M.Sc. (Agri.) Soil Science
Teaching Scheme & Curriculum
Semester 1

Subjects				Contact Hours/Week			Theory Marks		Practical/Viva Marks		Total Marks
Sr.	Name	Type	Credit	Lect	Tut	Lab	T	T	P	P	
1	Soil Physics	Major	3	2	-	2	50	50	-	-	100
2	Soil Chemistry	Major	3	2	-	2	50	50	-	-	100
3	Soil, Water and Air Pollution	Major	3	2	-	2	50	50	-	-	100
4	Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	Major	2	0	-	4	50	50	-	-	100
5	Dry Land Farming & Water shade Management	Minor	3	2	-	2	50	50	-	-	100
6	Experimental Designs	Supporting	3	2	-	2	50	50	-	-	100
7	Library and Information Services	Non-Gradial	1	0	-	2			-	100	100
8	Basic Concepts in Laboratory Techniques	Non-Gradial	1	0	-	2			-	100	100
		Total	19	10	-	18					800

Lect *- Lecture,* ***Tut*** *- Tutorial,* ***Lab*** *- Lab, T - Theory,* ***P*** *- Practical*
Theory Passing %: *60* ***Practical Passing %:*** *60*

Prerequisite	Students should possess fundamental knowledge of soil science, basic physics, and agricultural sciences. Understanding of elementary concepts related to soil composition, water movement, and environmental interactions will facilitate effective learning of soil physical properties and processes.
Rationale	The course provides comprehensive knowledge of soil physical properties and their influence on plant growth, water dynamics, aeration, and soil management practices. It develops scientific understanding of soil-water-air relationships essential for sustainable agriculture and resource conservation. The course also emphasizes practical approaches for improving soil physical conditions to enhance crop productivity and environmental sustainability.
Course Title	**Soil physics**
Credits	3 (2+1)
Objectives of the course	1. To impart knowledge on the fundamental physical properties and behavior of soils. 2. To develop understanding of soil-water-air relationships and their role in crop production. 3. To explain the principles governing soil structure, compaction, consistency, and thermal properties. 4. To enable students to analyze soil physical constraints and adopt suitable soil management practices for sustainable agriculture.
Syllabus	
Theory	**Unit I** Basic principles of physics applied to soils, soil as a three phase system. **Unit II** Soil texture, textural classes, mechanical analysis, specific surface. **Unit III** Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts.Alleviation of soil physical constraints for crop production. Soil erosion and edibility **Unit IV** Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting -mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation. **Unit V** Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential. **Unit VI** Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils. **Unit VII** Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. **Unit VIII** Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant

	growth; soil air management. **Unit IX** Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.
Practical	➢ Determination of B.D, P.D and mass volume relationship of soil, Mechanical analysis by hydrometer and international pipette method, ➢ Measurement of Atterberg limits, Aggregate analysis - dry and wet, Measurement of soil-water content by different methods, Measurement of soil-water potential by using tensiometer and gypsum Blocks, Determination of soil-moisture characteristics curve and computation of pore-size, distribution, Determination of hydraulic conductivity under saturated and unsaturated conditions, ➢ Determination of infiltration rate of soil, Determination of aeration porosity and oxygen diffusion rate, Soil temperature measurements by different methods, Estimation of water balance components in bare and cropped fields.
Course Outcomes	**CO1:** Explain the basic physical principles of soils, including soil texture, structure, consistence, and soil as a three-phase system. **CO2:** Analyze soil water relationships, water movement, hydraulic properties, and soil moisture dynamics under saturated and unsaturated conditions. **CO3:** Interpret the processes of soil aeration, soil temperature regulation, infiltration, drainage, and soil-plant-atmosphere interactions affecting crop growth. **CO4:** Evaluate soil physical constraints such as compaction, erosion, crusting, swelling, and shrinkage, and recommend appropriate soil management practices for sustainable crop production.
Suggested Readings	1. Baver LD, Gardner WH and Gardner WR. 1972. Soil Physics. John Wiley & Sons. 2. Ghildyal BP and Tripathi RP. 2001. Soil Physics. New Age International. • Hanks JR and Ashcroft GL. 1980. Applied Soil Physics. Springer Verlag. 3. Hillel D. 1972. Optimizing the Soil Physical Environment toward Greater Crop Yields. Academic Press. 4. Hillel D. 1980. Applications of Soil Physics. Academic Press. 5. Hillel D. 1998. Environmental Soil Physics. Academic Press. 6. Hillel D. 2003. Introduction to Environmental Soil Physics. Academic Press. 7. Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSS, New Delhi. 8. Kirkham D and Powers WL. 1972. Advanced Soil Physics. Wiley-Interscience. 9. Kohnke H. 1968. Soil Physics. McGraw Hill.

