M.Sc. (Agri.) Entomology
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	Insect Morphology	Major	3	2	-	2	50	50	-	-	100
2	Insect Anatomy and Physiology	Major	3	2	-	2	50	50	-	-	100
3	Biological Control of Insect Pests and Weeds	Major	3	2	-	2	50	50	-	-	100
4	Concepts of Integrated Pest Management	Major	2	2	-	0	50	50	-	-	100
5	Principles of Plant Pathology	Minor	3	2	-	2	50	50	-	-	100
6	Experimental Designs	Supporting	3	2	-	2	50	50	-	-	100
7	Library and Library Information Services	Non-Gradial	1	0	-	2			-	100	100
8	Basic Concepts in Laboratory Techniques	Non-Gradial	1	0	-	2			-	100	100
		Total	**19**	**12**	**-**	**14**					**800**

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

Prerequisite	Students should have foundational knowledge of general entomology, insect classification, and basic insect anatomy and physiology at the undergraduate level, along with basic skills in microscopy and specimen handling.
Rationale	Insect morphology forms the structural basis for understanding insect taxonomy, physiology, behavior, ecology, and pest management. A thorough knowledge of external structures, sense organs, immature stages, and morphological adaptations enables students to accurately identify insects, interpret evolutionary relationships, and apply morphological traits in areas such as forensic entomology, systematics, and integrated pest management.
Course Title	**Insect Morphology**
Credits	3 (2+1)
Objectives of the course	1. To impart comprehensive knowledge of the external morphology and structural organization of insects. 2. To explain structural modifications of head, thorax, abdomen, wings, legs, and genitalia in relation to function and adaptation. 3. To develop understanding of insect sense organs, defense mechanisms, chaetotaxy, and organogenesis. 4. To enable identification and comparative study of immature stages and their ecological and pest management significance.
Syllabus	
Theory	**Unit I** External Morphology: Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation. Head- Origin, structure and modification; mouthparts, antennae, their types and functioning; tentorium and neck sclerites. Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; legs: structure and modifications. Abdomen- Segmentation and appendages; genitalia and their modifications; embryonic and post-embryonic development. **Unit II** Insect sense organs (mechano-, photo- and chemo- receptors); organogenensis at pupal stage; insect defense; chaetotaxy; morphological traits in relation to forensic entomology. **Unit III** Types of immature stages in insect orders, morphology of egg, nymph/ larva and pupa, identification of different immature stages of crop pests and stored product insects. Comparative study of life history strategies in hemi-metabola and holometabola, immature stages as ecological and evolutionary adaptations, significance of immature stages for pest management.
Practical	➢ Preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia; Dissection of genitalia.

	➢ Types of immature stages in insects; their collection, rearing and preservation; ➢ Identification of immature insects to orders and families, in endopterygote orders, viz., Diptera, Lepidoptera, Hymenoptera and Coleoptera using key;
Course Outcomes	**CO1:** Analyze the structural organization of insect external morphology including body wall, tagmata, sclerites, segmentation, and appendages. **CO2:** Evaluate the structural modifications of head, thorax, abdomen, wings, legs, mouthparts, antennae, and genitalia in relation to their functional adaptations. **CO3:** Interpret the types and functions of insect sense organs, defensive mechanisms, chaetotaxy, and organogenesis during the pupal stage. **CO4:** Classify and compare immature stages of major insect orders and relate their morphology to ecological adaptations and pest management significance.
Suggested Readings	1. Chapman RF. 1998. *The Insects: Structure and Function*. Cambridge Univ. Press, Cambridge. 2. Chu HF. 1992. *How to Know Immature Insects*. William Brown Publication, Iowa. 3. Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publishers, New Delhi. 4. Evans JW. 2004. *Outlines of Agricultural Entomology*. Asiatic Publ., New Delhi. 5. Gillott C. 1995. *Entomology*, 2nd Ed. Plenum Press, New York, London. 6. Gullan PJ and Cranston PS. 2000. *The Insects, An Outline of Entomology*, 2 Ed. Blackwell Science, UK. 7. Peterson A. 1962. *Larvae of Insects*. Ohio University Press, Ohio. 8. Richards OW and Davies RG. 1977. *Imm's General Text Book of Entomology*. 10th Ed. Chapman and Hall, London. 9. Snodgross RE. 1993. *Principles of Insect Morphology*. Cornell Univ. Press, Ithaca. 10. Tembhore DB. 2000. *Modern Entomology*, Himalaya Publishing House, Mumbai. 11. Stehr FW. 1998. *Immature Insects*. Vols. I, II. Kendall Hunt Publication, Iowa.

