

Department of Plant Pathology
Faculty of Agricultural Sciences
University of the Punjab, Lahore
Course Outline



Programme	B.Sc. (Hons.) Agriculture (Plant Pathology) 4 Year program	Course Code	PP-303	Credit Hours	3(2-1)
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Course Title	Introduction to Plant Parasitic Nematodes
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Course Introduction

The course introduction outlines several key aspects related to plant parasitic nematodes and their importance:

1. **Introduction to Phylum Nematoda and Related Phyla:**
 - This section likely covers the basic introduction to nematodes, including their classification within the animal kingdom and their relationships with other phyla.
2. **Abundance and Importance of Plant Parasitic Nematodes:**
 - Emphasizes the prevalence and significance of nematodes that specifically parasitize plants. This would include their impact on agriculture, horticulture, and natural ecosystems.
3. **Nematode Morphology and Anatomy:**
 - Detailed study of the physical structure and internal anatomy of nematodes. This includes examination of their various systems such as digestive, reproductive, and nervous systems.
4. **Taxonomy of Plant Parasitic Nematodes According to Feeding Habits:**
 - Classification of plant parasitic nematodes based on their feeding habits, which include:
 - **Fungivores:** Nematodes that feed on fungi.
 - **Omnivores:** Nematodes that have a mixed diet, including plant material and other organisms.
 - **Predators:** Nematodes that prey on other soil organisms.
 - **Parasites:** Nematodes that specifically attack and feed on plant tissues.
5. **Cellular Changes Brought During Feeding:**
 - Study of the physiological and biochemical changes induced in plants by nematode feeding. This covers the mechanisms through which nematodes cause damage to plant cells.
6. **Study of Important Nematode Diseases:**
 - Focus on specific nematode diseases that affect plants, including the symptoms they cause, the etiology (causal agents), and methods for disease management.

Overall, the course provides a comprehensive understanding of nematodes with a particular focus on those that parasitize plants, encompassing their biology, taxonomy, impact on agriculture, and strategies for control and management of nematode diseases.

Learning Outcomes

Upon completion of the course on plant parasitic nematodes with the specified contents, students are expected to achieve the following learning outcomes:

1. **Understanding of Nematode Diversity and Classification:**
 - Students will be able to describe the phylum Nematoda and its relationships with related phyla, demonstrating knowledge of nematode diversity and classification principles.
2. **Awareness of the Abundance and Agricultural Importance of Plant Parasitic Nematodes:**
 - Students will recognize the prevalence of plant parasitic nematodes and their significant impact on agriculture and ecosystems, including economic and ecological implications.
3. **Comprehensive Knowledge of Nematode Morphology and Anatomy:**
 - Students will be able to identify and explain the morphology and internal anatomy of nematodes, including detailed understanding of their digestive, reproductive, and nervous systems.
4. **Proficiency in Taxonomy Based on Feeding Habits:**
 - Students will categorize plant parasitic nematodes according to their feeding habits, distinguishing among fungivores, omnivores, predators, and parasites. They will understand the cellular changes induced in plants during nematode feeding.
5. **Understanding of Nematode Diseases and Their Management:**
 - Students will be familiar with important nematode diseases affecting plants, including symptoms, etiology (causal agents), and strategies for disease management. They will comprehend both preventive and control measures.
6. **Application of Knowledge in Agricultural and Environmental Contexts:**
 - Students will apply their understanding of nematodes to practical scenarios in agriculture and environmental management, making informed decisions regarding nematode control and sustainable practices.

Generally, completion of the course equips students with a solid foundation in nematology, enabling them to recognize, study, and manage nematodes effectively in various contexts, particularly in agriculture and ecosystem health.

