
6.	CSA559	COMPUTER FUNDAMENTALS AND PROGRAMMING	Compulsory Foundation	2	0	2	3
Total credits				**18**			

L: Lectures; T: Tutorial; P: Practical; Cr: Credits

Semester II

S. No.	Paper Code	Course Title	Course Type	L	T	P	Cr
1.	AGR504	PRINCIPLES AND PRACTICES OF WATER MANAGEMENT	Core	2	0	2	3
2.	AGR511A	CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE	Core	2	0	0	2
3.	AGR513A	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	Core	2	0	2	3
4.	AGR510	ANALYTICAL TECHNIQUE AND INSTRUMENTAL METHODS IN SOIL AND PLANT ANALYSIS	Minor	0	0	4	2
5.	ENG551	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	Compulsory foundation	0	0	2	1
6.	AGS503	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	Compulsory foundation	1	0	0	1
7.	AGS500	MASTER'S RESEARCH	Core	0	0	4	4
Total credits				**16**			

L: Lectures; T: Tutorial; P: Practical; Cr: Credits

Semester III

S. No.	Paper Code	Course Title	Course Type	L	T	P	Cr
1.	AGR552	MANAGEMENT OF PROBLEM SOILS AND WATER	Minor	2	0	2	3
2.	AGS711	EXPERIMENTAL DESIGNS	Supporting Course	2	0	2	3
3.	AGS501	LIBRARY AND INFORMATION SERVICES	Compulsory Foundation	0	1	2	1
4.	AGS504	BASIC CONCEPTS IN LABORATORY TECHNIQUES	Compulsory Foundation	0	1	2	1
5.	AGS505	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	Compulsory Foundation	1	0	0	1
6.	AGR551	SOIL EROSION AND CONSERVATION	Minor	2	0	2	3
7.	AGS560	MASTER'S SEMINAR	Core	0	1	2	1
8.	AGS500A	MASTER'S RESEARCH	Core	0	6	6	12
Total credits				**25**			

L: Lectures; T: Tutorial; P: Practical; Cr: Credits

Semester IV

S.No.	Paper Code	Course Title	Course Type	L	T	P	Cr
1.	AGR500B	MASTER'S RESEARCH	Core	0	1	30	15
2.	AGR500C	THESIS WORK	Core	0	1	10	5

L: Lectures; T: Tutorial; P: Practical; Cr: Credits

- **Course 1**

L	T	P	Credits
3	**0**	**0**	**3**

Course Code	**AGR501**						
Course Title	**Modern Concepts in Crop Production**						
Hours	36 L:3, T:0, P:0						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To understand advanced concepts of crop growth and productivity in relation to climate change** **CO2: To gain knowledge on bio-technology in agriculture, eco-restoration and nano technology** **CO3: To acquire knowledge on modern concepts in tillage and farm mechanization** **CO4: To gain knowledge on principles and components of organic farming, vermin-technology, resource conservation technology** **CO5: To gain knowledge on ideal plant ideotypes and yield maximization.**						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory (36 hrs)						
Syllabus	**Unit 1: (5 hours)** • Crop growth analysis in relation to environment • Geo-ecological zones of India.						**CO1**
	Unit 2: (5 hours) • Quantitative agro-biological principles and inverse yield nitrogen law • Mitscherlich yield equation, its interpretation and applicability • Baule unit.						**CO2**
	Unit 3: (8 hours) • Effect of lodging in cereals • Physiology of grain yield in cereals						**CO3**

	• Optimization of plant population and planting geometry in relation to different resources • Concept of ideal plant type and crop modeling for desired crop yield.	
	Unit 4: (8 hours) • Scientific principles of crop production • Crop response production functions • Concept of soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition.	**CO4**
	Unit 5: (10 hours) • Integrated farming systems • Organic farming • Resource conservation technology including modern concept of tillage • Dry farming; determining the nutrient needs for yield potentiality of crop plants • Concept of balance nutrition and integrated nutrient management; precision agriculture • Modern crop production concepts; soil less cultivation, aeroponic, hydroponic, robotic and terrace farming • Use of GIS, GPS and remote sensing in modern agriculture, precision farming and protected agriculture.	**CO5**

Reference Books:

- ***Principles and Practices of Agronomy: Agrobios*** by Balasubramaniyan P & Palaniappan SP.
- **Maximizing Crop *Yields: Marcel Dekker*** by Fageria NK.
- ***Soil Fertility and Fertilizers***: 7th Ed. Prentice Hall by Havlin JL, Beaton JD, Tisdale SL & Nelson WL.
- ***Sustaining our Food Security***. Konark Publ. by Paroda R.S.
- ***Principles of Crop Production***. Kalyani Publ. by Reddy SR.
- ***Principles of Agronomy***. The Bangalore Printing & Publ. by Sankaran S & Mudaliar TVS.
- ***Principles and Practices of Agronomy***. Kalyani by Singh SS.

