Detailed Course Scheme

Master of Science in Agriculture

(Agronomy)

Semester- II

(2024- 26)

DOC202406150007

RNB GLOBAL UNIVERSITY
Educating stars for tomorrow

RNB GLOBAL UNIVERSITY
RNB Global City, Ganganagar Road,
Bikaner, Rajasthan 334601

OVERVIEW

RNB Global University follows Semester System along with Choice Based Credit System as per latest guidelines of University Grants Commission (UGC) and Indian Council of Agricultural Research (ICAR). Accordingly, each academic year is divided into two semesters, **Odd (July-December) and Even (January- June).** Also, the university follows a system of continuous evaluation along with regular updating in course curricula and teaching pedagogy.

The Curriculum for M. Sc Agriculture (Agronomy) program for (January – June) 2025 along with examination pattern is as follows:

Course Scheme

Semester –II

S. No.	Course Code	Category	Course Name	L	T	P	Credits
1.	MSAC41150	M	Principles and practices of soil fertility and nutrient management	2	0	0	2
2.	MSAC41151	M	Principles and practices of soil fertility and nutrient management Lab	0	0	2	1
3.	MSAC41152	M	Principles and Practices of Water Management	2	0	0	2
4.	MSAC41153	M	Principles and Practices of Water Management Lab	0	0	2	1
5.	MSAE41154	M	Dryland Farming and Watershed Management	2	0	0	2
6.	MSAE41155	M	Dryland Farming and Watershed Management Lab	0	0	2	1
7.	MSAE43150	Mi	Soil erosion and conservation	2	0	0	2
8.	MSAE43151	Mi	Soil erosion and conservation Lab	0	0	2	1
9.	MSAE43152	Mi	Analytical technique and instrumental methods in soil and plant analysis Lab	0	0	4	2
10.	MSAC55150	C	Technical writing and communication skills	1	0	0	1
11.	MSAC55151	C	Intellectual property and its management in agriculture	1	0	0	1
		Total		**10**	**0**	**12**	**16**

M: Major course; Mi: Minor course; C: Common course

EVALUATION SCHEME - THEORY

The evaluation of the theory paper of M. Sc. Ag. (Agronomy) program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessments as follows:

Internal Assessment

The distribution of Internal Assessment Marks is as follows:

Type	Details	Marks
Mid Term	One Mid-term Sessional	25
Marks obtained in various Tests, Assignments, Presentations, Quiz, Tutorials, etc.	Average of marks obtained	20
Academic and course involvement		5
TOTAL	**50**	

External Assessment

Type	Marks
Theory	50

EVALUATION SCHEME - PRACTICAL

The evaluation of the practical paper of M. Sc. Ag (Agronomy) program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessment is as follows:

Internal Assessment

Type	Details	Marks
Marks obtained in various manuals, practical file, participation, any model prepared, output of practical	Average of marks obtained	45
Academic and course involvement		5
TOTAL	**50**	

External Assessment

Type	Marks
Practical	50

1. Vision

Vision of School of Agriculture is to be established as advanced studies and research and skill-based centre for students and scholars.

2. Mission

Mission of School of Agriculture is to cultivate a scholarly mindset and analytical abilities in students, as well as train them in agricultural sphere, to reach the profession's daunting needs by providing dynamic knowledge in the field of agriculture.

3. Program Educational Objectives (PEOs)

After successful completion of the program, the graduates will be

AGPEO 1: Able to apply concepts of basic and applied sciences to Agriculture

AGPEO 2: Able to design and develop interdisciplinary and innovative systems.

AGPEO 3: Able to inculcate effective communication skills, team work, ethics, leadership in preparation for a successful career in agriculture and R&D organizations.

4. Program Outcomes (POs)

Students post graduating with the M.Sc. Agriculture (Agronomy) degree should be able to:

PO1. Agriculture knowledge: Apply the knowledge of basic and applied sciences to agriculture, agriculture fundamentals and agriculture specialization to the solution of complex agriculture problems. Apply the knowledge of regenerative agriculture with a conservation and rehabilitation approach to food and farming systems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex agriculture problems reaching substantiated conclusions using first principles of basic and applied sciences. Understand rapid appraisal of agricultural innovation systems, a diagnostic tool that can guide the analysis of complex agricultural problems and innovation capacity of the agricultural system towards futuristic agriculture.

PO3. Design/development of solutions: Design solutions for complex agriculture problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern agriculture and IT tools including prediction and modeling to complex agriculture activities with an understanding of the limitations. Learning use of GIS, IoT, Automation, and Intelligent Systems in Farming & Agriculture development & trading.

PO6. The agriculture postgraduate and society: Apply reasoning informed by the contextual knowledge to assess social, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional agriculture practices. Recognize, analyze, and evaluate the critical human and social factors impacting agriculture. Understand the social dimensions of agriculture and its connections with food and environmental systems.

PO7. Environment and sustainability: Understand the impact of the professional agriculture solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the agriculture practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex agriculture activities with the agriculture community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the agriculture in general and crop husbandry as specific and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. Able to design, launch and run a new business, to create job and not to seek for job. Also capable with an effective mix of knowledge, skills, and personal attitudes to be employed initially and function successfully in the required roles.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Outcomes (PSOs)

At the end of the program, the student will be able to:

PSO 1. Clearly understand the concepts and applications in the field of agriculture in general and crop husbandry in specific. Apply the knowledge of crop cultivation, crop improvement, soil and crop management for sustainable organic agricultural production and development.

PSO 2. Associate the learning from the courses related to agriculture to arrive at solutions to real world problems. Analyze and identifying complex agricultural problems and formulating ethical solutions using the principles of agricultural science, and business.