	10. Lal R and Shukla MK. 2004. Principles of Soil Physics. Marcel Dekker. 11. Oswal MC. 1994. Soil Physics. Oxford & IBH

Prerequisite	Students should possess basic knowledge of soil science, chemistry, mineralogy, and environmental science. Familiarity with chemical reactions, soil constituents, and nutrient dynamics will support understanding of advanced soil chemical processes and equilibria.
Rationale	The course provides advanced understanding of soil chemical properties, ion exchange mechanisms, colloidal behavior, and soil reaction processes governing nutrient availability and soil productivity. It emphasizes the chemistry of acid, saline, sodic, and submerged soils along with environmental soil chemistry concepts. The course also develops analytical competence in interpreting soil chemical interactions for sustainable soil and nutrient management.
Course Title	**Soil Chemistry**
Credits	3 (2+1)
Objectives of the course	1. To impart advanced knowledge of soil chemical composition, colloidal properties, and ion exchange phenomena in soils. 2. To explain thermodynamic, electrochemical, and equilibrium principles governing soil chemical reactions and nutrient transformations. 3. To develop understanding of soil acidity, salinity, sodicity, and submerged soil chemistry along with their management practices. 4. To enhance the ability to analyse soil chemical behaviour and its implications for plant nutrition, environmental quality, and sustainable agriculture.
Syllabus	
Theory	**Unit I** Chemical (elemental) composition of the earth's crust, soils, rocks and minerals **Unit II** Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. **Unit III** Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, Characterization of OM; clay-organic interactions. **Unit IV** Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresisin sorption-desorption of oxy-anions and anions, shift of PZC on

	ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition. **Unit V** Potassium, phosphate and ammonium fixation in soils covering specific and nonspecific sorption; precipitation-dissolution equilibria; Concept of quantity/intensity(Q/ I)relationship; step and constant-rate K; management aspects. **Unit VI** Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity. Unit VII Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments. **Unit VIII** Chemistry and electrochemistry of submerged soils, geochemistry of micronutrients, environmental soil chemistry
Practical	
Course Outcomes	**CO1:** Explain the chemical composition of soils, minerals, and soil colloids, including the principles of thermodynamics, electrochemistry, and chemical equilibria governing soil systems. **CO2:** Analyze ion exchange processes, adsorption-desorption mechanisms, colloidal interactions, and nutrient fixation phenomena influencing nutrient availability in soils. **CO3:** Apply the concepts of soil chemical reactions and equilibria to interpret the behavior and management of acid, saline, sodic, and submerged soils. **CO4:** Evaluate soil chemical properties, environmental soil chemistry issues, and soil amendment practices for improving soil fertility, plant nutrition, and sustainable land management.
Suggested Readings	1. Bear RE. 1964. Chemistry of the Soil. Oxford and IBH. 2. Bolt GH and Bruggenwert MGM. 1978. Soil Chemistry. Elsevier. 3. Greenland DJ and Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons. 4. Greenland DJ and Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons. 5. McBride MB. 1994. Environmental Chemistry of Soils. Oxford University Press. 6. Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford University Press. 7. Sposito G. 1984. The Surface Chemistry of Soils. Oxford University Press.