Course Content		Assignments/Readings
Week 1	<p><u>THEORY</u></p> <p>Lecture 1: Introduction to Phylum Nematoda</p> <ul style="list-style-type: none"> • Definition of plant parasitic nematodes • General characteristics of plant parasitic nematodes • Classification within the animal kingdom <p>Lecture 2: Related Phyla and Taxonomic Relationships</p> <ul style="list-style-type: none"> • Overview of related phyla to Nematoda with emphasis on plant parasitic nematodes. 	<ul style="list-style-type: none"> <input type="checkbox"/> Agrios, G.N. 2005. "Plant Pathology." Chapter 12: Nematodes. Academic Press. <input type="checkbox"/> Dropkin, H.V. 1980. "Introduction to Plant Nematology." A Wiley-Interscience Publication. <input type="checkbox"/> Siddiqui, M.R. 2000. "Tylenchida: Parasites of Plants and Insects." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles

	<ul style="list-style-type: none"> Evolutionary relationships and their significance 	
	<p><u>PRACTICAL</u></p> <p>Module 1: Introduction to Nematode Sampling</p> <ul style="list-style-type: none"> Overview of sampling techniques in soil and plant materials Importance of representative sampling Demonstration of sampling equipment 	<ul style="list-style-type: none"> <input type="checkbox"/> Plant Parasitic Nematodes in Tropical and Subtropical Agriculture" by Luc, Sikora, and Bridge. This book provides insights into sampling techniques and their importance in nematology. <input type="checkbox"/> Related research articles
<p>Week 2</p>	<p>Lecture 3: Abundance and Importance of Plant Parasitic Nematodes</p> <ul style="list-style-type: none"> Definition and significance in agriculture Economic and ecological impact <p>Lecture 4: Introduction Nematode Morphology</p> <ul style="list-style-type: none"> External features of nematodes Cuticle structure and function 	<ul style="list-style-type: none"> <input type="checkbox"/> Luc, M., R. Sikora and J. Bridge. 2005. "Plant Parasitic Nematodes in Tropical and Subtropical Agriculture." CABI Publishing. <input type="checkbox"/> Dropkin, H.V. 1980. "Introduction to Plant Nematology." A Wiley-Interscience Publication. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 2: Extraction of Nematodes from Soil</p> <ul style="list-style-type: none"> Techniques for nematode extraction using Baermann funnel method Preparation of Baermann apparatus Hands-on extraction and observation under microscope 	<ul style="list-style-type: none"> <input type="checkbox"/> Plant Nematology" by Perry and Moens. Chapter 6 specifically covers extraction methods including Baermann funnel techniques. <input type="checkbox"/> Related research articles
<p>Week 3</p>	<p><u>THEORY</u></p> <p>Lecture 5: Internal Anatomy of Nematodes</p> <ul style="list-style-type: none"> Digestive system: structure and function Reproductive system: structure and types <p>Lecture 6: Nervous System of Nematodes</p> <ul style="list-style-type: none"> Organization of the nervous system Sensory structures and their roles 	<ul style="list-style-type: none"> <input type="checkbox"/> Dropkin, H.V. 1980. "Introduction to Plant Nematology." A Wiley-Interscience Publication. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles

	<p><u>PRACTICAL</u></p> <p>Module 3: Extraction of Nematodes from Infested Plant Materials</p> <ul style="list-style-type: none"> • Methods for extracting nematodes from roots and other plant parts • Washing and sieving techniques • Identification of nematodes extracted from plant tissues 	<p><input type="checkbox"/> "Plant Nematology" by Perry and Moens. Chapter 7 focuses on extracting nematodes from plant tissues, which includes washing and sieving techniques.</p> <p><input type="checkbox"/> Related research articles</p>
<p>Week 4</p>	<p><u>THEORY</u></p> <p>Lecture 7: Taxonomy of Plant Parasitic Nematodes</p> <ul style="list-style-type: none"> • Classification based on feeding habits • Overview of fungivores and their impact <p>Lecture 8: Omnivorous Nematodes</p> <ul style="list-style-type: none"> • Characteristics and feeding behavior • Examples and ecological roles 	<p><input type="checkbox"/> Hunt, D.J. 1993. Aphelenchida, Longidoridae and Trichodoridae: Their Systematics and Bionomics. CABI Publishing.</p> <p><input type="checkbox"/> Luc, M., R. Sikora and J. Bridge. 2005. "Plant Parasitic Nematodes in Tropical and Subtropical Agriculture." CABI Publishing.</p> <p><input type="checkbox"/> Internet</p> <p><input type="checkbox"/> PowerPoint slides</p> <p><input type="checkbox"/> Research articles</p>
	<p><u>PRACTICAL</u></p> <p>Module 4: Preparation of Temporary Slides</p> <ul style="list-style-type: none"> • Techniques for preparing temporary slides of nematodes • Use of glycerin or lactophenol for mounting • Observation and identification under microscope 	<p><input type="checkbox"/> "Plant Nematology" by Perry and Moens. Chapter 3 provides detailed methods for preparing temporary slides of nematodes.</p> <p><input type="checkbox"/> Related research articles.</p>
<p>Week 5</p>	<p><u>THEORY</u></p> <p>Lecture 9: Predatory Nematodes</p> <ul style="list-style-type: none"> • Adaptations for predation • Importance in biological control <p>Lecture 10: Parasitic Nematodes</p> <ul style="list-style-type: none"> • Types of parasitism in nematodes • Cellular changes induced during parasitic feeding 	<p><input type="checkbox"/> Luc, M., R. Sikora and J. Bridge. 2005. "Plant Parasitic Nematodes in Tropical and Subtropical Agriculture." CABI Publishing.</p> <p><input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing.</p> <p><input type="checkbox"/> Internet</p> <p><input type="checkbox"/> PowerPoint slides</p> <p><input type="checkbox"/> Research articles</p>
	<p><u>PRACTICAL</u></p> <p>Module 5: Preparation of Permanent Slides</p>	<p><u>Readings:</u></p> <p>"Plant Nematology" by</p>

	<ul style="list-style-type: none"> • Methods for preparing permanent slides of nematodes • Fixation and staining techniques • Use of Canada balsam or other mounting media 	<p>Perry and Moens. Chapter 3 also covers methods for preparing permanent slides, fixation, and staining techniques.</p> <p><input type="checkbox"/> Related research articles</p>
Week 6	<p><u>THEORY</u></p> <p>Lecture 11: Cellular Responses to Nematode Feeding</p> <ul style="list-style-type: none"> • Plant responses to nematode invasion • Mechanisms of resistance and susceptibility <p>Lecture 12: Study of Important Nematode Diseases</p> <ul style="list-style-type: none"> • Overview of major nematode diseases • Symptoms and diagnostic techniques 	<p><input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing.</p> <p><input type="checkbox"/> Agrios, G.N. 2005. "Plant Pathology." Chapter 12: Nematodes. Academic Press.</p> <p><input type="checkbox"/> Internet</p> <p><input type="checkbox"/> PowerPoint slides</p> <p><input type="checkbox"/> Research articles</p>
	<p><u>PRACTICAL</u></p> <p>Module 6: Staining Techniques for Nematodes</p> <ul style="list-style-type: none"> • Demonstration of various staining methods (e.g., acid fuchsin, lactophenol cotton blue) • Staining nematodes for morphological features • Comparison of stained versus unstained specimens 	<p><input type="checkbox"/> "Plant Nematology" by Perry and Moens. Chapter 3 discusses various staining methods essential for morphological studies.</p> <p><input type="checkbox"/> Related research articles</p>
Week 7	<p><u>THEORY</u></p> <p>Lecture 13: Etiology of Nematode Diseases</p> <ul style="list-style-type: none"> • Causal agents and lifecycle of pathogenic nematodes • Host-parasite interactions <p>Lecture 14: Management of Nematode Diseases</p> <ul style="list-style-type: none"> • Cultural practices for nematode control • Chemical and biological control methods 	<p><input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing.</p> <p><input type="checkbox"/> Internet</p> <p><input type="checkbox"/> PowerPoint slides</p> <p><input type="checkbox"/> Research articles</p>
	<p><u>PRACTICAL</u></p> <p>Module 7: Staining of Nematode Egg Masses in Roots</p> <ul style="list-style-type: none"> • Techniques for staining nematode egg masses in plant roots • Use of specific stains to highlight eggs • Examination and interpretation under microscope 	<p><input type="checkbox"/> "Plant Nematology" by Perry and Moens. Chapter 3 includes techniques for staining nematode egg masses and examining them under a microscope.</p> <p><input type="checkbox"/> Related research articles.</p>
Week 8	<p><u>THEORY</u></p> <p>Lecture 15: Integrated Pest Management (IPM)</p> <ul style="list-style-type: none"> • Principles and strategies in nematode IPM • Case studies and examples <p>Lecture 16: Molecular Approaches in Nematode Research</p> <ul style="list-style-type: none"> • Techniques in nematode molecular biology 	<p><input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing.</p> <p><input type="checkbox"/> Internet</p>