PSO 3. Have the capability to comprehend the technological advancements in the usage of modern design tools to analyze and design subsystems/processes for a variety of applications. Develop innovative processes, products, and technologies to meet the challenges in agriculture and farming practices

PSO 4. Possess the skills to communicate in both oral and written forms, the work already done and the future plans with necessary road maps, demonstrating the practice of professional ethics and the concerns for social and environmental wellbeing.

6. Course Outcomes (COs):

Course	Course outcomes: - After completion of these courses' students should be able to
MSAC41150- Principles and practices of soil fertility and nutrient management	**CO1:** Define key concepts related to soil fertility, such as nutrient cycles, soil organic matter, macronutrients, and micronutrients. **CO2:** Explain the physical, chemical, and biological properties of soil that influence fertility and plant nutrient availability. **CO3:** Apply soil testing methods to assess soil fertility levels and recommend appropriate nutrient management practices for different cropping systems. **CO4:** Analyze the interaction between soil properties and plant nutrient uptake, considering factors such as soil pH, organic matter content, and microbial activity. **CO5:** Design an integrated nutrient management plan to improve soil fertility while minimizing environmental impacts,
MSAC41151- Principles and practices of soil fertility and nutrient management Lab	**CO1:** Identify the essential macronutrients and micronutrients required for plant growth and soil fertility. **CO2:** Describe the standard laboratory procedures used for soil testing, **CO3:** Conduct soil sampling and use laboratory techniques to measure soil pH, electrical conductivity, and nutrient concentrations (N, P, K) in different soil types. **CO4:** Analyze the results of soil tests to assess soil fertility status and diagnose potential nutrient deficiencies or toxicities in various soil samples. **CO5:** Evaluate different soil fertility enhancement strategies, such as the use of organic amendments (compost, manure) and inorganic fertilizers, based on soil test results and crop requirements.

MSAC41152- Principles and practices of water management	**CO1:** Identify concepts related to water resources, including water cycle, irrigation techniques and water-use efficiency in agricultural systems. **CO2:** Explain the physical, chemical, and biological processes that affect water availability and quality in different ecosystems, including surface water and groundwater systems. **CO3:** Apply different water management techniques for determining crop water requirements to enhance water-use efficiency in agriculture. **CO4:** Analyze the impact of various irrigation methods and water management practices on crop productivity, soil health, and environmental sustainability. **CO5:** Evaluate the effectiveness of different water conservation strategies, for maintaining crop productivity under water-limited conditions.
MSAC41153- Principles and practices of water management Lab	**CO1:** Identify various types of irrigation systems and water management practices used in agriculture. **CO2:** Describe the fundamental principles of soil moisture measurement and the significance of water retention and infiltration rates in soil. **CO3:** Conduct practical experiments to measure soil moisture content. **CO4:** Analyze the effectiveness of different irrigation methods and crop response. **CO5:** Evaluate the performance of various water management techniques and irrigation systems
MSAE4154- Dryland farming and watershed management	**CO1:** Identify key concepts and terminologies related to dryland farming, watershed management, and soil and water conservation techniques. **CO2:** Explain the principles of dryland agriculture suitable for arid and semi-arid regions. **CO3:** Apply appropriate soil and water conservation techniques to enhance agricultural productivity in dryland conditions. **CO4:** Analyze the hydrological cycle within a watershed and assess the impact of land use practices on soil erosion. **CO5:** Design a comprehensive dryland farming plan considering local environmental conditions, socio-economic factors and community involvement.

MSAE4155- Dryland farming and watershed management Lab	**CO1:** Identify and describe various tools, techniques, and practices used in dryland farming and watershed management **CO2:** Explain the methods for assessing soil health and moisture content, in dryland conditions. **CO3:** Apply field techniques for measuring soil moisture, analyzing erosion potential, and assessing crop performance in dryland farming systems. **CO4:** Analyze data from soil and water conservation experiments to evaluate the effectiveness of different practices **CO5:** Evaluate the impact of land management practices on watershed health through field observations and data analysis.
MSAE43150- Soil erosion and conservation	**CO1:** Identify and describe the key concepts related to soil erosion, including types of erosion and the factors influencing erosion processes. **CO2:** Explain the environmental and economic impacts of soil erosion on agriculture, ecosystems, and human livelihoods. **CO3:** Apply methods for assessing soil erosion risk in various landscapes, including the use of erosion models and field measurements **CO4:** Analyze the effectiveness of different soil conservation practices in reducing erosion and maintaining soil health. **CO5:** Evaluate land management strategies and policies for soil conservation in agricultural practices.
MSAE43151- Soil erosion and conservation Lab	**CO1:** Identify various soil erosion types, conservation practices, and laboratory tools used to measure soil erosion and assess soil health. **CO2:** Explain the principles of soil erosion measurement techniques and soil loss assessment methods. **CO3:** Conduct practical experiments to measure soil erosion using tools like erosion pins, rainfall simulators, and sediment collection devices, **CO4:** Analyze the data collected from erosion experiments to evaluate the effectiveness of different soil conservation practices and their impact on soil health and erosion control. **CO5:** Design a soil conservation project that integrates experimental findings and best practices to mitigate erosion.