Prerequisite	Students should possess foundational knowledge of soil science, environmental science, chemistry, and agricultural practices. Familiarity with soil-water-plant relationships and agrochemical usage will support understanding of environmental pollution and remediation processes.
Rationale	The course provides comprehensive understanding of soil, water, and air pollution associated with agricultural and industrial activities. It emphasizes the sources, behavior, and impacts of pollutants on soil health, crop productivity, environmental quality, and human health. The course also focuses on risk assessment, remediation technologies, and modern monitoring approaches for sustainable environmental management.
Course Title	**Soil, Water and Air Pollution**
Credits	3 (2+1)
Objectives of the course	1. To impart knowledge on the sources, nature, and extent of soil, water, and air pollution in agricultural ecosystems. 2. To explain the behavior and impact of pollutants, pesticides, and toxic elements on soil properties, plants, animals, and human health. 3. To develop understanding of pollutant transport, greenhouse gas emissions, and contamination of natural resources. 4. To enhance competency in pollution assessment, remediation techniques, and remote sensing applications for environmental management.
Syllabus	
Theory	**Unit** I Soil, water and air pollution problems associated with agriculture, nature and extent. **Unit II** Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants- their CPC standards and effect on plants, animals and human beings. **Unit III** Sewage and industrial effluents–their composition and effecton soil properties/ health, and plant growth and humanbeings; soil as sink for waste disposal. **Unit IV** Pesticides–their classification, behaviour in soil and effecton soil microorganisms. **Unit V** Toxic elements–their sources, behaviour in soils, effect on nutrients availability, effect on plant and human health. **Unit VI** Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of green house gases–carbondioxide, methane and nitrous oxide. **Unit VII** Risk assessment of polluted soil, Remediation/ amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.
Practical	Sampling of sewage waters, sewage sludge, solid/ liquid industrial wastes,

	polluted soils and plants and their processing, Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), measurement of coliform (MPN), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents, Heavy metals in contaminated soils and plants, Management of contaminants in soil and plants to safe guard food safety, Air sampling and determination of particulate matter and oxides of sulphur, NO2 and O2 conc. Visit to various industrial sites to study the impact of pollutants on soil and plants.
Course Outcomes	**CO1:** Explain the sources, characteristics, and impacts of agricultural, industrial, and urban pollutants on soil, water, air, and living organisms. **CO2:** Analyze the behavior of pesticides, toxic elements, sewage, and industrial effluents in soils and their influence on soil properties, nutrient availability, and environmental quality. **CO3:** Apply concepts of pollution monitoring, risk assessment, and remediation techniques for management of contaminated soil and water resources. **CO4:** Evaluate the environmental consequences of nutrient leaching, pesticide contamination, greenhouse gas emissions, and the use of remote sensing tools for sustainable pollution management.
Suggested Readings	1. Lal R, Kimble J, Levine E and Stewart BA. 1995. Soil Management and Greenhouse Effect. CRC Press. 2. Middlebrooks EJ. 1979. Industrial Pollution Control. Vol. I. Agro-Industries. John Wiley Interscience. 3. Ross SM. Toxic Metals in Soil Plant Systems. John Wiley & Sons. Vesilund PA and Pierce 1983. Environmental Pollution and Control. Ann Arbor Science Publ.

Prerequisite	Students should possess basic knowledge of soil science, analytical chemistry, plant nutrition, and laboratory techniques. Familiarity with chemical analysis, instrumentation, and sample preparation methods will support understanding of advanced analytical procedures in soil and plant analysis.
Rationale	The course provides comprehensive training in analytical techniques and laboratory methods used in soil, water, and plant analysis. It emphasizes principles of instrumental analysis, nutrient estimation, ion exchange measurements, and elemental characterization essential for soil fertility evaluation and research. The course also develops practical skills in sample handling, laboratory safety, and interpretation of analytical data for sustainable soil and crop management.
Course Title	**Analytical Technique and Instrumental Methods in Soil and Plant Analysis**
Credits	2 (0+2)
Objectives of the	1. To impart knowledge on preparation of standard solutions, sampling