	<ul style="list-style-type: none"> • Applications in taxonomy and disease management 	<input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 8: Identification of Nematode-Inflicted Foliage Symptoms</p> <ul style="list-style-type: none"> • Recognition and assessment of foliage symptoms caused by nematodes • Field demonstration and sample collection • Discussion on symptom variation based on nematode species 	<input type="checkbox"/> "Plant Pathology" by Agrios. Chapter 14 covers symptoms and diagnosis caused by nematodes in plants. <input type="checkbox"/> Related research articles
Week 9	MID TERM EXAMS	
Week 10	<p><u>THEORY</u></p> <p>Lecture 17: Soil Ecology and Nematodes</p> <ul style="list-style-type: none"> • Nematode interactions with soil microbiota • Ecological roles and ecosystem services <p>Lecture 18: Nematodes in Sustainable Agriculture</p> <ul style="list-style-type: none"> • Role of nematodes in soil health • Organic farming practices and nematode management 	<input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 9: Identification of Nematode-Inflicted Root Symptoms</p> <ul style="list-style-type: none"> • Examination and identification of root symptoms induced by nematodes • Techniques for root washing and observation • Comparison of healthy versus nematode-infested roots 	<input type="checkbox"/> "Plant Pathology" by Agrios. Chapter 14 covers symptoms and diagnosis caused by nematodes in plants. <input type="checkbox"/> Related research articles
Week 11	<p><u>THEORY</u></p> <p>Lecture 19: Nematodes in Natural Ecosystems</p> <ul style="list-style-type: none"> • Impact of nematodes on biodiversity • Nematodes as indicators of environmental health <p>Lecture 20: Case Studies of Nematode Outbreaks</p> <ul style="list-style-type: none"> • Historical outbreaks and their consequences • Lessons learned and preventive measures 	<input type="checkbox"/> Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 10: Field Trip: Nematode Sampling in Agricultural Settings</p> <ul style="list-style-type: none"> • Practical application of sampling techniques in agricultural fields • Hands-on experience in identifying nematodes in the field • Collection of samples for later laboratory analysis 	<input type="checkbox"/> Related research articles
Week 12	<p><u>THEORY</u></p> <p>Lecture 21: Nematode Adaptations to Environmental</p>	<input type="checkbox"/> Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI

	<p>Stress</p> <ul style="list-style-type: none"> • Survival strategies in adverse conditions • Physiological responses to environmental changes <p>Lecture 22: Nematode Genetics and Genomics</p> <ul style="list-style-type: none"> • Genome sequencing projects in nematodes • Insights into nematode evolution and diversity 	<p>Publishing.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 11: Practical Exercise: Morphological Features of Nematodes</p> <ul style="list-style-type: none"> • Detailed study of nematode morphology under microscope • Identification of key morphological characteristics (e.g., stylet, esophagus, reproductive structures) • Drawing and labeling of nematode structures 	<ul style="list-style-type: none"> <input type="checkbox"/> Related research articles
<p>Week 13</p>	<p><u>THEORY</u></p> <p>Lecture 23: Emerging Issues in Nematode Research</p> <ul style="list-style-type: none"> • New nematode species and their impact • Global distribution and climate change effects <p>Lecture 24: Ethical Considerations in Nematode Research</p> <ul style="list-style-type: none"> • Bioethical issues in nematode experimentation • Responsible conduct of research 	<ul style="list-style-type: none"> <input type="checkbox"/> Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 12: Practical Exercise: Species Identification</p> <ul style="list-style-type: none"> • Use of taxonomic keys and guides for nematode species identification • Identification challenges and troubleshooting • Group discussion on identification results 	<ul style="list-style-type: none"> <input type="checkbox"/> Related research articles
<p>Week 14</p>	<p><u>THEORY</u></p> <p>Lecture 25: Career Paths in Nematology</p> <ul style="list-style-type: none"> • Opportunities in academia, industry, and government • Skills and qualifications for nematology careers <p>Lecture 26: Current Trends and Future Directions in Nematode Control</p> <ul style="list-style-type: none"> • Innovations in nematode management • Predictions for future challenges and solutions 	<ul style="list-style-type: none"> <input type="checkbox"/> Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 13: Practical Exercise: Nematode Life Cycle</p> <ul style="list-style-type: none"> • Observation and interpretation of nematode life stages • Discussion on lifecycle variations among different nematode species • Drawing and labeling nematode life cycle stages 	<ul style="list-style-type: none"> <input type="checkbox"/> Related research articles
<p>Week 15</p>	<p><u>THEORY</u></p> <p>Lecture 27: Student Presentations: Nematode Research Projects</p> <ul style="list-style-type: none"> • Presentation and discussion of student research • Peer feedback and constructive critique <p>Lecture 28: Review of Nematode Taxonomy and Classification</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Hunt, D.J. 1993. "Aphelenchida, Longidoridae and Trichodoridae: Their Systematics and Bionomics." CABI

	<ul style="list-style-type: none"> Recap of classification principles Practice exercises on identifying nematode taxa 	Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 14: Case Study: Nematode Damage Assessment</p> <ul style="list-style-type: none"> Analysis of nematode damage scenarios in crops Interpretation of economic and agronomic impacts Development of management strategies based on damage assessment 	<input type="checkbox"/> Related research articles
Week 16	<p><u>THEORY</u></p> <p>Lecture 29: Exam Preparation: Nematode Morphology and Anatomy</p> <ul style="list-style-type: none"> Revision of nematode anatomy and physiology Sample exam questions and discussion <p>Lecture 30: Exam Preparation: Nematode Diseases and Management</p> <ul style="list-style-type: none"> Review of key diseases, symptoms, and control methods Exam strategy and preparation tips 	<input type="checkbox"/> Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p><u>PRACTICAL</u></p> <p>Module 15: Integrated Pest Management (IPM) Strategies</p> <ul style="list-style-type: none"> Discussion on IPM approaches for nematode control Practical exercises on implementing IPM strategies in different contexts Evaluation of effectiveness and sustainability 	<input type="checkbox"/> Related research articles
Week 17	<p><u>THEORY</u></p> <p>Lecture 31: Case Study Analysis: Successful Nematode Control Programs</p> <ul style="list-style-type: none"> Analysis of effective nematode control strategies Lessons for future application and adaptation <p>Lecture 32: Course Wrap-Up and Reflection</p> <ul style="list-style-type: none"> Recap of key concepts and learning outcomes Reflection on personal growth and understanding in nematology 	<input type="checkbox"/> Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI Publishing. <input type="checkbox"/> Internet <input type="checkbox"/> PowerPoint slides <input type="checkbox"/> Research articles
	<p>Module 16: Practical Examination and Evaluation</p> <ul style="list-style-type: none"> Practical assessment of skills acquired throughout the course Identification of nematodes from prepared samples Evaluation based on accuracy, technique, and understanding 	<input type="checkbox"/> Related Research articles
Week 18	FINAL TERM EXAM	
Textbooks and Reading Material		
<p><i>I. Textbooks.</i></p> <p>In the detail course outline, one may mention chapters of the textbook with the content topics.</p>		