MSAE 43152- Analytical techniques and instrumental methods in soil and plant analysis Lab	**CO1:** Identify and describe the basic principles and functions of various analytical techniques and instruments used in soil and plant analysis. **CO2:** Explain the processes involved in sample preparation and analysis for soil and plant tissues and calibration and standards. **CO3:** Apply analytical techniques and instrumental methods to determine nutrient content, pH, electrical conductivity, and other critical parameters in soil and plant samples. **CO4:** Analyze the results and interpreting data to assess soil fertility and plant nutrient status, and drawing conclusions based on the analysis. **CO5:** Evaluate the reliability and accuracy of analytical methods and instruments and applicability to specific soil and plant analysis.
MSAC55150- Technical writing and communication skills	**CO1:** Identify and describe the key elements of technical writing. **CO2:** Explain the principles of effective communication in technical contexts, and the importance of organization in documents. **CO3:** Apply techniques for drafting various technical documents, to specific audiences and purposes. **CO4:** Analyze existing technical documents to evaluate their effectiveness in communicating information and suggest improvements based on best practices in technical writing. **CO5:** Evaluate the appropriateness for conveying technical information to diverse audiences.
MSAC55151- Intellectual property and its management in agriculture	**CO1:** Identify and describe the different types of intellectual property rights (IPR) relevant to agriculture. **CO2:** Explain the significance of intellectual property rights in agriculture. **CO3:** Apply the principles of intellectual property management to assess and protect agricultural innovations. **CO4:** Analyze case studies of intellectual property issues in agriculture. **CO5:** Evaluate the ethical and legal implications of intellectual property practices in agriculture.

7. CO PO Mapping:

MSAC41150	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	2		2		2	1	3	2
CO2	3	2	3	2	2	3	2	3	2	2	3	2
CO3	1	2	3	3	3	2	2	3	2	3	2	2
CO4	2	2	2	3	3	2	2	2	3	3	3	2
CO5	3	2	3	3	2	2	2	3	3	3	3	3

MSAC41151	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	2	2	2	2	3	2
CO2	2	3	3	3	2	2	2	2	2	2	1	2
CO3	3	3	2	2	2	2	3	2	2	2	3	3
CO4	3	2	3	2	2	2	2	2	2	2	2	2
CO5	2	2	1	3	2	3	2	2	2	2	3	3

MSAC41152	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	3	2	1	3	3	1	3
CO2	3	2	2	2	2	2	2	2	2	3	2	3
CO3	1	1	1	2	1	3	3	3	2	3	3	3
CO4	2	2	2	2	3	3	1	3	2	3	3	3
CO5	3	2	3	2	2	2	2	2	3	2	3	3

MSAC41153	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	2	3	1	1	3	3	1	3
CO2	3	2	2	2	2	2	1	2	2	3	2	3
CO3	1	1	2	1	1	3	1	3	2	3	3	3
CO4	2	2	2	2	3	3	1	3	2	3	3	3
CO5	2	2	3	2	2	2	2	2	3	2	3	3

MSAC41154	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	3	2	3	3	2	3	2	2
CO2	2	3	3	3	3	1	2	3	3	3	3	3
CO3	2	2	2	2	2	3	2	3	3	3	3	2
CO4	2	2	3	3	3	3	3	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	3	2	2	2

MSAC41155	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	3	2	3	3	3	3	3
CO2	2	2	3	3	3	2	2	2	3	3	2	2
CO3	2	3	2	3	1	2	2	3	2	3	2	3
CO4	3	3	2	2	3	2	2	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MSAE43150	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	3	3	3	3	3
CO2	2	2	3	3	3	2	2	2	3	3	2	2
CO3	2	3	2	3	1	2	2	3	2	3	2	3
CO4	3	3	2	2	3	2	3	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MSAE43151	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	1	3	3	3	3	3
CO2	2	2	3	3	3	2	2	2	3	3	2	2
CO3	2	3	2	3	1	2	2	3	2	3	2	3
CO4	3	3	2	2	3	2	3	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MSAE43152	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	3	2	3	3	3	3	3
CO2	2	2	3	3	3	2	1	2	2	3	2	3
CO3	2	3	2	2	1	2	2	3	2	3	2	3
CO4	3	2	2	2	3	2	2	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MSAC55150	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	3	2	3	3	3	3	3
CO2	2	2	3	3	3	2	1	2	2	3	2	3
CO3	2	3	2	2	1	2	2	3	2	3	2	3
CO4	3	2	2	2	3	2	2	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MSAC55151	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	3	2	3	3	3	3	3
CO2	2	2	3	3	3	2	1	2	2	3	2	3
CO3	2	3	2	2	1	2	2	3	2	3	2	3
CO4	3	2	2	2	3	2	2	3	2	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

8. Curriculum

Course Name: Principal and Practices of Soil Fertility and Nutrient Management

Course Code: MSAC41150

Course Outline

Theory

Unit I

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.

Unit II

Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.

Unit III

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. Soil less cultivation.

Unit IV

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.

Unit V

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops.

Suggested Reading

- Brady NC and Weil RR. 2002. *The Nature and Properties of Soils.* 13th Ed. Pearson Edu.
- Fageria NK, Baligar VC and Jones CA. 1991. *Growth and Mineral Nutrition of Field Crops.* Marcel Dekker.
- Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. *Soil Fertility and Fertilizers.* 7th Ed. Prentice Hall.
- Prasad R and Power JF. 1997. *Soil Fertility Management for Sustainable Agriculture*. CRC Press.
- Yawalkar KS, Agrawal JP and Bokde S. 2000. *Manures and Fertilizers*. Agri-Horti Publ.

Course Name: Principal and Practices of Soil Fertility and Nutrient Management Lab

Course Code: MSAC41151

Practical

- Determination of soil pH and soil EC
- Determination of soil organic C
- Determination of available N, P, K and S of soil
- Determination of total N, P, K and S of soil
- Determination of total N, P, K, S in plant
- Computation of optimum and economic yield

Course Name: Principles and Practices of Water Management

Course Code: MSAC41152

Course Outline

Theory

Unit I

Water and its role in plants; Irrigation: Definition and objectives, water resources and irrigation development in of India and Rajasthan, major irrigation projects, extent of area and crops irrigated in India and in different states.

Unit II

Field water cycle, water movement in soil and plants; transpiration; 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 loses.

Unit III

Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and polyhouses. Irrigation efficiency and water use efficiency.

Unit IV

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.

Unit V

Excess of soil water and plant growth; water management in problem soils, drainage requirement of crops and methods of field drainage, their layout and spacing; rain water management and its utilization for crop production.

