

GURU KASHI UNIVERSITY



M.Sc. Plant Pathology

Session : 2022-23

Department of Plant Pathology

PROGRAMME LEARNING OUTCOMES

- 1 To provide knowledge of identification and distribution of all plant pathogenic groups, principle of diseases management, diseases etiology and epidemiology.
- 2 To acquire in depth knowledge on molecular level host-pathogen interactions, development of disease resistance in plants, Phytosanitary measures.
- 3 To attain knowledge on the principles and the role of Plant Quarantine at National and International level, Regulations of import /export of plant material, sanitary and phytosanitary issues, quarantine.

Programme Structure

Semester: Flexible Study Scheme							
Sr. No.	New Course Code	Course Name	Type of Course	L	T	P	No. of Credits
1.	MPP101	Mycology	T	2	0	0	2
2.	MPP102	Detection and Diagnosis of Plant Diseases	T	2	0	0	2
3.	MPP103	Principles of Plant Pathology	T	3	0	0	3
4.	MPP104	Plant Bacteriology	T	2	0	0	2
5.	MPP105	Plant Virology	T	2	0	0	2
6.	MPP106	Integrated Plant Disease Management	T	2	0	0	2
7.	MPP107	Molecular Approaches in Plant Protection	T	2	0	0	2
8.	MPP108	Quarantine in Plant Protection	T	2	0	0	2
9.	MPP109	Post Harvest Diseases	T	2	0	0	2
10.	MPP110	Fungal Diseases of Plants	T	2	0	0	2
11.	MPP111	Bio-control of insect pests*	T	2	0	0	2
12.	MPP112	Agriculture statistics	P	3	0	0	3
13.	MPP113	Lab- Mycology	P	0	0	2	1
14.	MPP114	Lab- Detection and Diagnosis of Plant Diseases	P	0	0	2	1
15.	MPP115	Lab- Plant Bacteriology	P	0	0	2	1
16.	MPP116	Lab- Plant Virology	P	0	0	2	1

17.	MPP117	Lab- Integrated Plant Disease Management	P	0	0	2	1
18.	MPP118	Lab- Molecular Approaches in Plant Protection	P	0	0	2	1
19.	MPP119	Lab- Post Harvest Diseases	P	0	0	2	1
20.	MPP120	Lab -Fungal Diseases of Plants	P	0	0	2	1
21.	MPP121	Lab - Bio-control of insect pests*	P	0	0	2	1
22.	MPP122	Lab- Agriculture statistics	P	0	0	2	1
23.	MPP123	Credit Seminar I	P	NA	NA	NA	1
24.	MPP124	Credit Seminar II	P	NA	NA	NA	1
25.	MPP125	Fundamentals of Computer Applications Lab	P		-	2	1(NC)
26.	MPP126	Library and Information services Lab	P		-	2	1(NC)
27.	MPP127	Technical writing and communication skills Lab	P		-	2	1(NC)
28.	MPP128	Master Research	P	NA	NA	NA	24(NC)
Discipline Elective							
29.	MPP129	Insect vectors of plant pathogens*	T	2	0	0	2
30.	MPP130	Lab- Insect vectors of plant pathogens*	P	0	0	2	1
31	MPP 131	Weed Management	T	2	0	0	2
32	MPP 132	Lab - Weed Management	P	0	0	2	1
Total No. of Credits							41+27 (NC)

Evaluation Criteria for Theory Courses

- A. Continuous Assessment: [25 Marks]
 - Continuous Assessment 1: [10 Marks]
 - Continuous Assessment 2: [10 Marks]
 - Continuous Assessment 3: [05 Marks]
- B. Mid Semester Test-1: [30 Marks]
- C. Mid Semester Test-2: [20Marks]
- D. End-Term Exam: [20 Marks]
- E. Attendance: [5 Marks]

For the CAs the teacher shall take surprised test/term paper/quiz/assignments

Evaluation Criteria for practical Courses

- ❖ The syllabus of subject is divided into five experiments, each experiment marks is of 20 marks (10 lab performance, 5 viva, 5 lab record)- Total marks 100

Evaluation Criteria for Seminar

- ❖ It is of total Marks-100
 - Collection of review of literature - 20marks
 - Data Analysis -20 marks
 - Power Point Presentation - 20 marks
 - Presentation skills - 20 marks
 - Viva voce - 20 marks

Evaluation Criteria for Master Research

- ❖ The evaluation is Satisfactory or Unsatisfactory on the basis of the performance of the candidate.

Course Title: Mycology
Course Code: MPP101

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Acquire basic information regarding nomenclature, historical development and classification of fungi.
- 2 Classify the importance of mycology in agriculture, relation of fungi to human affairs, history of mycology
- 3 Learn the different structures produced by fungi and their identification
- 4 Understand the comparative morphology, ultrastructure, characters of different groups of fungi up to generic level
- 5 Investigate about the importance of mycorrhiza & lichens, types, fungal genetics and variability in fungi.

Course Contents

Unit I

8 hours

Introduction, basic concepts and terminology. Mycology in relation to agriculture and mankind. History of mycology.

Unit II

7 hours

Concepts of nomenclature and classification. Fungal biodiversity. Reproduction in fungi. Comparative morphology, ultrastructure and characters of different groups of fungi.

Unit III

9 hours

Generic level of Divisions Myxomycota and Eumycota emphasizing subdivisions Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

Unit IV

6hours

Types of Lichens and importance, fungal genetics and variability in fungi.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. *Introductory Mycology*. Fourth edition. Wiley Publishing, Inc., New Delhi. pp. 800.