Prerequisite	Students should have a basic understanding of general biology, including cell structure, tissues, and organ systems. They should be familiar with fundamental zoology concepts such as classification and body organization. Knowledge of basic chemistry and physiological processes like respiration and digestion is important. An introductory idea of insect diversity and morphology will help in understanding insect body systems.
Rationale	A comprehensive understanding of insect anatomy and physiology is essential for analyzing insect behaviour, growth, and survival. It provides a scientific basis for accurate identification of pest and beneficial species. Knowledge of structural organization aids in developing sustainable pest management strategies. This subject is fundamental to postgraduate studies in entomology and agricultural sciences.
Course Title	**Insect Anatomy and Physiology**
Credits	3 (2+1)
Objectives of the course	1. To understand the structural organization of insects. 2. To explain the functions of different insect body systems. 3. To analyze the relationship between structure and function in insects. 4. To apply anatomical knowledge in pest management practices.
Syllabus	
Theory	**Unit I** Scope and importance of insect physiology; physiology of integument, moulting, chemistry of cuticle, biosynthesis of chitin; growth, hormonal control, metamorphosis and diapause; pheromone secretion, transmission, perception and reception. **Unit II** Physiology and mechanism of digestion, circulation, respiration, excretion, reproduction, secretion (exocrine and endocrine glands) and nerve impulse transmission in insects. **Unit III** Importance of insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.
Practical	➢ Latest analytical techniques for analysis of free amino acids of hemolymph; ➢ Determination of chitin in insect cuticle; ➢ Examination and count of insect hemocytes; preparation and evaluation of various diets; ➢ Consumption, utilization and digestion of natural and artificial diets.

Course Outcomes	**CO1:** Describe the structural organization and functions of various insect body systems. **CO2:** Demonstrate the use of anatomical and physiological knowledge in identifying pest and beneficial insects and their management. **CO3:** Examine the relationship between structure and function to interpret insect behaviour and adaptations. **CO4:** Assess pest management strategies based on insect physiological responses and ecological considerations.
Suggested Readings	1. Chapman RF. 1998. *Insects: Structure and Function*. ELBS Ed., London. 2. Duntson PA. 2004. *The Insects: Structure, Function and Biodiversity*. Kalyani Publishers, New Delhi. 3. Gullan PJ and Cranston PS. 2000. *The Insects*: *An Outline of Entomology*, 2 Ed. Blackwell Science, UK. 4. Kerkut GA and Gilbert LI. 1985. *Comprehensive Insect Physiology, Biochemistry and Pharmacology.* Vols. I-XIII. Pergamon Press, New York. 5. Patnaik BD. 2002. *Physiology of Insects*. Dominant Publishers, New Delhi. 6. Richards OW and Davies RG. 1977. *Imm's General Text Book of Entomology.* 10th Ed. Vol. 1. *Structure, Physiology and Development.* Chapman and Hall, New York. 7. Simpson SJ. 2007. *Advances in Insect Physiology*, Vol. 33, Academic Press (Elsevier), London, UK 8. Wigglesworth VB. 1984. *Insect Physiology.* 8th Ed. Chapman and Hall, New York.