Unit VI

Quality of irrigation water and management of saline water for irrigation, water management in problem soils

Unit VII

Soil moisture conservation, water harvesting, rain water management and its utilization for crop production.

Unit VIII

Hydroponics, Water management of crops under climate change scenario.

Course Name: Principles and Practices of Water Management Lab

Course Code: MSAC41153

Practical

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

Suggested Reading

- Majumdar DK. 2014. *Irrigation Water Management: Principles and Practice*. PHL Learning private publishers
- Mukund Joshi. 2013. *A Text Book of Irrigation and Water Management Hardcover*, Kalyani publishers
- Lenka D. 1999. *Irrigation and Drainage*. Kalyani.
- Michael AM. 1978. *Irrigation: Theory and Practice*. Vikas Publ.
- Paliwal KV. 1972. *Irrigation with Saline Water*. IARI Monograph, New Delhi.
- Panda SC. 2003. *Principles and Practices of Water Management*. Agrobios.
- Prihar SS and Sandhu BS. 1987. *Irrigation of Food Crops - Principles and Practices*. ICAR.
- Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
- Singh Pratap and Maliwal PL. 2005. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publ.

Course Name: Dryland Farming and Watershed Management

Course Code: MSAE41154

Course Outline

Theory

Unit I

Definition, concept and characteristics of dry land farming; 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 limiting crop production in dry land areas; types of drought, characterization of environment for water availability; 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 contingent plan for aberrant weather conditions.

Unit IV

Tillage, tilth, frequency and depth of cultivation, compaction in 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.

Unit V

Concept of watershed resource management, problems, approach and components.

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Course Name: Dryland Farming and Watershed Management Lab

Course Code: MSAE41155

Practical

The method of seed priming involves treating seeds before sowing to enhance germination and early growth. The determination of moisture content is crucial for understanding the germination potential of important dryland crops. The relative water content and saturation deficit of a leaf are essential parameters to assess plant water status. Moisture stress effects and the recovery behavior of important crops are significant in evaluating plant resilience under drought conditions. The potential evapotranspiration (ET) can be estimated using the Thornthwaite method, while the reference ET is calculated using the Penman-Monteith method. Climate classification can be performed by the Thornthwaite method, based on moisture, humidity, and aridity indices, and by the Koppen method for more detailed climate zoning. Water balance estimation can be carried out using both the Thornthwaite and FAO methods. Drought assessment is a key factor in understanding water scarcity impacts on crops, and the estimation of the length of the growing period helps in determining the viable cropping season. The probability of rainfall and crop planning for different drought conditions is essential for managing dryland agriculture. Spraying anti-transpirants can reduce water loss and improve crop performance under water stress. Water use efficiency measures the effective use of water by crops. Visits to dryland research stations and watershed projects provide practical insights into sustainable water management in agriculture.

Suggested Reading

- Reddy TY. 2018. *Dryland Agriculture Principles and Practices*, Kalyani publishers
- Das NR. 2007. *Tillage and Crop Production*. Scientific Publ.
- Dhopte AM. 2002. *Agrotechnology for Dryland Farming*. Scientific Publ.
- Dhruv Narayan VV. 2002. *Soil and Water Conservation Research in India*. ICAR.
- Gupta US. (Ed.). 1995. *Production and Improvements of Crops forDrylands*. Oxford & IBH.
- Katyal JC and Farrington J. 1995. *Research for Rainfed Farming*. CRIDA.
- Rao SC and Ryan J. 2007. *Challenges and Strategies of Dryland Agriculture*. Scientific Publ.
- Singh P and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ. Company.
- Singh RP. 1988. *Improved Agronomic Practices for Dryland Crops*. CRIDA.
- Singh RP. 2005. *Sustainable Development of Dryland Agriculture in India*. Scientific Publ.
- Singh SD. 1998. *Arid Land Irrigation and Ecological Management*. Scientific Publ.
- Venkateshwarlu J. 2004. *Rainfed Agriculture in India. Research and Development Scenario*. ICAR.

Course Name: Soil Erosion and Conservation

Course Code: MSAE43150

Course Outline

Theory

Unit I

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

Unit II

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 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 III

Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country.

Unit IV

Principles of erosion control; erosion control measures – agronomical and engineering; erosion control structures - their design and layout.

Unit V

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 VI

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 88 Physical Sciences: Soil Science evaluation of watersheds; use of remote sensing in assessment and planning of watersheds, sediment measurement

Course Name: Soil Erosion and Conservation Lab

Course Code: MSAE43151

Practical

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

Suggested Reading

- Biswas TD and Narayanasamy G. (Eds.) 1996. Soil Management in Relation to Land Degradation and Environment. Bull. Indian Society of Soil Science No. 17.
- Doran JW and Jones AJ. 1996. Methods of Assessing Soil Quality. Soil Science Society of America, Spl Publ. No. 49, Madison, USA.
- Gurmal Singh, Venkataramanan C, Sastry G and Joshi BP. 1990. Manual of Soil and Water Conservation Practices. Oxford & IBH.
- Hudson N. 1995. Soil Conservation. Iowa State University Press.
- Indian Society of Soil Science 2002. Fundamentals of Soil Science. ISSS, New Delhi.
- Oswal MC. 1994. Soil Physics. Oxford & IBH.

Course Name: Analytical Technique and Instrumental Methods in Soil and Plant Analysis Lab

Course Code: MSAE43152

Course Outline

Practical

Unit I

Preparation of solutions for standard curves, indicators and standard solutions for acid base, oxidation reduction and complex metric titration; soil, water and plant sampling techniques, the 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, ultra violet and infrared spectro-photometer, atomic absorption, flame photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrome try and X-ray defractrometery; identification of minerals byX ray by different methods, CHNS analyzer. **Unit IV**

Electrochemical titration of clays; estimation of exchangeable cations (Na,Ca,Mg,K); estimation of root cation exchange capacity.

