



Master's Programme in Plant Pathology

Course Layout

Minimum Credit Requirements

Sr. No.	Subject	Minimum credit (s)
1.	Major	20
2.	Minor	09
3.	Supporting	06
4.	Seminar	01
5.	Research	20
6.	Total Credits	36+20=56
7.	Compulsory Non Credit Courses	06

Sr. No.	Course Number	Course Title	Credits
Plant Pathology			
A) Major subjects (Min. 20 credits)			
I Semester			
1.	PL.PATH.501	Mycology	2+1=3
2.	PL.PATH.502	Plant Virology	2+1=3
3.	PL.PATH.503	Plant Bacteriology	2+1=3
II Semester			
4.	PL.PATH.504	Principles of Plant Pathology	3+0=3
5.	PL.PATH.506	Principles of Plant Disease Management	2+1=3
6.	PL.PATH.510	Seed Health technology	2+1=3
III Semester			
7.	PL.PATH.505	Detections and Diagnosis of Plant Diseases	0+2=2
Total			13+7=20

B) Minor Subjects (Min. 09 credits)			
I Semester			
1.	MBB-501	Principles of Biotechnology	2+1=3
II Semester			
2.	MBB-505	Techniques in Molecular Biology	0+3=3
3.	GP-510	Breeding for Biotic and Abiotic Stress Resistance	2+1=3
Total			4+5=09
C) Supporting Subjects (Min. 06 credits)			
I Semester			
1.	MICRO 503	Microbial Genetics	2+1=3
II Semester			
2.	STAT 507	Design of Experiments for Plant Protection	2+1=3
Total			4+2=06
D) Seminar (Min. 01 credits)			
IV Semester			
1.	PL.PATH.591	Master's Seminar	1+ 0=1
Total			1+0=01
E) Master's Research (Min. 20 credits)			
1.		Master's Research	20
F) Non Credit Compulsory Courses			
I Semester			
1.	PGS.501	Library and information services	0+1=1
2.	PGS.504	Basic concepts to laboratory technique	0+1=1
II Semester			
3.	PGS.502	Technical writing and communication skills	0+1=1
4.	PGS.503	Intellectual property and its management in Agriculture	1+0=1
III Semester			
5.	PGS.505	Agricultural Research Ethics and Rural Development Programme	1+0=1
6.	PGS.506	Disaster Management	1+ 0=1
Total			3+3=06

Course Contents

A) Major Subject:-
I Semester:-
i) <u>Mycology</u>
Theory Syllabus
UNIT I
Introduction, definition of different terms, basic concepts.
UNIT II
Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology.
UNIT III
Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.
UNIT IV
The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina. Lichens types and importance, fungal genetics and variability in fungi.

Practical Syllabus:

Detailed comparative study of different groups of fungi; Collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

Text book and Reference books:

Ainsworth G.C, Sparrow F.K & Susman H.S. 1973. *The Fungi – An Advanced Treatise*. Vol. IV (A & B). Academic Press, New York.

Alexopoulos C.J, Mims C.W & Blackwell M. 2000. *Introductory Mycology*. 5th Ed. John Wiley & Sons, New York.

Mehrotra R.S & Arneja K.R. 1990. *An Introductory Mycology*. Wiley Eastern, New Delhi.

Sarbhoy A.K. 2000. *Text book of Mycology*. ICAR, New Delhi.

Singh R.S. 1982. *Plant Pathogens – The Fungi*. Oxford & IBH, New Delhi.

Webster J. 1980. *Introduction to Fungi*. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

ii) <u>Plant Virology</u>
Theory Syllabus
UNIT I
History of plant viruses, composition and structure of viruses
UNIT II
Symptomatology of important plant viral diseases, transmission, chemical and physical properties, host virus interaction, virus vector relationship.
UNIT III
Virus nomenclature and classification, genome organization, replication and movement of viruses
UNIT IV
Isolation and purification, electron microscopy, protein and nucleic acid based diagnostics.
UNIT V
Mycoviruses, phytoplasma, arbo and baculoviruses, satellite viruses, satellite RNAs, Phages, Viroids, Prions principles of the working of electron microscope and ultra microtome.
UNIT VI
Origin and evaluation, mechanism of resistance, genetic engineering, ecology and management of plant viruses.

Practical Syllabus:

Study of symptoms caused by viruses, transmission, assay of viruses , physical properties, purification, method of raising antisera, serological tests, electron microscopy and ultratomy, PCR.

Text book and Reference books:

- Bos L. 1964. Symptoms of Virus Diseases in Plants . Oxford & IBH., New Delhi
 Brunt A.A, Krabtree K, Dallwitz M.J, Gibbs A.J & Watson L. 1995. Virus of Plants: Descriptions and Lists from VIDE Datatbase. CABI, Wallington.
 Gibbs A & Harrison B. 1976. Plant Virology – The Principle, Edward Arnold, London.
 Hull R. 2002. Mathew’s Plant Virology. 4th Ed. Academic Press, New York.
 Noordam D 1973. Identification of Plant Viruses, Methods and Experiments. Oxford &IBH, New Delhi.

iii) <u>Plant Bacteriology</u>
Theory Syllabus
UNIT I
History and introduction to phytopathogenic procarya, viz., bacterial, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria.
UNIT II
Evolution, classification and nomenclature of phytopathogenic procarya and important diseases caused by them.
UNIT III
Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya.
UNIT IV
General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios.
UNIT V
Prokaryotic inhibitors and their mode of action against phytopathogenic bacteria.
UNIT VI
Survival and dissemination of phytopathogenic bacteria.

Practical Syllabus:

Isolation purification, identification and host inoculation of phytopathogenic bacteria, staining methods, biochemical and serological characterization, isolation of plasmid and use of antibacterial chemicals/antibiotics.

