

**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-309	Credit Hours	3(2-1)
Course Title	Methods and Techniques in Plant Pathology				
Course Introduction					
<p>In this course, we will explore innovative methodologies for plant pathogen diagnostics. Throughout our journey, we will uncover how plant pathogens can significantly be collected, transported, processed, isolated, identified, purified, and preserved. Emphasis will be on developing an understanding of Koch's postulates; microscopic, histo-pathological, serological, and molecular techniques; experimental layout, data collection, statistical analysis interpretation, and report writing. Through a combination of theoretical insights and practical applications, students will gain a comprehensive understanding of the methods and techniques employed in plant pathology.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. be familiar with methods for isolation identification and preservation of invasive pathogens and diseases. 					
Course Content				Assignments/Readings	
Week 1	<p><u>THEORY</u></p> <p>Unit-I:</p> <p>1.1 Plant Diagnostic Clinic:</p> <p>1.2 Developing an Expert System for Plant Disease Diagnosis</p> <p>1.3 Plant Problem Diagnosis</p> <p>1.4 <i>What information should you provide?</i></p> <p>1.5 Guidelines for Collecting and Submitting Samples</p>			<ul style="list-style-type: none"> • Burns. R. 2008. Plant Pathology; Techniques and Protocols (Methods in Molecular Biology). Humana Press • Sinclair, J.B., and O.D. Dhingra. 1995. Basic Plant Pathology Methods. CRC Press USA. • Trigliano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition. 	
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Equipments, glassware, chemicals and reagents for plant disease clinic 				

<p>Week 2</p>	<p><u>THEORY</u></p> <p>Unit-II:</p> <p>2.1 Hypothesizing the Case Study 2.2 Defining objectives 2.3 Diagnostic protocols</p>	<ul style="list-style-type: none"> • Trigiano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition. • <u>Nicola Luchi</u>, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Types of media ○ Media preparation 	
<p>Week 3</p>	<p><u>THEORY</u></p> <p>Unit-III:</p> <p>3.1 Collection of pathogenic samples viz., fungi, bacteria, nematodes, and viruses 3.2 Protocols for handling, transport, and processing</p>	<ul style="list-style-type: none"> • Narayanasamy, P. 2001. Plant Pathogen Detection and Disease Diagnosis (2nd ed.). Marcel Dekker. • <u>Nicola Luchi</u>, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Methods of collection and preservation of plant disease specimens 	
<p>Week 4</p>	<p>Unit-IV:</p> <p>4.1 Techniques for the preservation of diseased specimens</p> <p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Preparation of inoculum ○ Inoculation techniques for various plant pathogens <ul style="list-style-type: none"> ○ Fungi and bacteria ○ Nematodes ○ Viruses 	<ul style="list-style-type: none"> • Sinclair, J.B., and O.D. Dhingra. 1995. Basic Plant Pathology Methods. CRC Press USA. • Trigiano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition. • <u>Nicola Luchi</u>, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
<p>Week 5</p>	<p><u>THEORY</u></p>	<ul style="list-style-type: none"> • Bashir, M. and S. Hassan.

	<p>Unit-V:</p> <p>5.1 Protocols and procedures used for the isolation of pathogens</p> <p>5.1.a Fungi,</p> <p>5.1.b Bacteria,</p> <p>5.1.c Nematodes, and</p> <p>5.1.d Viruses</p>	<p>1998. Diagnostic Methods for Plant Viruses, PARC, Islamabad.</p> <ul style="list-style-type: none"> • Hampton, R., E. Ball and S. DeBoer. 1990. Serological Methods for Detection and identification of Viral and Bacterial Plant Pathogens - A Laboratory Manual. American Phytopathological Press, Saint Paul, Minnesota, USA • Malcolm C.S. and W.A. Charles. 2000. Diagnosing Plant Diseases Caused by Nematodes. American Phytopathological Society Press, St. Paul, Minnesota, USA. • Narayanasamy, P. 2001. Plant Pathogen Detection and Disease Diagnosis (2nd ed.). Marcel Dekker.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Identification techniques of different plant pathogens ○ Morphological, 	
<p>Week 6</p>	<p><u>THEORY</u></p> <p>Quiz test</p> <p>Unit-VI:</p> <p>6.1 Purification of pathogens</p> <p>6.2 Multiplication of pathogens</p>	<p><u>Reading</u></p> <p>Internet</p> <p>PowerPoint slides</p> <p>And research articles</p>
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Identification techniques of different plant pathogens ○ Biochemical, and 	<p><u>Assignment (Practical)</u></p> <p>Report writing for the isolation and identification of pathogen from selected samples</p>