- **Course 2**

L	T	P	Credits
2	0	2	3

Course Code	**AGR502**						
Course Title	**Principles and Practices of Soil Fertility and Nutrient Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To expand breadth of knowledge and expertise in soil fertility and productivity in crop production.** **CO2: To develop scientific capability in independently assessing, interpreting, and summarizing soil problems.** **CO3: To propose, evaluate or execute experimental protocol regarding nutrient budgeting for crop production.** **CO4: To foster commitment to ethical behavior in fertilization of crops with respect to environment perspectives** **CO5: To gain knowledge about soil fertility assessment and methods of fertilizer application**						
Examination Type	Theory/Practical/Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/Practical/Theory (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (5 hours)** • Soil fertility and productivity - factors affecting features of good soil management • Problems of supply and availability of nutrients • Relation between nutrient supply and crop growth • Organic farming - basic concepts and definitions.						**CO1**
	Unit 2: (5 hours) • Criteria of essentiality of nutrients • Essential plant nutrients – their functions, nutrient deficiency symptoms • Transformation and dynamics of major plant nutrients.						**CO2**
	Unit 3: (3 hours)						**CO3**

	• Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses • Recycling of organic wastes and residue management.	
	Unit 4: (5 hours) • Commercial fertilizers; composition • Relative fertilizer value and cost • Crop response to different nutrients, residual effects and fertilizer use efficiency • Agronomic, chemical and physiological, fertilizer mixtures and grades, methods of increasing fertilizer use efficiency • Nutrient interactions.	**CO4**
	Unit 5: (6 hours) • Time and methods of manures and fertilizers application • Foliar application and its concept • Relative performance of organic and inorganic manures • Economics of fertilizer use; Integrated nutrient management • Use of vermicompost and residue wastes in crops.	**CO5**
	Practical: (24 hours) • Determination of soil pH and soil EC. • Determination of soil organic C. • Determination of available available N, P, K and S of soil. • Determination of total N, P, K and S of soil. Determination of total N, P, K and S in plants. • Computation of optimum and economic yield.	

Reference Books:

- ***The Nature and Properties of Soil***: 13th Ed. Pearson Edu. by Brady NC & Weil R.R
- ***Growth and Mineral Nutrition of Field Crops***. Marcel Dekker by Fageria NK, Baligar VC & Jones CA.
- ***Soil Fertility and Fertilizers***: 7th Ed. Prentice Hall by Havlin JL, Beaton JD, Tisdale SL & Nelson WL.
- ***Soil Fertility Management for Sustainable Agriculture***. CRC Press by Prasad R & Power JF.
- ***Manures and Fertilizers***. Agri-Horti Publications by Yawalkar KS, Agrawal JP & Bokde S.

- **Course 3**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGR503A**						
Course Title	**Principles and Practices of Weed Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To understand the knowledge on weed biology and survey of weeds in varied ecosystem.** **CO2: To identify the nature, type and economic uses of weeds in varied habitat.** **CO3: To gain knowledge on herbicide application techniques.** **CO4: To evaluate different methods of weed control.** **CO5: To formulate integrated weed management practices for different ecosystems.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/Practical/Theory (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (5 hours)** • Weed biology and ecology and classification • Crop-weed competition including allelopathy • Principles and methods of weed control and • Classification management • Weed indices • Weed shift in different eco-systems.						**CO1**
	Unit 2: (5 hours) • Herbicides introduction and history of their development • Classification based on chemical, physiological application and selectivity • Mode and mechanism of action of herbicides.						**CO2**

	Unit 3: (3 hours) • Herbicide structure - activity relationship • Factors affecting the efficiency of herbicides • Herbicide formulations • Herbicide mixtures • Sequential application of herbicides, rotation • Weed control through use of nano-herbicides and • Bio-herbicides, myco-herbicides bio-agents and allelochemicals • Movement of herbicides in soiland plant • Degradation of herbicides in soil and plants • Herbicide resistance, residue, persistence and management • Development of herbicide resistance in weeds and crops and their management • Herbicide combination and rotation.	**CO3**
	Unit 4: (5 hours) • Weed management in major crops and cropping systems • Alien, invasive and parasitic weeds and their management • Weed shifts in cropping systems • Aquatic and perennial weed control • Weed control in non-crop area.	**CO4**
	Unit 5: (6 hours) • Integrated weed management • Recent development in weed management- robotics use of drones and aeroplanes, organic etc. • Cost: benefit analysis of weed management.	**CO5**
	Practical: (24 hours) • Identification of important weeds of different crops. • Preparation of a weed herbarium. • Weed survey in crops and cropping systems. • Crop-weed competition studies, • Weed indices calculation and interpretation with data, • Preparation of spray solutions of herbicides for high and low-volume sprayers, • Use of various types of spray pumps and nozzles and calculation of swath width, • Economics of weed control, • Herbicide resistance analysis in plant and soil. • Bioassay of herbicide resistance residues, • Calculation of herbicidal requirement.	

Reference Books:

- ***Herbicide Classes in Development: Mode of Action, Targets, Genetic Engineering, Chemistry*** by Böger, Peter, Wakabayashi, Ko, Hirai and Kenji.
- ***Recent Advances in Weed Management*** by Chauhan B and Mahajan G.
- ***Weed Science: Basics and Applications*** by Das TK**.**
- ***Principles of Weed Control*** by Fennimore, Steven A and Bell, Carl.
- ***Weed Management: Principles and Practices*** by Gupta OP.
- ***Weed Management,*** Kalyani by Walia US**.**
- ***Integrated Weed Management for Sustainable Agriculture*** by Zimdahl RL.