Unit V

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

Unit VI

Drawing normalized exchange isotherms; measurement of redox potential.

Suggested Readings

- Hesse P. 1971. Textbook of Soil Chemical Analysis. William Clowes & Sons.
- Jackson M L.1967. Soil Chemical Analysis. Prentice Hall of India.
- Keith A Smith 1991. Soil Analysis; Modern Instrumental Techniques. Marcel Dekker.
- Kenneth Helrich 1990. Official Methods of Analysis. Association of Official Analytical Chemists.
- Page A L, Miller R H and Keeney D R. 1982. Methods of Soil Analysis. Part II. SSSA, Madison.
- Piper C S. Soil and Plant Analysis. Hans Publ.
- Singh D, Chhonkar P K and Pandey R N. 1999. Soil Plant Water Analysis A Methods Manual. IARI, New Delhi.
- Tan K H. 2003. Soil Sampling, Preparation and Analysis. CRC Press
- Tandon H L S. 1993. Methods of Analysis of Soils, Fertilizers and Waters. FDCO, New Delhi.
- Vogel A L. 1979. A Textbook of Quantitative Inorganic Analysis. E L B S Longman.

Course Name: Technical Writing and Communication Skills

Course Code: MSAC55150

Course Outline

Practical

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, precise citations, etc.; Commonly used abbreviations in the and sis 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.

Suggested Readings

- Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Chicago Manual of Style.14th Ed.1996. Prentice Hall of India.
- Collins' Co build English Dictionary. 1995. Harper Collins.
- Gordon H Mand Walter J A. 1970. Technical Writing. 3rd Ed. Holt, Rinehart and Winston.
- Hornby A S. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English.6th Ed. Oxford University Press.
- James H S. 1994. Handbook for Technical Writing. N T C Business Books.
- Joseph G. 2000. M L A Handbook for Writers of Research Papers. 5th Ed. Affiliated East West Press.

- Mohan K. 2005. Speaking English Effectively. MacMillan India. Richard W S. 1969. Technical Writing.
- SethiJ and Dhamija P V. 2004. Course in Phonetics and Spoken English.2nd Ed.Prentice Hall of India.

Course Name: Intellectual Property and its Management in Agriculture

Course Code: MSAC55151

Course Outline

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; 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, copy rights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and protection; Protectable subject matters, biodiversity protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity 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.

Suggested Readings

- Erbisch F H and Maredia .1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P.2001. Intellectual Property Rights: Unleashing Knowledge Economy. Mc Graw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M and Scott N.(Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000;
- Trademarks Act, 1999; The Copyright Act, 1957; Layout Design Act, 2000; PPV and FR Act 2001, Rules 2003; The Biological Diversity Act, 2002.

9. Lesson Plan

MSAC41150-Principal and Practices of Soil Fertility and Nutrient Management

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Soil fertility and productivity concept, differences and factors affecting	C-1	Lecture
Unit-I	Features of a good soil management	C-2	Lecture
Unit-I	Problems of supply and factors affecting availability of nutrients	C-3	Lecture
Unit-I	Presentation	C-4	Presentation
Unit-I	Problems of supply and factors affecting availability of nutrients	C-5	Lecture
Unit-I	Relation between nutrient supply and crop growth	C-6	Lecture
Unit-I	Organic farming - basic concepts and definitions	C-7	Lecture
Unit-I	Organic farming - basic concepts and definitions	C-8	Lecture
Unit-I	Criteria of essentiality of nutrients, essential plant nutrients – their functions, nutrient deficiency symptoms	C-9	Lecture
Unit-I	Clarification class	C-10	Clarification class
Unit-II	Criteria of essentiality of nutrients, essential plant nutrients – their functions, nutrient deficiency symptoms	C-11	Lecture
Unit-II	Criteria of essentiality of nutrients, essential plant nutrients – their functions, nutrient deficiency symptoms	C-12	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Transformation and dynamics of major plant nutrients	C-13	Lecture
Unit-III	Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses	C-14	Lecture
Unit-III	Quiz	C-15	Quiz
Unit-III	Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses	C-16	Lecture
Unit-III	Recycling of organic wastes and residue management	C-17	Lecture
Unit-III	Soil less cultivation	C-18	Lecture
Unit-III	Quiz	C-19	Quiz
Unit-IV	Commercial fertilizers; composition, relative	C-20	Lecture

	fertilizer value and cost, fertilizer mixtures and grades		
Unit-IV	Relative performance of organic and inorganic nutrients and economics of fertilizer use	C-21	Lecture
	Home Assignment		Home Assignment
Unit-IV	Commercial fertilizers; composition, relative fertilizer value and cost, fertilizer mixtures and grades	C-22	Lecture
Unit-IV	Crop response to different nutrients	C-23	Lecture
Unit-IV	Residue wastes in crops	C-24	Lecture
Unit-IV	Clarification class	C-25	Clarification class
Unit-IV	Residual effects and fertilizer use efficiency; agronomic, chemical and physiological methods	C-26	Lecture
Unit-IV	Methods of increasing fertilizer use efficiency	C-27	Lecture
Unit-V	Time and methods of manures and fertilizers application	C-28	Lecture
Unit-V	Foliar application and its concept	C-29	Lecture
Unit-V	Classroom assignment	C-30	Classroom assignment