Week 7	<p><u>THEORY</u></p> <p>Unit-VII:</p> <p>7.1 Identification of plant pathogens,</p> <p>7.1.a Morphological basis</p> <p>7.1.b Biochemical studies</p> <p>7.1.c Genetic studies</p>	<p>Assignment (Theory):</p> <p>Topics will be assigned to individuals or groups of students.</p> <p><u>Books for reading</u></p> <ul style="list-style-type: none"> • Schaad, N.W., J.B. Jones and W. Chun. 2001. Laboratory Guide for Identification of Plant Pathogenic Bacteria, Third Edition. American Phytopathological Society Press, St. Paul, Minnesota, USA. • Sinclair, J.B., and O.D. Dhingra. 1995. Basic Plant Pathology Methods. CRC Press USA. • Trigiano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition. • <u>Nicola Luchi</u>, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Identification techniques of different plant pathogens ○ Molecular approaches 	
Week 8	<p><u>THEORY</u></p> <p>Unit-VIII:</p> <p>8.1. Strategies for the preservation of plant pathogens;</p>	<ul style="list-style-type: none"> • Bhutta, A.R. and I. Ahmad. 2001. Seed Pathological Techniques and their Application. National Book Foundation, Islamabad, Pakistan.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Maintenance and preservation of cultures; 	<ul style="list-style-type: none"> • Fox, R.T.V. 1994. Principles of Diagnostic Techniques in Plant Pathology. CAB International, UK.
Week 9	MID-TERM	

<p>Week 10</p>	<p><u>THEORY</u></p> <p>Unit-IX:</p> <p>9.1 Koch's postulates 9.1.a Pathogenicity testing</p>	<p>Assignment (Theory):</p> <p>Topics will be assigned to individuals or groups of students.</p>
<p>Week 11</p>	<p><u>THEORY</u></p> <p>Unit-X:</p> <p>10.1 Microscopic techniques for disease diagnostics 10.2 Microscopic techniques for the identification of pathogens</p> <p><u>PRACTICAL</u></p> <p>Field visit for demonstrating techniques of collection of pathogens.</p> <ul style="list-style-type: none"> ○ Microscopy ○ Macro and micro-photography and ○ micrometry of plant pathogens; 	<p><u>Reading</u></p> <ol style="list-style-type: none"> 1. Bhutta, A.R. and I. Ahmad. 2001. Seed Pathological Techniques and their Application. National Book Foundation, Islamabad, Pakistan. 2. Fox, R.T.V. 1994. Principles of Diagnostic Techniques in Plant Pathology. CAB International, UK. 3. Nicola Luchi, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
<p>Week 12</p>	<p><u>THEORY</u></p> <p>Unit-XI:</p> <p>11.1 Histopathological technique 11.2 Serological techniques;</p> <p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Molecular methods <p>Monitoring and Data Analysis from Field Trials</p>	<ul style="list-style-type: none"> • Hampton, R., E. Ball and S. DeBoer. 1990. Serological Methods for Detection and identification of Viral and Bacterial Plant Pathogens - A Laboratory Manual. American Phytopathological Press, Saint Paul, Minnesota, USA