course	techniques, and analytical procedures for soil, water, and plant analysis. 2. To explain the principles and applications of spectroscopic, chromatographic, electrochemical, and X-ray analytical techniques. 3. To develop competency in determination of nutrient status, ion exchange properties, and elemental composition of soils and plants. 4. To enhance analytical and interpretative skills for evaluating soil fertility, nutrient dynamics, and laboratory data in agricultural research.
Syllabus	
Theory	-
Practical	**Unit I** 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. **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 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. **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.
Course Outcomes	**CO1:** Explain the principles of solution preparation, sampling procedures, titration methods, and analytical techniques used in soil, water, and plant analysis. **CO2:** Analyze soil and plant samples using spectrophotometric, chromatographic, electrochemical, and instrumental methods for nutrient and elemental determination. **CO3:** Apply laboratory techniques for estimating nutrient fixation capacities, exchangeable cations, redox potential, and elemental composition of soils and plants. **CO4:** Evaluate analytical data, normalized exchange isotherms, and nutrient status of soils and plants for soil fertility assessment and research applications.
Suggested Readings	1. Hesse P. 971. Textbook of Soil Chemical Analysis. 2. Jackson ML. 1967. Soil Chemical Analysis. Prentice Hall of India. Keith A Smith 1991. Soil Analysis; Modern Instrumental Techniques. Marcel Dekker. 3. Kenneth Helrich 1990. Official Methods of Analysis. Association of

	Official Analytical Chemists. 4. Page AL, Miller RH and Keeney DR. 1982. Methods of Soil Analysis. Part II. SSSA, Madison. 5. Piper CE. Soil and Plant Analysis. Hans Publ. 6. Singh D, Chhonkar PK and Pandey RN. 1999. Soil Plant Water Analysis - A Methods Manual. IARI, New Delhi. 7. Tan KH. 2003. Soil Sampling, Preparation and Analysis. CRC Press/Taylor & Francis. 8. Tandon HLS. 1993. Methods of Analysis of Soils, Fertilizers and Waters. FDCO, New Delhi. 9. Vogel AL. 1979. A Textbook of Quantitative Inorganic Analysis. ELBS Longman.

Prerequisite	Students should have foundational knowledge of agronomy, soil science, agricultural meteorology, and crop production under rainfed conditions.
Rationale	Dryland agriculture plays a crucial role in food production in rainfed regions. Understanding moisture conservation, drought management, watershed management, and climate-based crop planning is essential for sustainable crop production under water-limited environments.
Course Title	**Dryland Farming and Watershed Management**
Credits	3(2+1)
Objectives of the course	1. To impart knowledge on dryland farming concepts and rainfed agricultural systems. 2. To explain drought management strategies, moisture conservation, and crop planning techniques. 3. To develop understanding of watershed management and efficient utilization of water resources. 4. To provide practical exposure on estimation of evapotranspiration, water balance, and drought assessment techniques.
Syllabus	
Theory	**Unit I** Definition, concept and characteristics of dryland farming; dryland versus rainfed farming; significance and dimensions of dryland farming in Indian agriculture. **Unit II** Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dryland areas; types of drought; characterization of environment for water availability; crop planning for erratic and aberrant weather conditions. **Unit III** Stress physiology and drought resistance; adaptation of crop plants to drought; drought management strategies; preparation of crop plans for dryland areas; contingent crop planning for aberrant weather conditions. **Unit IV** Tillage, tilth, frequency and depth of cultivation; soil compaction and conservation tillage; tillage in relation to weed control and moisture conservation; techniques of soil moisture conservation including mulches and antitranspirants; soil and crop management practices; seeding and