- **Course 4**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGR505**						
Course Title	**Agro-meteorology and Crop Weather Forecasting**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge on agro meteorology and its different variables on crop production.** **CO2: To understand the onset and withdrawal of monsoon and crop seasons.** **CO3: To gain knowledge about evapo-transpiration and its effect on crop production.** **CO4: To understand weather forecasting and weather in relation to pest and disease management.** **CO5: To design crop weather calendar for various agro climatic zones.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Agro-meteorology-aim, scope and development in relation to crop environment; • Composition of atmosphere, • Distribution of atmospheric pressure and wind.						**CO1**
	Unit 2: (5 hours) • Characteristics of solar radiation; • Energy balance of atmosphere system; • Radiation distribution in plant canopies, • Radiation utilization by field crops; • Photosynthesis and efficiency of radiation utilization by field crops; • Energy budget of plant canopies;						**CO2**

	• Environmental temperature: soil, air and canopy temperature.	
	Unit 3: (5 hours) • Temperature profile in air, soil, crop canopies; • Soil and air temperature effects on plant processes; • Environmental moisture and evaporation: measures of atmospheric temperature and relative humidity, vapor pressure and their relationships; • Evapo-transpiration and meteorological factors determining evapotranspiration.	**CO3**
	Unit 4: (6 hours) • Modification of plant environment: artificial rain making, heat transfer, controlling heat load, heat trapping and shading; • Protection from cold, sensible and latent heat flux, controlling soil moisture; • Monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon; • Weather hazards, • Drought monitoring and planning for mitigation.	**CO4**
	Unit 5: (5 hours) • Weather forecasting in India – short, medium and long range; • Aerospace science and weather forecasting; • Benefits of weather services to agriculture, • Remote sensing; application in agriculture and its present status in India; • Atmospheric pollution and its effect on climate and crop production; • Climate change and its impact on agriculture.	**CO5**
	Practical: (24 hours) • Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure. • Measurement of solar radiation outside and within plant canopy. • Measurement/estimation of evapo-transpiration by various methods. • Measurement/estimation of soil water balance. Rainfall variability analysis. • Determination of heat-unit requirement for different crops.	

	• Measurement of crop canopy temperature. • Measurement of soil temperatures at different depths. • Remote sensing and familiarization with agro-advisory service bulletins. • Study of synoptic charts and weather reports, working principle of automatic weather station. • Visit to solar observatory.	

Reference Books:

- ***Climate and Agriculture on Ecological Survey*** by Chang Jan Hu.
- ***General Climatology*** by Critchfield HJ.
- ***The Monsoons*** by Das PK.
- ***Climatology*** by Lal DS.
- ***Climate, Weather and Crops in India*** by Lenka D.
- ***Introduction to Agro-meteorology*** by Mavi H.S.
- ***Agrometeorology: Principles and Application of Climate Studies in Agriculture*** by Mavi HS & Tupper GJ.
- ***Agrometeorology and Remote Sensing: Principles and Practices*** by Sahu DD.
- ***Practical Manual on Agricultural Meteorology*** by Variraju R & Krishnamurty.
- ***Textbook of Agricultural Meteorology*** by Varshneya MC & Balakrishana Pillai P.

- **Course 5**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGR551**						
Course Title	**Soil Erosion and Conservation**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Minor Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge on agro meteorology and its different variables on crop production.** **CO2: To understand the onset and withdrawal of monsoon and crop seasons.** **CO3: To gain knowledge about evapo-transpiration and its effect on crop production.** **CO4: To understand weather forecasting and weather in relation to pest and disease management.** **CO5: To design crop weather calendar for various agro climatic zones.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • History, distribution, identification and description of soil erosion problems in India.						**CO1**
	Unit 2: (5 hours) • 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						**CO2**

	• Soil losses in relation to soil properties and precipitation.	
	Unit 3: (5 hours) • Wind erosion- types, mechanism • Factors affecting wind erosion; extent of problem in the country.	**CO3**
	Unit 4: (6 hours) • Principles of erosion control; erosion control measures – agronomical and engineering • Erosion control structures - their design and layout.	**CO4**
	Unit 5: (5 hours) • Soil conservation planning • Land capability classification • Soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.	**CO5**
	Unit 6: (5 hours) • Watershed management - concept, objectives and approach • Water harvesting and recycling; flood control in watershed management • Socio-economic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds • Use of remote sensing in assessment and planning of watersheds, sediment measurement **Practical: (24 hours)** • Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index • Computation of kinetic energy of falling rain drops • Computation of rainfall erosivity index (EI30) using rain gauge data • Land capability classification of a watershed • Visits to a watersheds	**CO6**

Reference Books:

- ***Soil Management in Relation to Land Degradation and Environment*** by Biswas TD and Narayanasamy G.
- ***Methods of Assessing Soil Quality by*** Doran JW and Jones AJ.
- ***Manual of Soil and Water Conservation Practices*** by Gurmal Singh, Venkataramanan C, Sastry G and Joshi BP.
- ***Soil Conservation*** by Hudson N.

- ***Fundamentals of Soil Science*** by Indian Society of Soil Science.
- ***Soil Physics*** by Oswal MC.