Prerequisite	A student should have basic knowledge of insect pests, weeds, and their impact on crops, and understand ecological concepts and natural enemies such as predators, parasitoids, and pathogens. The student should be familiar with the principles of integrated pest management (IPM) and have awareness of general agricultural practices and crop protection methods.
Rationale	Biological control provides an eco-friendly and sustainable approach for managing insect pests and weeds. It reduces dependence on chemical pesticides, minimizing environmental pollution and resistance development. The course helps students understand the role of natural enemies in maintaining ecological balance. It also promotes safe and effective pest management practices for sustainable agriculture.
Credits	3 (2+1)
Objectives of the course	1. To understand the principles and importance of biological control in pest and weed management. 2. To identify and utilize natural enemies such as predators, parasitoids, and pathogens. 3. To develop skills in mass multiplication and application of biocontrol agents. 4. To promote sustainable and eco-friendly pest management practices.
Syllabus	
Theory	**Unit I** History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes. **Unit II** Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa, etc., their mode of action. Biological control of weeds using insects. Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these. Defense mechanisms in insects against pathogens. **Unit III** Mass production of quality bio-control agents- techniques, formulations, economics, field release/ application and evaluation. Development of insectaries, their maintenance. **Unit IV** Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.
Practical	➢ Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers;

	➢ Visits to bio-control laboratories to learn rearing and mass production of egg, egg- larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds; ➢ Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.
Course Outcomes	**CO1:** Explain the principles and significance of biological control in managing insect pests and weeds. **CO2:** Identify different natural enemies such as predators, parasitoids, and pathogens used in pest management. **CO3:** Apply techniques for mass multiplication and field utilization of biocontrol agents. **CO4:** Evaluate the effectiveness of biological control methods in sustainable agriculture systems.
Suggested Readings	1. Burges HD and Hussey NW. (Eds). 1971. *Microbial Control of Insects and Mites.* Academic Press, London. 2. De Bach P. 1964. *Biological Control of Insect Pests and Weeds.* Chapman and Hall, New York. 3. Dhaliwal GS and Arora R. 2001. *Integrated Pest Management: Concepts and Approaches.* Kalyani Publishers, New Delhi. 4. Gerson H and Smiley RL. 1990. *Acarine Biocontrol Agents – An Illustrated Key and Manual.* Chapman and Hall, New York. 5. Huffaker CB and Messenger PS. 1976. *Theory and Practices of Biological Control.* Academic Press, London. 6. Ignacimuthu SS and Jayaraj S. 2003. *Biological Control of Insect Pests*. Phoenix Publ., New Delhi. 7. Saxena AB. 2003. *Biological Control of Insect Pests*. Anmol Publ., New Delhi. 8. Van Driesche and Bellows TS. Jr. 1996. *Biological Control*. Chapman and Hall, New York.

Prerequisite	Student should know the basic concepts of insect biology, ecology, and pest identification before studying Integrated Pest Management (IPM). Basic understanding of crop production, agro-ecosystems, and the role of natural enemies in pest regulation is required. Knowledge of different pest control methods such as cultural, biological, and chemical control is essential. Understanding of environmental and economic aspects of pest management is important for sustainable agriculture.
Rationale	Integrated Pest Management (IPM) is an important approach that focuses on sustainable and eco-friendly pest control strategies. It reduces excessive dependence on chemical pesticides and promotes the use of biological and cultural methods. The subject helps in maintaining ecological balance while ensuring effective pest management. It also supports safe food production and minimizes environmental and health hazards.
Course Title	**Concepts of Integrated Pest Management**
Credits	2 (2+0)
Objectives of the course	1. To understand the principles and concepts of Integrated Pest Management (IPM). 2. To identify major pests and their natural enemies in different agro-ecosystems. 3. To apply cultural, biological, and chemical methods for effective pest management. 4. To evaluate sustainable and eco-friendly pest control strategies for crop protection.
Syllabus	
Theory	**Unit I** History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons. **Unit II** Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects. **Unit III** Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical and mechanical methods; semiochemicals, biotechnological and bio-rational approaches in IPM. Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost- benefit ratios and partial budgeting; case studies of successful