	efficient fertilizer use. **Unit V** Concept of watershed resource management, problems, approaches and components.
Practical	➢ Seed priming methods ➢ Determination of moisture content and germination of dryland crops ➢ Determination of Relative Water Content and Saturation Deficit of leaves ➢ Study of moisture stress effects and recovery behavior of crops ➢ Estimation of potential ET by Thornthwaite method ➢ Estimation of reference ET by Penman-Monteith method ➢ Climate classification by Thornthwaite and Koppen methods ➢ Estimation of water balance by Thornthwaite and FAO methods ➢ Drought assessment techniques ➢ Estimation of length of growing period ➢ Rainfall probability analysis and crop planning ➢ Application of antitranspirants and their effects ➢ Water use efficiency studies ➢ Visits to dryland research stations and watershed projects
Course Outcomes	**CO1**: Explain the principles, characteristics, and importance of dryland farming and watershed management. **CO2**: Analyze drought conditions, crop adaptation mechanisms, and moisture conservation practices for sustainable dryland agriculture. **CO3**: Evaluate crop planning, water balance, evapotranspiration, and watershed resource management strategies under rainfed conditions. **CO4**: Perform practical applications related to drought assessment, climate classification, water use efficiency, and dryland crop management.
Suggested Readings	1. Dryland Agriculture Principles and Practices. 2018. Kalyani Publishers. 2. Tillage and Crop Production. 2007. Scientific Publishers. 3. Agrotechnology for Dryland Farming. 2002. Scientific Publishers. 4. Soil and Water Conservation Research in India. 2002. ICAR. 5. Production and Improvement of Crops for Drylands. 1995. Oxford & IBH. 6. Research for Rainfed Farming. 1995. CRIDA. 7. Challenges and Strategies of Dryland Agriculture. 2007. Scientific Publishers. 8. Technologies for Food Security and Sustainable Agriculture. 2005. Agrotech Publications. 9. Improved Agronomic Practices for Dryland Crops. 1988. CRIDA. 10. Sustainable Development of Dryland Agriculture in India. 2005. Scientific Publishers. 11. Arid Land Irrigation and Ecological Management. 1998. Scientific Publishers. 12. Rainfed Agriculture in India: Research and Development Scenario. 2004. ICAR.

Prerequisite	Students should have basic knowledge of statistics, data analysis, and elementary mathematical concepts at the undergraduate level.
Rationale	Experimental design is a fundamental component of scientific research in agricultural and allied sciences. Proper planning, layout, and statistical analysis of experiments improve precision, reduce experimental error, and ensure reliable interpretation of research findings. This course provides essential knowledge of experimental designs and analysis techniques widely used in agricultural research.
Course Title	**Experimental Designs**
Credits	3(2+1)
Objectives of the course	1. To impart knowledge on the principles and importance of experimental design in scientific research. 2. To explain different experimental designs and their statistical analysis procedures. 3. To develop understanding of factorial experiments, confounding, covariance analysis, and incomplete block designs. 4. To provide practical exposure in layout planning, analysis, and interpretation of experimental data.
Syllabus	
Theory	**Unit I** Need for designing experiments; characteristics of a good design; basic principles of experimental design – randomization, replication and local control. **Unit II** Uniformity trials; size and shape of plots and blocks; analysis of variance; Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD). **Unit III** Factorial experiments (symmetrical as well as asymmetrical); orthogonality and partitioning of degrees of freedom; concept of confounding. **Unit IV** 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 (BIBD), resolvable designs and their applications; lattice design and alpha design – concepts, randomization procedures, analysis and interpretation of results; response surface methodology; combined analysis.
Practical	➢ Analysis of uniformity trial data ➢ Formation of plots and blocks ➢ Fairfield Smith Law ➢ Analysis of data obtained from CRD, RBD and LSD ➢ Analysis of factorial experiments ➢ Analysis with missing data ➢ Analysis of split plot and strip plot designs
Course Outcomes	**CO1**: Explain the need, principles, and characteristics of experimental designs used in agricultural and applied science research. **CO2**: Apply appropriate experimental designs such as CRD, RBD, LSD,

	factorial, split plot, and strip plot designs for research experiments. **CO3**: Analyze experimental data using ANOVA, covariance analysis, confounding techniques, and incomplete block designs. **CO4**: Interpret experimental results and perform practical data analysis for scientific research and decision-making.
Suggested Readings	1. Experimental Designs. 1957. 2nd Ed. John Wiley. 2. Design and Analysis of Experiments. 1999. Springer. 3. Design and Analysis of Experiments. 2012. 8th Ed. John Wiley. 4. Experimental Designs. 1985. MacMillan. 5. Design and Analysis of Experiments. 1953. Oliver & Boyd. 6. Handbook on Analysis of Agricultural Experiments. 1979. IASRI Publications. 7. The Agricultural Field Experiment. 1983. John Wiley. 8. ICAR Directorate of Research Services