- a. Agrios, G.N. 2005. "Plant Pathology." Chapter 12: Nematodes. Academic Press.
- b. Dropkin, H.V. 1980. "Introduction to Plant Nematology." A Wiley-Interscience Publication.
- c. Hunt, D.J. 1993. "Aphelenchida, Longidoridae and Trichodoridae: Their Systematics and Bionomics." CABI Publishing.
- d. Luc, M., R. Sikora and J. Bridge. 2005. "Plant Parasitic Nematodes in Tropical and Subtropical Agriculture." CABI Publishing.
- e. Perry, R.N. and M. Moens. 2006. "Plant Nematology." CABI Publishing
- f. Perry, R.N. and M. Moens (Eds.). 2013. "Plant Nematology." CABI Publishing.
- g. Siddiqui, M.R. 2000. "Tylenchida: Parasites of Plants and Insects." CABI Publishing.

II. Suggested Readings

a. Books

- Bridge, J. and J.L. Starr. 2007. Plant Nematodes of Agriculture Importance: A color hand book. Manson Publishing.
- Noe, P.J. 2003. Plant-Parasitic Nematodes. pp 61-67. In: Plant Pathology: Concepts and Laboratory Exercises. R. N. Trigiano, M. T. Windham, and A. S. Windham. (Eds.). CRC Laboratory Press, USA.
- Noe, P.J. 2003. Pathogenicity and Isolation of Plant-parasitic Nematodes. pp 69-73. In: Plant Pathology: Concepts and Laboratory Exercises. R. N. Trigiano, M. T. Windham, and A. S. Windham. (Eds.). CRC Press, USA.
- Saeed, M. 1990. Development of Phytonematology in Pakistan. pp 515-525. In: Progress in Plant Nematology. S. K. Saxena, A. Rashid, and R. M. Khan. (Eds.). CBS Publications Pvt. Ltd. Delhi.
- Mashela, P.W., De Waele, D., Dube, Z., Khosa, M.C., Pofu, K.M., Tefu, G., Daneel, M.S. and Fourie, H., 2017. Alternative Nematode Management Strategies. In Nematology in South Africa: A View from the 21st Century (pp. 151-181). Springer International Publishing.

b. Journal Articles/ Reports available in library and on internet

- It is preferable to use latest available editions of books. Mention the publisher & year of publication.
- The References/ bibliography may be in accordance with the typing manual of the concerned faculty/subject. Preferably follow APA 7th Edition publication manual.

Teaching Learning Strategies

- **Lectures and Discussions:** Theoretical aspects are taught through lectures supplemented with discussions to deepen understanding of concepts.
- **Laboratory Sessions:** Practical sessions focus on hands-on activities such as sampling, extraction, staining, and slide preparation.
- **Case Studies and Examples:** Use of real-life examples and case studies to

illustrate the impact of nematodes on plants and ecosystems.

- **Visual Aids:** Utilization of microscopy and visual aids to enhance learning of nematode morphology and anatomical features.
- **Field Visits:** Opportunities for field visits to observe nematode-infected plants and symptoms in natural settings.
- **Interactive Learning:** Encouragement of student participation through group activities, presentations, and discussions on nematode taxonomy, diseases, and management strategies.

By integrating these theoretical and practical components with varied teaching methods, the course aims to provide a comprehensive understanding of plant parasitic nematodes, their biology, and management strategies in agricultural and environmental contexts.

Assignments: Types and Number with Calendar

Mentioned in course content

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
1.	Final Assessment	40%	Written examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.