Week 13	<p><u>THEORY</u></p> <p>Group Discussion</p> <p>Unit XII:</p> <p>12.2 Molecular techniques</p>	<ul style="list-style-type: none"> • Nicola Luchi, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Histo-pathological analysis ○ 	
Week 14	REVISION/TEST	
	<p><u>THEORY</u></p> <p>Revision/ Test/ class presentations</p> <p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Serological methods 	
Week 15	<p><u>THEORY</u></p> <p>Unit XIII:</p> <p>13.1 pre-and postharvest handling to reduce losses in vegetables and fruits.</p> <p>Unit XIV:</p> <p>14.1 Experimental layout, data collection, statistical analysis</p>	<ul style="list-style-type: none"> • Nicola Luchi, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	<p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ experimental layout, ○ data collection, statistical analysis ○ interpretation 	

Week 16	<p><u>THEORY</u></p> <p>Unit XV:</p> <p>15.1 interpretation and report writing;</p> <p>15.2 Course review</p> <p><u>PRACTICAL</u></p> <ul style="list-style-type: none"> ○ Report writing 	<ul style="list-style-type: none"> • Sinclair, J.B., and O.D. Dhingra. 1995. Basic Plant Pathology Methods. CRC Press USA. • Trigiano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition. • <u>Nicola Luchi</u>, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.
	FINAL-TERM	
Textbooks and Reading Material		
<p>Suggested Readings</p> <p>BOOKS</p> <ul style="list-style-type: none"> • Ahmad, I., M. Aslam and A. Munir. 1992. Phytopathological Diagnostic Techniques. Pakistan Agricultural Research Council, Islamabad, Pakistan. • Aneja, K.R. 2003. Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International (Pvt.) Ltd. New Delhi. India. • Bashir, M. and S. Hassan. 1998. Diagnostic Methods for Plant Viruses, PARC, Islamabad. • Bhutta, A.R. and I. Ahmad. 2001. Seed Pathological Techniques and their Application. National Book Foundation, Islamabad, Pakistan. • Burns. R. 2008. Plant Pathology; Techniques and Protocols (Methods in Molecular Biology). Humana Press • Foster, G.D., I.E., Johansen, Y. Hong and P.D. Nagy. (Eds). 2008. Plant Virology Protocols - From Viral Sequence to Protein Function (2nd edition). Humana Press. • Fox, R.T.V. 1994. Principles of Diagnostic Techniques in Plant Pathology. CAB International, UK. • Hampton, R., E. Ball and S. DeBoer. 1990. Serological Methods for Detection and identification of Viral and Bacterial Plant Pathogens - A Laboratory Manual. American Phytopathological Press, Saint Paul, Minnesota, USA • Malcolm C.S. and W.A. Charles. 2000. Diagnosing Plant Diseases Caused by Nematodes. American Phytopathological Society Press, St. Paul, Minnesota, USA. 		

- Narayanasamy, P. 2001. Plant Pathogen Detection and Disease Diagnosis (2nd ed.). Marcel Dekker.
- Schaad, N.W., J.B. Jones and W. Chun. 2001. Laboratory Guide for Identification of Plant Pathogenic Bacteria, Third Edition. American Phytopathological Society Press, St. Paul, Minnesota, USA.
- Sinclair, J.B., and O.D. Dhingra. 1995. Basic Plant Pathology Methods. CRC Press USA.
- Trigliano, R.N., M.T. Windham and A.S. Windham. 2007. Plant Pathology Concepts and Laboratory Exercises, Second Edition.
- Nicola Luchi, 2022. Plant Pathology: Method and Protocols (Methods in Molecular Biology, 2536). Publisher: Humana, 1st ed. 2022.

Journal Articles/ Reports

Resources will be shared during class

Teaching Learning Strategies

1. Class lectures
2. Discussions
3. Practical demonstrations
4. Hands-on training where applicable
5. Arrange Q&A sessions to allow students to interact directly with professionals and gain insights into recent techniques employed in plant pathology.

Assignments: Types and Number with Calendar

Assignments

Types and Number with calendar

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.
3.	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.