Prerequisite	Students should possess basic knowledge of academic communication, information resources, and computer applications. Familiarity with internet usage and elementary research methodology will facilitate effective understanding of library systems and information retrieval techniques.
Rationale	The course is designed to acquaint students with modern library systems, information sources, and digital resource management essential for higher education and research. It enables learners to develop competencies in literature search, referencing, citation practices, and utilization of electronic information resources. The course also promotes information literacy skills necessary for academic writing, research documentation, and efficient access to scientific knowledge in the digital era.
Course Title	**Library and Information Services**
Credits	1(0+1)
Objectives of the course	1. To familiarize students with the structure, functions, and services of libraries in education and research. 2. To develop understanding of various information sources, indexing, and abstracting services used in scientific research. 3. To enhance skills in literature survey, citation techniques, bibliography preparation, and information retrieval. 4. To enable students to effectively use digital library resources, online databases, internet tools, and e-resources for academic purposes.
Syllabus	
Theory	-
Practical	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; resources access methods.
Course Outcomes	**CO1:** Explain the role, functions, and organization of libraries and classify different sources of scientific information. **CO2:** Describe abstracting, indexing, and citation services and interpret their significance in academic and research activities. **CO3:** Apply literature survey methods, reference management techniques, and bibliography preparation in scholarly work. **CO4:** Demonstrate the use of digital library tools, online databases, internet search engines, and e-resource access methods for efficient information retrieval.

Prerequisite	Students should possess basic knowledge of laboratory practices, elementary chemistry, biology, and plant sciences acquired at the undergraduate foundation level. Familiarity with common laboratory instruments, solution preparation, and safety protocols will facilitate effective understanding of practical laboratory operations and experimental techniques.
Rationale	This course is designed to develop essential laboratory competencies and technical skills required in agricultural and biological sciences. It provides hands-on training in laboratory safety, handling of chemicals and instruments, preparation of solutions and media, sterilization techniques, and basic biotechnological procedures. The course enhances students' practical proficiency, accuracy in experimentation, and scientific handling of laboratory resources necessary for research and field applications.
Course Code	
Course Title	**Basic Concepts in Laboratory Techniques**
Credits	1(0+1)
Objectives of the course	1. To familiarize students with laboratory safety procedures and proper handling of chemicals, glassware, and scientific instruments. 2. To develop practical skills in preparation of solutions, buffers, media, and agro-chemical formulations for laboratory and field applications. 3. To impart knowledge and hands-on training in sterilization techniques, viability testing, and tissue culture methods in crop plants. 4. To enable students to apply standard laboratory methodologies and botanical terminology in scientific experimentation and plant description.
Practical	➢ 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;

	➢ 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.
Course Outcomes	**CO1:** Explain laboratory safety measures, chemical handling procedures, and the operational principles of common laboratory instruments and equipment. **CO2:** Demonstrate the preparation, dilution, neutralization, and handling of chemical solutions, buffers, acids, and agro-chemical doses using standard laboratory techniques. **CO3:** Apply sterilization methods, media preparation techniques, seed and pollen viability testing, and tissue culture practices in laboratory experiments. **CO4:** Analyze and interpret botanical characteristics of flowering plants using standard taxonomic terminology and scientific laboratory practices.
Suggested Readings	1. Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press. Common Academic Regulations for PG and Ph.D. Programmes Restructured and Revised Syllabi of Post-graduate Programmes Vol. 2 2. Gabb MH and Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.