- **Course 6**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**CSA559**						
Course Title	**Computer Fundamentals and Programming**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge on agro meteorology and its different variables on crop production.** **CO2: To understand the onset and withdrawal of monsoon and crop seasons.** **CO3: To gain knowledge about evapo-transpiration and its effect on crop production.** **CO4: To understand weather forecasting and weather in relation to pest and disease management.** **CO5: To design crop weather calendar for various agro climatic zones.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Agro-meteorology-aim, scope and development in relation to crop environment; • Composition of atmosphere, • Distribution of atmospheric pressure and wind.						**CO1**
	Unit 2: (5 hours) • Characteristics of solar radiation; • Energy balance of atmosphere system; • Radiation distribution in plant canopies, • Radiation utilization by field crops; • Photosynthesis and efficiency of radiation utilization by field crops; • Energy budget of plant canopies;						**CO2**

	• Environmental temperature: soil, air and canopy temperature.	
	Unit 3: (5 hours) • Temperature profile in air, soil, crop canopies; • Soil and air temperature effects on plant processes; • Environmental moisture and evaporation: measures of atmospheric temperature and relative humidity, vapor pressure and their relationships; • Evapo-transpiration and meteorological factors determining evapotranspiration.	**CO3**
	Unit 4: (6 hours) • Modification of plant environment: artificial rain making, heat transfer, controlling heat load, heat trapping and shading; • Protection from cold, sensible and latent heat flux, controlling soil moisture; • Monsoon and their origin, characteristics of monsoon; onset, progress and withdrawal of monsoon; • Weather hazards, • Drought monitoring and planning for mitigation.	**CO4**
	Unit 5: (5 hours) • Weather forecasting in India – short, medium and long range; • Aerospace science and weather forecasting; • Benefits of weather services to agriculture, • Remote sensing; application in agriculture and its present status in India; • Atmospheric pollution and its effect on climate and crop production; • Climate change and its impact on agriculture.	**CO5**
	Practical: (24 hours) • Visit to agro-meteorological observatory and to record sun-shine hours, wind velocity, wind direction, relative humidity, soil and air temperature, evaporation, precipitation and atmospheric pressure. • Measurement of solar radiation outside and within plant canopy. • Measurement/estimation of evapo-transpiration by various methods. • Measurement/estimation of soil water balance. Rainfall variability analysis. • Determination of heat-unit requirement for different crops.	

	• Measurement of crop canopy temperature. • Measurement of soil temperatures at different depths. • Remote sensing and familiarization with agro-advisory service bulletins. • Study of synoptic charts and weather reports, working principle of automatic weather station. • Visit to solar observatory.	

Reference Books:

- ***Climate and Agriculture on Ecological Survey*** by Chang Jan Hu.
- ***General Climatology*** by Critchfield HJ.
- ***The Monsoons*** by Das PK.
- ***Climatology*** by Lal DS.
- ***Climate, Weather and Crops in India*** by Lenka D.
- ***Introduction to Agro-meteorology*** by Mavi H.S.

Semester 2

- **Course 1**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGR504**						
Course Title	**Principles and Practices of Water Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To understand the principles involved in estimating water requirement for different crops.** **CO2: To gain knowledge on various methods of irrigation scheduling and approaches.** **CO3: To acquire knowledge on pressurized irrigation system to economize the water.** **CO4: To construct ideologies pertaining to water management in problem soils.** **CO5: To analyse the quality of irrigation water.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Water and its role in plants; • Irrigation: definition and objectives, • Water resources and irrigation development of India and concerned state, • Major irrigation projects, extent of area and crops irrigated in India and in different states.						**CO1**
	Unit 2: (5 hours) • Field water cycle, • Water movement in soil and plants; • Transpiration;						**CO2**

	• Soil-water-plant relationships; • Water absorption by plants; • Plant response to water stress, • Crop plant adaptation to moisture stress condition. • Water availability and its relationship with nutrient availability and losses.	
	Unit 3: (5 hours) • Soil, plant and meteorological: factors determining water needs of crops; • Scheduling, depth and methods of irrigation; • Microirrigation systems; • Deficit irrigation, • Fertigation; management of water in controlled environments and polyhouses. • Irrigation efficiency and water use efficiency.	**CO3**
	Unit 4: (5 hours) • Water management of crop and cropping system; • Quality of irrigation water and management of saline water for irrigation; • Water use efficiency. • Crop water requirement- estimation of ET and effective rainfall; • Water management of the major crops and cropping systems. • Automated irrigation system.	**CO4**
	Unit 5: (6 hours) • Excess of soil water and plant growth; • Water management in problem soil; • Drainage requirement of crops and methods of field drainage, their layout and spacing; • Soil moisture conservation, • Water harvesting, rain water management and its utilization for crop production. • Hydroponics, • Water management of crops under climate change scenario.	**CO5**
	Practical: (24 hours) • Determination of Field capacity by field method, • Determination of Permanent Wilting Point by sunflower pot culture technique, • Determination of Field capacity and Permanent Wilting Point by Pressure Plate Apparatus, • Determination of Hygroscopic Coefficient,	

	• Determination of maximum water holding capacity of soil, • Measurement of matric potential using gauge and mercury type tensiometer, • Determination of soil-moisture characteristics curves, • Determination of saturated hydraulic conductivity by constant and falling head method, • Determination of hydraulic conductivity of saturated soil below the water table by auger hole method, • Measurement of soil water diffusivity, • Estimation of unsaturated hydraulic conductivity, • Estimation of upward flux of water using tensiometer and from depth ground water table, • Determination of irrigation requirement of crops (calculations), • Determination of effective rainfall (calculations), • Determination of ET of crops by soil moisture depletion method, • Determination of water requirements of crops, • Measurement of irrigation water by volume and velocity-area method, • Measurement of irrigation water by measuring devices and calculation of irrigation efficiency, • Determination of infiltration rate by double ring infiltrometer.	

Reference Books:

- ***Irrigation Water Management: Principles and Practice*** by Majumdar DK.
- ***A Text Book of Irrigation and Water Management Hardcover*** by Mukund Joshi.
- ***Irrigation and Drainage*** by Lenka D.
- ***Irrigation: Theory and Practice*** by Michael AM.
- ***Irrigation of Food Crops - Principles and Practices*** by Prihar SS & Sandhu BS.
- ***Principles of Crop Production*** by Reddy SR.
- ***Technologies for Food Security and Sustainable Agriculture*** by Singh Pratap & Maliwal PL.