MSAC41151-Principal and Practices of Soil Fertility and Nutrient Management Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Determination of soil pH and soil EC	P-1	Practical
Unit-I	Determination of soil pH and soil EC	P-2	Practical
Unit-I	Determination of soil organic C	P-3	Practical
Unit-I	Determination of soil organic C	P-4	Practical
Unit-I	Determination of available N, P, K and S of soil	P-5	Practical
Unit-I	Determination of available N, P, K and S of soil	P-6	Practical
Unit-I	Determination of available N, P, K and S of soil	P-7	Practical
Unit-I	Determination of available N, P, K and S of soil	P-8	Practical
Unit-I	Determination of total N, P, K and S of soil	P-9	Practical
Unit-I	Determination of total N, P, K and S of soil	P-10	Practical
Unit-I	Determination of total N, P, K, S in plant	P-11	Practical
Unit-I	Determination of total N, P, K, S in plant	P-12	Practical
Unit-I	Determination of total N, P, K, S in plant	P-13	Practical
Unit-I	Determination of total N, P, K, S in plant	P-14	Practical
Unit-I	Computation of optimum and economic yield	P-15	Practical

MSAC41152-Principles and Practices of Water Management

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Water, its properties and role in plants	C-1	Lecture
Unit-I	Irrigation: Definition and objectives, water resources and irrigation development in India and Rajasthan	C-2	Lecture
Unit-I	Major irrigation projects, extent of area and crops irrigated in India and in Rajasthan.	C-3	Lecture
Unit-II	Field water cycle, water movement in soil and plants	C-4	Lecture
Unit-II	Transpiration; types and approaches to reduce transpiration, Soil-water-plant relationships; water absorption by plants;	C-5	Lecture
Unit-II	Transpiration; types and approaches to reduce transpiration, Soil-water-plant relationships; water absorption by plants;	C-6	Lecture
Unit-II	Clarification class	C-7	Clarification Class
Unit-II	Plant response to water stress, crop plant adaptation to moisture stress condition.	C-8	Lecture
Unit-II	Plant response to water stress, crop plant adaptation to moisture stress condition.	C-9	Lecture
Unit-III	Soil, plant and meteorological factors determining water needs of crops	C-10	Lecture
	Home Assignment		Home Assignment
Unit-III	Soil, plant and meteorological factors determining water needs of crops	C-11	Lecture
Unit-III	Scheduling, depth and methods of irrigation;	C-12	Lecture
Unit-III	Micro irrigation systems; deficit irrigation; fertigation;	C-13	Lecture
Unit-III	Management of water in controlled environments and polyhouses, Irrigation efficiency, water use efficiency and factor affecting it	C-14	Lecture
Unit-III	Management of water in controlled environments and polyhouses, Irrigation efficiency, water use efficiency and factor affecting it	C-15	Lecture
Unit-III	Quiz	C-16	Quiz
Unit-IV	Water management of crops and cropping systems,	C-17	Lecture

Unit-IV	Crop water requirement- estimation of ET and effective rainfall	C-18	Lecture
Unit-IV	Clarification class	C-19	Clarification class
Unit-IV	Water management of the major crops and cropping systems. Automated irrigation system.	C-20	Lecture
Unit-V	Excess of soil water and plant growth;	C-21	Lecture
Unit-V	Drainage requirement of crops and methods of field drainage, their layout and spacing;	C-22	Lecture
Unit-V	Class Assignment	C-23	Classroom assignment
Unit-V	Rain water management and its utilization for crop production	C-24	Lecture
Unit-VI	Quality of irrigation water and management of saline water for irrigation,	C-25	Lecture
Unit-VII	Water management in problematic soils	C-26	Lecture
Unit-VII	Soil moisture conservation – concepts and techniques	C-27	Lecture
	Presentation	C-28	Presentation
Unit-VII	Water harvesting, rain water management and its utilization for crop production.	C-29	Lecture
Unit-VIII	Hydroponics – an introduction, its components and types	C-30	Lecture
	Home Assignment		Home Assignment

MSAC41153-Principles and Practices of Water Management Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Determination of FC and PWP	P-1	Practical
Unit-I	Determination of Hygroscopic Coefficient	P-2	Practical
Unit-I	Determination of maximum water holding capacity of soil	P-3	Practical
Unit-I	Measurement of matric potential using gauge and mercury type tensiometer	P-4	Practical
Unit-I	Determination of soil-moisture characteristics curves	P-5	Practical
Unit-I	Determination of hydraulic conductivity in saturated soil by different methods	P-6	Practical
Unit-I	Estimation of unsaturated hydraulic conductivity	P-7	Practical
Unit-I	Measurement of soil water diffusivity	P-8	Practical
Unit-I	Estimation of upward flux of water using tensiometer and from depth ground water table	P-9	Practical
Unit-I	Determination of irrigation requirement of crops (calculations)	P-10	Practical
Unit-I	Determination of effective rainfall (calculations)	P-11	Practical
Unit-I	Determination of ET of crops by soil moisture depletion method	P-12	Practical
Unit-I	Determination of water requirements of crops	P-13	Practical
Unit-I	Measurement of irrigation water by volume and velocity-area method	P-14	Practical
Unit-I	Measurement of irrigation water by measuring devices and calculation of irrigation efficiency	P-15	Practical

MSAE41154-Dryland Farming and Watershed Management

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Dryland farming- definition and concept	C-1	Lecture
Unit-I	Characteristics of dry land farming, dry land versus rainfed farming	C-2	Lecture
Unit-I	Characteristics of dry land farming, dry land versus rainfed farming	C-3	Lecture
Unit-I	Significance and dimensions of dry land farming in Indian agriculture	C-4	Lecture
Unit-I	Clarification Class	C-5	Clarification Class
Unit II	Soil and climatic parameters with special emphasis on rainfall characteristics	C-6	Lecture
Unit-II	Soil and climatic parameters with special emphasis on rainfall characteristics	C-7	Lecture
Unit-II	Drought – definition and types of droughts	C-8	Lecture
	Home Assignment	C-9	Home Assignment
Unit-II	Constraints limiting crop production in dry land areas	C-10	Lecture
Unit-II	Constraints limiting crop production in dry land areas	C-11	Lecture
Unit-II	Presentation	C-12	Presentation
Unit-II	Characterization of environment for water availability	C-13	Lecture
Unit-II	Crop planning for erratic and aberrant weather conditions	C-14	Lecture
Unit-II	Classroom assignment	C-15	Classroom Assignment
Unit-III	Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies	C-16	Lecture
Unit-III	Preparation of appropriate crop plans for dry land areas	C-17	Lecture
Unit-III	Preparation of appropriate crop plans for dry land areas	C-18	Lecture
Unit-III	Quiz	C-19	Quiz
Unit-III	Mid-season contingent plan for aberrant weather conditions	C-20	Lecture
Unit-IV	Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage	C-21	Lecture