Text book and Reference books:

- Goto M. 1990 *Fundamentals of Plant Bacteriology*. Academic Press, New York.
 Jayaraman J & Verma J.P. 2002. *Fundamentals of Plant Bacteriology*, Kalyani Publ., Ludhiana.
 Mount M.S & Lacy G.H. 1982. *Phytopathogenic Prokaryotes*. Vols. I, II. Academic Press, New York.
 Verma J.P, Varma A & Kumar D. (Eds). 1995, *Detection of Plant Pathogens and their Management*. Angkor Publ., House, New Delhi.
 Verma J.P. 1998. *The Bacteria*. Malhotra Publ. House, New Delhi.

Books and manuals recommended:

- Cuppucino, J.G. and Sherman, N. 1987. *Micorbiology A Laboratory Manual*, 2nd Edition, The Benjamin Cummings Publishing Company Inc.
 Klement, Z., rudolph, K. and Sands, D.C. 1990. *Methods in phytobacteriology*. Akademiai Kiado, Budapest.

II Semester:-
iv) Principles of Plant Pathology
Theory Syllabus
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 IV
Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.
UNIT V
Disease management strategies.

Text book and Reference books:

Agrios G.N. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York.

Heitefuss R & Williams P.H. 1976. *Physiological Plant Pathology*. Springer Verlag, Berlin, New York.

Mehrotra R.S & Aggarwal A. 2003. *Plant Pathology*. 2nd Ed. Oxford & IBH, New Delhi.

Singh R.S. 2002. *Introduction to Principles of Plant Pathology*. Oxford & IBH, New Delhi.

Singh D.P & Singh A. 2007. *Disease and Insect Resistance in Plants*. Oxford & IBH, New Delhi.

Upadhyay R.K & Mukherjee K.G. 1997. *Toxins in Plant Disease Development and Evolving Biotechnology*. Oxford & IBH, New Delhi.

v) <u>Principles of Plant Disease Management</u>
Theory Syllabus
UNIT I
Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases. Disease resistance and molecular approach for disease management.
UNIT II
Foliage, seed and soil application of chemicals , role of stickers, spreaders and other adjuvants, health vis-à-vis environmental hazards, residual effects and safety measures.
UNIT III
History of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

Practical Syllabus

In vitro and *in vivo* evaluation of chemicals against plant pathogens; ED and MIC values, study of structural details of sprayers and dusters.

Text book and Reference books

- Fry W.E. 1982. *Principles of Plant Disease Management*. Academic Press, New York.
- Hewitt H.G. 1998. *Fungicides in Crop Protection*. CABI, Wallington.
- Marsh R.W. 1972. *Systemic Fungicides*. Longman, New York.
- Nene Y.L & Thapliyal P.N. 1993. *Fungicide in Plant Disease Control*. Oxford & IBH, New Delhi.
- Plati j. 1981. *Cultural Practices and Infectious Crop Diseases*. Springer- Verlag, New York.
- Vyas S.C. 1993. *Handbook of Systemic Fungicides*. Vols. 1-111. Tata McGraw Hill, New Delhi.

vi) <u>Seed Health Technology</u>
Theory Syllabus
UNIT I
History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.
UNIT II
Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens.
UNIT III
Seed certification and tolerance limits, types of losses caused by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection.
UNIT IV
Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.

Practical Syllabus

Conventional and advanced techniques in the detection and identification of seed-borne fungi, bacteria and viruses. Relationship between seed-borne infection and expression of the disease in the field.

Text book and Reference books

Agarwal.V.K & J.B Sinclair. 1993. *Principles of Seed Pathology*. Vols.I & II, CBS Publ., New Delhi.

Hutchins J.D & Reeves J.E. (Eds.). 1997. *Seed Health Testing: Progress Towards the 21st Century*. CABI, Wallington.

Paul Neergaard. 1988. *Seed Pathology*. MacMillan, London

Suryanarayana D. 1978. *Seed Pathology*. Vikash Publ., New Delhi.

Semester: - III

vii) <u>Detection and Diagnosis of Plant Disease</u>
Theory Syllabus
UNIT I
Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.
UNIT II
Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.
UNIT III
Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of references.

Text book and Reference books

Baudoin ABAM, Hooper G.R, Mathre D.E & Carroll R.B. 1990. *Laboratory Exercises in Plant Pathology: An Instructional Kit*. Scientific Publ.,Jodhpur.

Dhingra O.D & Sinclair J.B. 1986.*Basic Plant Pathology Methods*. CRC Press, London, Tokyo.

Fox R.T.V. 1993. *Principles of Diagnostic Techniques in Plant Pathology*.CABI Wallington.

Mathews R.E.F. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press, Boca Raton, Tokyo.

Pathak V.N. 1984. *Laboratory Manual of Plant Pathology*.Oxford & IBH,NewDelhi.

Forster D & Taylor S.C. 1998. *Plant Virology Protocols: From Virus Isolation to Transgenic Resistance.Methods in Molecular Biology*.Humana Press, Totowa, New Jersey.

Matthews R.E.F. 1993. *Diagnosis of Plant Virus Diseases*. CRC Press,Florida.

Noordam D. 1973. *Identification of Plant Viruses, Methods and Experiments*. Cent. Agric. Pub. Doc., Wageningen.

Trigiano R.N, Windham M.T & Windham A.S. 2004.*Plant Pathology-Concepts and Laboratory Exercises*. CRC Press, Florida.

Chakravarti B.P. 2005. *Methods of Bacterial Plant Pathology*. Agrotech, Udaipur.

Kolte S.J. *Essential of Plant Pathological Techniques*.