- **Course 2**

L	T	P	Credits
2	**0**	**0**	**2**

Course Code	**AGR511A**						
Course Title	**Cropping Systems and Sustainable Agriculture**						
Hours	24 L:2, T:0, P:0						
Credits	2						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To prepare cropping schemes and design and evaluate cropping system and workout input requirements for crops.** **CO2: To prepare integrated farming system models for different eco systems.** **CO3: To evaluate different methods of weed control and formulate integrated weed management practices for different ecosystems.** **CO4: To gain knowledge about soil fertility assessment and methods of fertilizer application.** **CO5: To gain knowledge about drought mitigation strategies and to equip students with geostatistical techniques and variables of crop yield mapping; and also understand GIS based nutrient delivery system as well as DSSAT for variable crop yield mapping.** **CO6: To acquire knowledge on concepts and application of artificial intelligence in agriculture**						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Cropping systems: definition, indices and its importance; • Physical resources, soil and water management in cropping systems; • Assessment of land use.						**CO1**
	Unit 2: (5 hours) • Concept of sustainability in cropping systems						**CO2**

	• Farming systems, scope and objectives; • Production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, • Mechanism of yield advantage in intercropping systems.	
	Unit 3: (4 hours) • Above and below ground interactions • Allelopathic effects; competition relations; • Multi-storied cropping and yield stability in intercropping, • Role of non-monetary inputs and low cost technologies; • Research need on sustainable agriculture.	**CO3**
	Unit 4: (5 hours) • Crop diversification for sustainability; • Role of organic matter in maintenance of soil fertility; • Crop residue management; • Fertilizer use efficiency and concept of fertilizer use in intensive cropping system. • Advanced nutritional tools for big data analysis and interpretation.	**CO4**
	Unit 5: (4 hours) • Plant ideotypes for drylands; • Plant growth regulators and their role in sustainability.	**CO5**
	Unit 6: (3 hours) • Artificial Intelligence- Concept and application.	**CO6**

Reference Books:

- ***Cropping Systems and Sustainable Agriculture*** by Panda SC.
- ***Cropping and Farming Systems*** by Panda SC.
- ***Cropping Systems in the Tropics; Principles and Management*** by Palaniappan SP and Sivaraman K.
- ***Principles of Crop Production*** by Reddy SR.
- ***Principles of Agronomy*** by Sankaran S and Mudaliar TVS.
- ***Principles and Practices of Agronomy*** by Singh SS.
- ***Soil Fertility and Fertilizers*** by Tisdale SL, Nelson WL, Beaton JD and Havlin JL.

- **Course 3**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGR513A**						
Course Title	**Principles and Practices of Organic Farming**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge on concepts of organic agriculture.** **CO2: To gain the information about the impact of organic farming and indigenous practices on environment.** **CO3: To prepare integrated farming system models for different eco systems; cropping schemes and design and evaluate cropping system and workout input requirements for crops.** **CO4: Understands the scope and importance of organic farming and pest management related challenges in organic farming, cultural and traditional pest management activities and their impact.** **CO5: To understand the procedure followed for organic certification as per NPOP guidelines namely production standards, labelling and accreditation.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (5 hours)** • Organic farming - concept and definition, its relevance to India and global agriculture and future prospects • Principles of organic agriculture • Organics and farming standards; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation tillage • Shelter zones, hedges, pasture management, agro-forestry.						**CO1**

	Unit 2: (6 hours) • Organic farming and water use efficiency • Soil fertility, nutrient recycling • Organic residues, organic manures, composting, soil biota and decomposition of organic residues • Earthworms and vermicompost, green manures, biofertilizers and biogas technology.	**CO2**
	Unit 3: (5 hours) • Farming systems • Selection of crops and crop rotations • Multiple and relay cropping systems • Intercropping in relation to maintenance of soil productivity.	**CO3**
	Unit 4: (3 hours) • Control of weeds, diseases and insect pest management • Biological agents and pheromones • Biopesticides.	**CO4**
	Unit 5: (5 hours) • Socio-economic impacts • Marketing and export potential • Inspection, certification, labeling and accreditation procedures • Organic farming and national economy.	**CO5**
	Practical: (24 hours) • Method of making compost by aerobic method. • Method of making compost by anaerobic method. • Method of making vermicompost. • Identification and nursery raising of important agro-forestry tress and tress for shelter belts. • Efficient use of biofertilizers, • Technique of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter*, *Azospirillum* and PSB cultures in field. • Visit to a biogas plant. • Visit to an organic farm. • Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms.	

Reference Books:

- ***Emerging Trends in Biological Control of Phytophagous Insects*** by Ananthakrishnan TN.
- ***A Manual of Rural Composting*** by Gaur AC.

- ***Organic Farming*** by Lampin N.
- ***Hand Book of Organic Farming*** by Sharma A.
- ***Technology for Production of Natural Enemies*** by Singh SP.
- ***A Text Book of Environmental Sciences*** by Trivedi RN.
- ***Soil Microbiology*** by SubbaRao NS.
- ***Organic Farming and Sustainable Agriculture*** by Veeresh GK, Shivashankar K and Suiglachar MA.