Unit-IV	Concept of conservation tillage	C-22	Lecture
Unit-IV	Tillage in relation to weed control and moisture conservation	C-23	Lecture
Unit-IV	Classroom assignment	C-24	Classroom Assignment
Unit-IV	Techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics)	C-25	Lecture
Unit-IV	Water harvesting –concepts, techniques and practices	C-26	Lecture
Unit-IV	Anti transpirants - their types, mechanism and role in dry farming	C-27	Lecture
	Home Assignment		Home Assignment
Unit-IV	Soil and crop management techniques, seeding and efficient fertilizer use	C-28	Lecture
Unit-V	Concept of watershed resource management, problems, approach and	C-29	Lecture
Unit-V	Clarification Class	C-30	Clarification Class

MSAE41155-Dryland Farming and Watershed Management Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Method of Seed Priming	P-1	Practical
Unit-I	Determination of moisture content of germination of important dryland crops	P-2	Practical
Unit-I	Determination of Relative Water Content and Saturation Deficit of Leaf	P-3	Practical
Unit-I	Moisture stress effects and recovery behaviour of important crops	P-4	Practical
Unit-I	Estimation of Potential ET by Thornthwaite method	P-5	Practical
Unit-I	Estimation of Reference ET by Penman Monteith Method	P-6	Practical
Unit-I	Classification of climate by Thornthwaite method (based on moisture index, humidity index and aridity index)	P-7	Practical
Unit-I	Classification of climate by Koppen Method	P-8	Practical
Unit-I	Estimation of water balance by Thornthwaite method	P-9	Practical
Unit-I	Estimation of water balance by FAO method	P-10	Practical
Unit-I	Assessment of drought	P-11	Practical
Unit-I	Estimation of length of growing period	P-12	Practical
Unit-I	Estimation of probability of rain and crop planning for different drought condition	P-13	Practical
Unit-I	Spray of anti-transpirants and their effect on crops Water use efficiency	P-14	Practical
Unit-I	Visit to dryland research stations and watershed projects	P-15	Practical

MSAE43150-Soil Erosion and Conservation

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	History, distribution, identification and description of soil erosion problems in India.	C-1	Lecture
Unit-I	History, distribution, identification and description of soil erosion problems in India.	C-2	Lecture
Unit-I	History, distribution, identification and description of soil erosion problems in India.	C-3	Lecture
Unit-II	Forms of soil erosion	C-4	Lecture
Unit-II	Quiz	C-5	Quiz
Unit-II	Effects of soil erosion and factors affecting soil erosion;	C-6	Lecture
Unit-II	Effects of soil erosion and factors affecting soil erosion;	C-7	Lecture
Unit-II	Types and mechanisms of water erosion	C-8	Lecture
Unit-II	Clarification class	C-9	Clarification class
Unit-II	Raindrops and soil erosion; rainfall erosivity estimation as index and kinetic energy	C-10	Lecture
Unit-II	Raindrops and soil erosion; rainfall erosivity estimation as index and kinetic energy	C-11	Lecture
Unit-II	Raindrops and soil erosion; rainfall erosivity estimation as index and kinetic energy	C-12	Lecture
Unit-II	Factors affecting water erosion	C-13	Lecture
	Home Assignment		Home Assignment
Unit-II	Empirical and quantitative estimation of water erosion	C-14	Lecture
Unit-II	Presentation	C-15	Presentation
Unit -II	Methods of measurement and prediction of runoff	C-16	Lecture
Unit- II	Soil losses in relation to soil properties and precipitation.	C-17	Lecture
Unit -II	Classroom Assignment	C-18	Classroom Assignment
Unit -III	Wind erosion- types, mechanism and factors affecting wind erosion	C-19	Lecture
Unit- III	Extent of wind erosion problem in the country.	C-20	Lecture
Unit- IV	Principles of erosion control	C-21	Lecture
Unit -IV	Erosion control measures	C-22	Lecture

Unit- IV	Agronomical and engineering; erosion control structures - their design and layout.	C-23	Lecture
Unit- IV	Classroom Assignment	C-24	Classroom Assignment
Unit -V	Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.	C-25	Lecture
Unit -VI	Watershed management - concept, objectives and approach; water harvesting and recycling;	C-26	Lecture
Unit -VI	Flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring	C-27	Lecture
Unit -VI	Quiz	C-28	Quiz
Unit -VI	Physical Sciences: Soil Science evaluation of watersheds; use of remote sensing in assessment and planning of watersheds, sediment measurement	C-29	Lecture
Unit -VI	Clarification class	C-30	Clarification class