	IPM programmes. ITK-s in IPM, area-wide IPM and IPM for organic farming; components of ecological engineering with successful examples. **Unit IV** Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.
Practical	-
Course Outcomes	**CO1:** Explain the principles and components of Integrated Pest Management (IPM) in crop protection. **CO2**: Identify major pests and beneficial organisms in different agro-ecosystems. **CO3**: Apply suitable IPM strategies using cultural, biological, and chemical methods. **CO4**: Assess the effectiveness of eco-friendly pest management practices for sustainable agriculture.
Suggested Readings	1. Dhaliwal GS and Arora R. 2003. *Integrated Pest Management – Concepts and Approaches.* Kalyani Publishers, New Delhi. 2. Horowitz AR and Ishaaya I. 2004. *Insect Pest Management: Field and Protected Crops*. Springer, New Delhi. 3. Ignacimuthu SS and Jayaraj S. 2007. *Biotechnology and Insect Pest Management*. Elite Publ., New Delhi. 4. Norris RF, Caswell-Chen EP and Kogan M. 2002. *Concepts in Integrated Pest Management.* Prentice Hall, New Delhi. *5.* Pedigo RL. 2002. *Entomology and Pest Management.* 4th Ed. Prentice Hall, New Delhi. *6.* Subramanyam B and Hagstrum DW. 1995. *Integrated Management of Insects in Stored Products.* Marcel Dekker, New York.

Prerequisite	Students should have foundational knowledge of basic biology, microbiology, genetics, and plant sciences. Familiarity with cell biology, biochemistry, and introductory concepts of plant physiology will support understanding of plant-pathogen interactions and disease resistance mechanisms.
Rationale	This course provides fundamental and advanced knowledge of plant pathology with emphasis on the nature, development, and management of plant diseases. It introduces students to the biology of plant pathogens, host-pathogen interactions, and molecular mechanisms governing disease resistance. The course is designed to develop analytical and applied understanding of disease development and resistance breeding, thereby supporting sustainable crop protection and modern agricultural practices in alignment with contemporary advances in plant health management and biotechnology.
Course Title	**Principles of Plant Pathology**
Credits	3 (2+1)
Objectives of the course	1. To impart fundamental knowledge regarding concepts, causes, and historical development of plant pathology. 2. To explain the biology, survival, dispersal, and environmental relationships of major plant pathogens. 3. To develop understanding of host-pathogen interactions, disease development processes, and plant defense mechanisms. 4. To acquaint students with genetic and molecular approaches for developing disease-resistant crop varieties.
Syllabus	
Theory	**Unit I** Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases. **Unit II** Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development. **Unit III** Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens. **Unit I** Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.
Practical	➢ Basic plant pathological techniques; ➢ Isolation, inoculation and purification of plant pathogens and proving Koch's postulates; ➢ Techniques to study variability in different plant pathogens; ➢ Purification of enzymes, toxins and their bioassay; ➢ Estimation of growth regulators, phenols, phytoalexins in resistant and susceptible plants.
Course	**CO1:** Explain the basic concepts, importance, history, and causal factors

Outcomes	associated with plant diseases. **CO2:** Describe the growth, reproduction, survival, dispersal, and environmental relationships influencing plant pathogens and disease development. **CO3:** Analyze host-pathogen interactions, mechanisms of infection, disease development, and plant defense responses at physiological and biochemical levels. **CO4:** Evaluate genetic and molecular approaches involved in disease resistance, including resistance genes, marker-assisted selection, and genetic engineering strategies.
Suggested Readings	1. Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York. 2. Heitefuss R and Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York. 3. Mehrotra RS and Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi. 4. Singh RP. 2012. Plant Pathology 2nd edn. Kalyani Publishers, New Delhi. 5. Singh RS. 2017. Introduction to Principles of Plant Pathology. 5th edn. MedTech, New Delhi. 6. Singh DP and Singh A. 2007. Disease and Insect Resistance in Plants. Oxford & IBH, New Delhi. 7. Upadhyay RK. and Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.

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.
Suggested Readings	-

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 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.
Syllabus	
Theory	-
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.