- **Course 4**

L	T	P	Credits
0	**0**	**4**	**2**

Course Code	**AGR510**						
Course Title	**Analytical Technique and Instrumental Methods in Soil and Plant Analysis**						
Hours	24 L:0, T:0, P:2						
Credits	2						
Type	**Minor Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: 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.** **CO2: To gain knowledge about preparations of common analytical reagents for qualitative and quantitative analysis of both soil as well as plant samples.** **CO3: The students will have a firm foundation in the fundamentals and application of analytical techniques in scientific research** **CO4: The students will be able to design and carry out scientific experiments as well as accurately record and analyze the results obtained from such experiments** **CO5: To gain knowledge about redox potential and its measurement.**						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Preparation of solutions for standard curves, indicators and standard solutions for acid-base, oxidation reduction and complexometric titration • Soil, water and plant sampling techniques, their processing and handling						**CO1**
	Unit 2: (5 hours) • Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium						**CO2**

	• Estimation of phosphorus, ammonium and potassium fixation capacities of soils.	
	Unit 3: (4 hours) • Principles of visible, ultra violet 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, CHNS analyzer.	**CO3**
	Unit 4: (5 hours) • -Electrochemical titration of clays; estimation of exchangeable cations (Na, Ca, Mg, K) • Estimation of root cation exchange capacity.	**CO4**
	Unit 5: (4 hours) • Wet digestion/fusion/extraction of soil with aquaregia with soil for elemental analysis • Triacid/di-acid digestion of plant samples; determination of available and total nutrients (N, P, K, S, Ca, Mg, Zn, Cu, Fe, Mn, B, Mo) in soils • Determination of total nutrients (N, P, K, S, Ca, Mg, Zn, Cu, Fe, Mn, B, Mo) in plants.	**CO5**
	Unit 6: (3 hours) • Drawing normalized exchange isotherms • Measurement of redox potential.	**CO5**

Reference Books:

- ***Hesse P. Textbook of Soil Chemical Analysis*** by Hesse P**.**
- ***Soil Chemical Analysis. Prentice Hall of India*** by Jackson ML.
- ***Soil Analysis; Modern Instrumental Techniques*** by Keith A Smith.
- ***Methods of Soil Analysis Part II*** by Page AL, Miller RH and Keeney DR**.**
- ***Soil Sampling, Preparation and Analysis*** by Tan KH**.**
- ***Methods of Analysis of Soils, Fertilizers and Waters*** by Tandon HLS.
- ***A Textbook of Quantitative Inorganic Analysis*** by Vogel AL.
- ***Official Methods of Analysis*** by Kenneth Helric.
- ***Soil and Plant Analysis*** by Piper CE.
- ***Soil Plant Water Analysis - A Methods Manual*** by Singh D, Chhonkar PK and Pandey RN.

- **Course 5**

L	T	P	Credits
0	**0**	**2**	**1**

Course Code	**ENG551**						
Course Title	**Technical Writing and Communications Skills**						
Hours	24 L:0, T:0, P:2						
Credits	1						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: Acquisition of technical communication's generic aspects like Reading Technical Material, Technical Writing, Listening, Thinking and using technical phrases in spoken, Knowing the parts of a technical documents like screenshots, graphs, tabular data, data analysis, pictorial depiction.** **CO2: Getting adapted with the technical generic formats/templates of technical writing of memos, technical report writing, technical presentations, technical proposal writing, minutes of meeting and the notes taking techniques.** **CO3: Accessing the reading material and developing the writing technical material with the use of technical concepts and tools like Vacaroo, Miscrosoft Visio, Notepad, Split Page Technique, Diagram Technique.** **CO4: Learning the skill of proofreading and copy editing, paraphrasing and spinning using technical tools and manually using the knowledge of advance technical grammar.** **CO5: Learning the technical phrases and writing styles like descriptive, argumentative etc for developing good technical documents for presentations or disseminating technical documents.**						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Practical (24 hrs)						
Syllabus	**Practical: (24 hours)** • Various forms of scientific writings- theses, technical papers, reviews, manuals, etc. • Various parts of thesis and research communications (title page, authorship contents page, preface, -						**CO1, CO2, CO3, CO4, CO5**

	introduction, review of literature, material and methods, experimental results and discussion) • Writing of abstracts, summaries, precis, citations, etc. • Commonly used abbreviations in the theses and research communications • Illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations • Writing of numbers and dates in scientific write-ups • Editing and proof-reading • Writing of a review article • Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks) • Error analysis (Common errors), Concord, Collocation, Phonetic symbols and transcription • Accentual pattern: Weak forms in connected speech • Participation in group discussion • Facing an interview • Presentation of scientific papers.	

Reference Books:

- ***Spoken English: Flourish Your Language*** by Barnes and Noble. Robert C.
- ***Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.***
- ***Collins' Cobuild English Dictionary. 1995.***
- ***Technical Writing*** by Harper Collins. Gordon HM and Walter JA.
- ***Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed.*** by Holt, Rinehart and Winston. Hornby AS.
- ***Handbook for Technical Writing*** by James HS.
- ***MLA Handbook for Writers of Research Papers. 5th Ed.*** by Joseph G.
- ***Speaking English Effectively*** by Mohan K.
- ***Technical Writing by*** Richard WS.
- ***Course in Phonetics and Spoken English. 2nd Ed. by*** Sethi J and Dhamija PV.
- ***High School English Grammar and Composition*** by Wren PC and Martin H.