MSAE43151-Soil Erosion and Conservation Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Determination of different soil erodibility indices	P-1	Practical
Unit-I	Determination of different soil erodibility indices	P-2	Practical
Unit-I	Determination of different soil erodibility indices	P-3	Practical
Unit-I	Determination of different soil erodibility indices	P-4	Practical
Unit-I	Computation of rainfall erosivity index (EI30) using rain gauge data	P-5	Practical
Unit-I	Computation of rainfall erosivity index (EI30) using rain gauge data	P-6	Practical
Unit-I	Computation of rainfall erosivity index (EI30) using rain gauge data	P-7	Practical
Unit-I	Computation of rainfall erosivity index (EI30) using rain gauge data	P-8	Practical
Unit-I	Land capability classification of a watershed Visits to a watershed	P-9	Practical
Unit-I	Land capability classification of a watershed Visits to a watershed	P-10	Practical
Unit-I	Computation of kinetic energy of falling rain drops	P-11	Practical
Unit-I	Computation of rainfall erosivity index (EI30) using rain gauge data	P-12	Practical
Unit-I	Land capability classification of a watershed	P-13	Practical
Unit-I	Visits to a watersheds	P-14	Practical
Unit-I	Visits to a watersheds	P-15	Practical

MSAE43152 -Analytical Technique and Instrumental Methods in Soil and Plant Analysis Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Preparation of solutions for standard curves, indicators and standard solutions for acid-base, oxidation reduction and complex metric titration	P-1	Practical
Unit-I	Soil, water and plant sampling techniques, their processing and handling.	P-2	Practical
Unit-II	Determination of nutrient potential and potential buffering capacity of phosphorus	P-3	Practical
Unit-II	Determination of nutrient potential and potential buffering capacity of potassium	P-4	Practical
Unit-II	Estimation of phosphorus fixation capacity of soil	P-5	Practical
Unit-II	Estimation of ammonium fixation capacity of soil	P-6	Practical
Unit-II	Estimation of potassium fixation capacity of soil	P-7	Practical
Unit-III	Principles of visible, ultra violet and infrared spectrophotometry, atomic absorption, flame photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrometry and X-ray diffractometry; identification of minerals by X ray by different methods, CHNS analyzer	P-8	Practical
Unit-IV	Electrochemical titration of clays	P-9	Practical
Unit-IV	Estimation of exchangeable cations (Na, Ca, Mg, K)	P-10	Practical
Unit-IV	Estimation of root cation exchange capacity.	P-11	Practical
Unit-V	Wet digestion/fusion/extraction of soil with aqua regia with soil for elemental analysis	P-12	Practical
Unit-V	Triacid /di-acid digestion of plant samples	P-13	Practical
Unit-V	Determination of available and total nitrogen in soil	P-14	Practical
Unit-V	Determination of available and total potassium in soil	P-15	Practical
Unit-V	Determination of available and total calcium, magnesium in soil	P-16	Practical
Unit-V	Determination of available and total boron in soil	P-17	Practical

Unit-V	Determination of available and total molybdenum in soil	P-18	Practical
Unit-V	Determination of nitrogen in plant	P-19	Practical
Unit-V	Determination of phosphorus in plant	P-20	Practical
Unit-V	Determination of potassium in plant	P-21	Practical
Unit-V	Determination of Sulphur in plant	P-22	Practical
Unit-V	Determination of calcium and magnesium in plant	P-23	Practical
Unit-V	Determination of iron, copper, manganese, zinc in plant	P-24	Practical
Unit-V	Determination of boron in plant	P-25	Practical
Unit-V	Determination of boron in plant	P-26	Practical
Unit-V	Determination of molybdenum in plant	P-27	Practical
Unit-V	Determination of iron, copper, manganese, zinc in plant	P-28	Practical
Unit-V	Determination of calcium and magnesium in plant	P-29	Practical
Unit-VI	Drawing normalized exchange isotherms; measurement of redox potential	P-30	Practical

MSAC55150-Technical Writing and Communication Skills

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.;	P-1	Practical
Unit-I	Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion);	P-2	Practical
Unit-I	Writing of abstracts, summaries, precise citations, etc.;	P-3	Practical
Unit-I	Commonly used abbreviations in the research communications;	P-4	Practical
Unit-I	Illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations;	P-5	Practical
Unit-I	Writing of numbers and dates in scientific write-ups;	P-6	Practical
Unit-I	Editing and proof-reading;	P-7	Practical
Unit-I	Writing of a review article;	P-8	Practical
Unit-I	Communication Skills-Grammar (Tenses, parts of speech, clauses, punctuation marks);	P-9	Practical
Unit-I	Error analysis (Common errors), Concord, Collocation, Phonetic symbols and transcription	P-10	Practical
Unit-I	Accentual pattern: Weak forms in connected speech;	P-11	Practical
Unit-I	Participation in group discussion;	P-12	Practical
Unit-I	Facing an interview;	P-13	Practical
Unit-I	Presentation of scientific papers	P-14	Practical
Unit-I	Presentation of scientific papers	P-15	Practical

MSAC55151-Intellectual Property and its Management in Agriculture

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction of Intellectual Property Right regime	C-1	Lecture
Unit-I	Various provisions in TRIPS Agreement	C-2	Lecture
Unit-I	Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs	C-3	Lecture
Unit-I	Indian Legislations for the protection of various types of Intellectual Properties	C-4	Lecture
Unit-I	Fundamentals of patents, copy rights, geographical indications	C-5	Lecture
Unit-I	Presentation	C-6	Presentation
Unit-I	Designs and layout, trade secrets and traditional knowledge, trademarks,	C-7	Lecture
Unit-I	protection of plant varieties and farmers' rights and protection	C-8	Lecture
Unit-I	Protectable subject matters, biodiversity protection in biotechnology,	C-9	Lecture
Unit-I	protection of other biological materials, ownership and period of protection	C-10	Lecture
Unit-I	Clarification class	C-11	Clarification class
Unit-I	National Biodiversity initiatives; Convention on Biological Diversity;	C-12	Lecture
Unit-I	International Treaty on Plant Genetic Resources	C-13	Lecture
Unit-I	Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	C-14	Lecture
Unit-I	Quiz	C-15	Quiz

This is tentative lesson plan. The same may be changed from faculty as per the teaching pedagogy adapted by the faculty.

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