- **Course 6**

L	T	P	Credits
1	**0**	**0**	**1**

Course Code	**AGS503**						
Course Title	**Intellectual Property and Its Management In Agriculture**						
Hours	12 L:1, T:0, P:0						
Credits	1						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To formulate research problem.** **CO2: To analyze literature review and find research gaps to finalize research objectives.** **CO3: To identify the need of ethics in research.** **CO4: To identify the need of IPR of research projects for economic growth and social benefits.** **CO5: To know about biological diversity and international treaty on Plant Genetic Resources for Food and Agriculture.**						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory (12 hrs)						
Syllabus	**Theory: (12 hours)** • 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 • 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 • Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection						

	• National Biodiversity protection initiatives • Convention on Biological Diversity • International Treaty on Plant Genetic Resources for Food and Agriculture • Licensing of technologies, Material transfer agreements, Research collaboration Agreement • License Agreement.	

Reference Books:

- ***Intellectual Property Rights in Agricultural Biotechnology*** by Erbisch FH and Maredia K.
- ***Intellectual Property Rights: Unleashing Knowledge Economy*** by Ganguli P.
- ***Intellectual Property Rights: Key to New Wealth Generation. NRDC and Aesthetic Technologies.***
- ***Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.***
- ***Intellectual Property Rights in Animal Breeding and Genetics*** by Rothschild M and Scott N. (Ed.).
- ***Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*** by Saha R. (Ed.).

Semester 3

- **Course 1**

L	T	P	Credits
2	0	2	3

Course Code	**AGR552**						
Course Title	**Management of Problem Soils and Water**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Minor Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and s+kills: **CO1: To understand about waste land and problematic soils in India and management of the soils.** **CO2: To know the different reclamation and management practices for the development of the soils.** **CO3: To understand different factors responsible for saline, sodic and acidic soils and their properties.** **CO4: To use the fundamentals of soil science disciplines for the reclamation of degraded soils.** **CO5: To demonstrate fundamental knowledge to identify problematic soils and associated problems and identify processes resulting in deterioration of soil physical and chemical properties.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Area and distribution of problem soils–acidic, saline, sodic and physically degraded soils • Origin and basic concept of problematic soils, and factors responsible.						**CO1**
	Unit 2: (5 hours) • Morphological features of saline, sodic and saline-sodic soils						**CO2**

	• Characterization of salt-affected soils-soluble salts, ESP, pH; physical, chemical and microbiological properties.	
	Unit 3: (5 hours) • Management of salt-affected soils; salt tolerance of crops- mechanism and ratings • Salt stress meaning and its effect on crop growth, monitoring of soils alkalinity in the field • Management principles for sandy, clayey, red lateritic and dryland soils.	**CO3**
	Unit 4: (5 hours) • 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.	**CO4**
	Unit 5: (6 hours) • 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.	**CO5**
	Unit 6: (6 hours) • Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters. **Practical: (24 hours)** • Characterization of acid, acid sulfate, salt-affected and calcareous soils • Determination of cations (Na^+, K^+, Ca^{++} and Mg^{++}) in groundwater and soil samples • Determination of an ions (Cl^-, SO_4^-, CO_3^- and HCO_3^-) in ground waters and soil samples • Lime and gypsum requirements of acid and sodic soils.	

Reference Books:

- ***Chemistry of the Soil by Bear FE. 1964.***
- ***Salt-affected Soils. Department of Soil Science & Biometeorology by Jurinak JJ.***
- ***]USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.***

- **Course 2**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGS711**						
Course Title	**Experimental Designs**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To generate hypotheses which can be tested using experiments.** **CO2: To understand the different types of designs and apply them accordingly.** **CO3: To know the basic principles of writing and programming (in qualtrics) an experiment.** **CO4: To analyze and report experimental results.** **CO5: To understand and critically reflect on current developments in experimental research.**						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical (24 hrs) + Practical (24 hrs)						
Syllabus	**Unit 1: (3 hours)** • Need for designing of experiments, characteristics of a good design • Basic principles of designs- randomization, replication and local control.						**CO1**
	Unit 2: (5 hours) • Uniformity trials, size and shape of plots and blocks • Analysis of variance • Completely randomized design, randomized block design and Latin square design.						**CO2**
	Unit 3: (5 hours) • Factorial experiments, (symmetrical as well as asymmetrical), orthogonality and partitioning of degrees of freedom						**CO3**

	• Concept of confounding.	
	Unit 4: (5 hours) • Split plot and strip plot designs, • Analysis of covariance and missing plot techniques in randomized block and Latin square designs • Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, • Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. • Response surfaces • Combined analysis.	**CO4**
	Practical: (24 hours) • Uniformity trial data analysis, formation of plots and blocks, • Fairfield Smith Law • Analysis of data obtained from CRD, RBD, LSD • Analysis of factorial experiments • Analysis with missing data • Split plot and strip plot designs.	

Reference Books:

- ***Experimental Designs. 2nd Ed.*** by Cochran WG and Cox GM.
- ***Design and Analysis of Experiments*** by Dean AM and Voss D.
- ***Design and Analysis of Experiments, 8th Ed.*** by Montgomery DC.
- ***Experimental Designs*** by Federer WT.
- ***Design and Analysis of Experiments*** by Fisher RA.
- ***Handbook on Analysis of Agricultural Experiments*** by Nigam AK and Gupta VK.
- ***The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*** by Pearce SC.

- **Course 3**

L	T	P	Credits
0	**0**	**2**	**1**

Course Code	**AGS501**						
Course Title	**Library and Information Services**						
Hours	24 L:0, T:0, P:2						
Credits	1						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To understand the development of libraries.** **CO2: To classify libraries based on their purpose and functions.** **CO3: To understand laws related to libraries and information and understand librarianship as a profession.** **CO4: To assess the role of national and international library associations and organizations.** **CO5: To highlight role of various library promoters at the national and international level.**						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Practical (24 hrs)						
Syllabus	**Practical: (24 hours)** • Introduction to library and its services • Role of libraries in education, research and technology transfer • Classification systems and organization of library • Sources of information- Primary Sources, Secondary Sources and Tertiary Sources • Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); • Tracing information from reference sources • Literature survey • Citation techniques/ Preparation of bibliography • Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services						

	• Use of Internet including search engines and its resources • e-resources access methods.	

Reference Books:

- ***Academic librarianship: changing roles in the digital age*** by Wu Diana Yuhfen and Liu Mengxiong
- ***Scientific social survey and research. Rev. 4th Ed***. by Young, P.V.

- **Course 4**

L	T	P	Credits
0	**0**	**2**	**1**

Course Code	**AGS504**						
Course Title	**Basic Concepts in Laboratory Techniques**						
Hours	24 L:0, T:0, P:2						
Credits	1						
Type	**Compulsory Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge on the rules for laboratory safety with regards to personal protective equipment, disposal of infectious materials, personal habits, universal precautions and locations and use of fire safety equipment and eyewash and follow experimental procedures in the laboratory.** **CO2: To demonstrate correct technique for use and maintenance of a microscope and explain the role of certifying agencies for the laboratory profession.** **CO3: To assess the importance of quality control in the clinical laboratory.** **CO4: To solve problems involving volume and perform mathematical problems relating to solutions.** **CO5: To identify components of a laboratory information system and predict types of errors, which may occur through inadequate information processing.**						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Practical (24 hrs)						
Syllabus	**Practical (24 hrs):** • Safety measures while in Lab • Handling of chemical substances • Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets • Washing, drying and sterilization of glassware • Drying of solvents/ chemicals						**CO1, CO2, CO3, CO4, CO5**

	• Weighing and preparation of solutions of different strengths and their dilution • Handling techniques of solutions • Preparation of different agro-chemical doses in field and pot applications • Preparation of solutions of acids • Neutralisation of acid and bases • Preparation of buffers of different strengths and pH values • Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath • Electric wiring and earthing • Preparation of media and methods of sterilization • Seed viability testing, testing of pollen viability • Tissue culture of crop plants • Description of flowering plants in botanical terms in relation to taxonomy.	

Reference Books:

- ***CRC Hand Book of Laboratory Safety*** by Furr AK.
- ***A Handbook of Laboratory Solutions*** by Gabb MH and Latchem WE.

- **Course 5**

L	T	P	Credits
1	**0**	**0**	**1**

Course Code	**AGS505**						
Course Title	**Agricultural Research, Research Ethics and Rural Development Programmes**						
Hours	12 L:1, T:0, P:0						
Credits	1						
Type	**Compulsory Course**						
ourse Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To know about the basic issues related with agricultural research, ethics in research as well as rural development.** **CO2: To gain the information about the principles and philosophy of rural development and various ongoing rural and community development programmes and policies.** **CO3: To motivated towards practicing and promoting ethics in research and developmental endeavours.**						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory (12 hrs)						
Syllabus	**Unit 1: (5 hours)** • 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.						**CO1**
	Unit 2: (2 hours)						**CO2**

	• Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics	
	Unit 3: (5 hours) • 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), 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.	**CO3**

Reference Books:

- ***Indian Agriculture - Four Decades of Development*** by Bhalla GS and Singh G.
- ***Manual on International Research and Research Ethics*** by Punia MS.
- ***Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*** by Rao BSV.
- ***Rural Development - Principles, Policies and Management*** by Singh K.

- **Course 6**

L	T	P	Credits
2	**0**	**2**	**3**

Course Code	**AGS551**						
Course Title	**Production Technology of Cool Season Vegetable Crops**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Open Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: To acquire knowledge about the production technology of cool season vegetable crops.** **CO2: To devise cropping scheme and plan for commercial vegetable production.** **CO3: To apply knowledge of intercultural practices for improving yield of vegetable crops.** **CO4: To develop skills for growing temperate vegetable crops.** **CO5: To gain knowledge about calculation related to the economics of vegetable production in India.**						
Examination Type	Theory/Practical/Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**0**	**25%**	**0**	**35%**	**5%**
Examination Mode	Theory/Practical/Theory (24 hrs) + Practical (24 hrs)						
Syllabus	Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of: **Unit 1: (3 hours)** • Potato						**CO1**
	Unit 2: (5 hours) • Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels sprout.						**CO2**
	Unit 3: (5 hours) • Root crops: carrot, radish, turnip and beetroot						**CO3**
	Unit 4: (5 hours)						**CO4**

	• Bulb crops: onion and garlic.	
	Unit 5: (6 hours) • Peas and broad bean, green leafy cool season vegetables.	**CO5**
	Practical: (24 hours) • Cultural operations (fertilizer application, sowing, mulching irrigation, weed control) of winter vegetable crops and their economics • Experiments to demonstrate the role of mineral elements • Plant growth substances and herbicides • Study of physiological disorders, • Preparation of cropping scheme for commercial farms. • Visit to commercial greenhouse/polyhouse	

Reference Books:

- ***Vegetable Production in India*** by Brady NC & Weil R.R
- ***Hand Book of Horticulture*** by K L Chadha
- ***Package and Practices of Vegetables*** by PAU