2. Harshberger, J.W. 2010. *A Text-Book of Mycology and Plant Pathology*. Nabu Press, Charleston, South Carolina. pp. 780.
3. Hait, G. 2017. *A Textbook of Mycology*, 1st edition. New Central Book Agency (NCBA), Kolkata, West Bengal. pp. 774.

Course Title: Detection and Diagnosis of Plant Diseases

Course Code: MPP102

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study the isolation of pathogens using selective media, pure culture techniques. Also the methods to prove Koch's postulates with biotroph and necrotroph pathogens in Lab.
- 2 Learn about the preservation of plant pathogens and disease specimens.
- 3 Understand the use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.
- 4 Get Familiar with the use of Microscopic techniques and staining methods, chromatography, phase contrast and electron microscopy, spectrophotometer, ultracentrifuge and electrophoretic apparatus.
- 5 Demonstrate the serological and molecular techniques for detection of plant pathogens.

Course Contents

- Unit I** **10 hours**
Isolation of pathogens using selective media, pure culture techniques. Methods to prove Koch's postulates with biotroph and necrotroph pathogens.
- Unit II** **05 hours**
Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.
- Unit III** **10 hours**
Microscopic techniques and staining methods, chromatography, phase contrast and electron microscopy, spectrophotometer, ultracentrifuge and electrophoretic apparatus.
- Unit IV** **05 hours**
Serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides and bactericides. Data collection and preparation of reports.
- Transaction Mode**
Lecture, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

1. Meena, A. K., Godara, S. L. and Meena, P. N. 2020. *Detection and Diagnosis of Plant Diseases*. Scientific Publishers, Jodhpur, Rajasthan. pp. 124.
2. Boonham, N., Tomlinson, J. and Mumford, R. 2016. *Molecular Methods in Plant Disease Diagnostics, Principles and Protocols*. CABI Publishing. New Delhi. pp. 212.
3. Kumar, P. Tiwari, A.K., Kamle, M. Abbas, Z. Singh, P. 2019. *Plant Pathogens, Detection and Management for Sustainable Agriculture*. Apple Academic Press, Florida, USA. pp.362.

Course Title: Principles of Plant Pathology
Course Code: MPP103

L	T	P	Credits
3	0	0	3

Total Hours -45

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Study the importance, terminology and concepts of plant diseases. To study the History and growth of plant pathology.
- 2 Classify and Understand the biotic and abiotic causes of plant diseases for the study of Growth, reproduction, survival and dispersal of important plant pathogens.
- 3 Assess the concept of host parasite interaction, recognition concept and infection.
- 4 Recognize the symptomatology, disease development, role of enzymes, toxins, growth regulators to identify the disease.
- 5 Acquaint about defense strategies and altered plant metabolism as affected by plant pathogens.

Course Content

Unit I

9 hours

Importance, terminology and concepts of plant diseases. History and growth of plant pathology. Biotic and abiotic causes of plant diseases. Growth, reproduction, survival and dispersal of important plant pathogens.

Unit II

9 hours

Role of environment and host nutrition on disease development. Host parasite interaction, recognition concept and infection. Symptomatology, disease development.

Unit III

12 hours

Role of enzymes, toxins, growth regulators. Defense strategies, oxidative burst, phenolics, phytoalexins, PR proteins and elicitors.

Unit IV

15 hours

Altered plant metabolism as affected by plant pathogens. Genetics of resistance, 'R' genes, mechanism of genetic variation in pathogens, molecular basis for resistance, marker-assisted selection and genetic engineering for disease resistance. Disease management strategies.

Transaction Mode

Lecture, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Agrios, G.N. 2005. *Plant Pathology*. 5th Ed. Academic Press, New York. pp.952.
2. Heitefuss,R.and Williams, P.H. 1976. *Physiological Plant Pathology*. Springer Verlag, Berlin, New York. pp. 196.
3. Mehrotra,R.S.and Aggarwal, A. 2003. *Plant Pathology*. 2nd Ed. Oxford & IBH, New Delhi. pp. 846.
4. Singh, R.S. 2002. *Introduction to Principles of Plant Pathology*. Oxford & IBH, New Delhi. pp. 416.

Course Title: Plant Bacteriology**Course Code: MPP104**

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Assess the basic knowledge on biology, classification and nomenclature, survival, phytopathogenic prokaryotic bacteria.
- 2 Acquire basic information regarding about phytoplasma, Bdellovibrios and bacteriophages.
- 3 Learn about the identification and preservation of bacterial cultures.
- 4 Gain the insights of understanding of disease distribution, symptomatology, etiology, epidemiology and control.
- 5 Study the role of bacteria in agriculture and as biocontrol agents.

Course Content**Unit I****6 hours**

History and introduction to phytopathogenic prokaryotes, viz., bacteria, MLOs, spiroplasmas and other fastidious prokaryotes.

Unit II**9 hours**

Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic prokaryotes and list of important diseases caused by them.

Unit III**8 hours**

Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic prokaryotes. General biology of bacteriophages, L form bacteria, plasmids and Bdellovibrios.

Unit IV**7 hours**

Prokaryotic inhibitors and their mode of action against phytopathogenic bacteria. Survival and dissemination of phytopathogenic bacteria.

Transaction Mode

Lecture, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

1. Goto, M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York. pp. 952.
2. Mount, M.S. and Lacy, G.H. 1982. *Phytopathogenic Prokaryotes*. Vols. I Academic Press, New York. pp. 560.
3. Mondal, K.K. 2011. *Plant Bacteriology*. Kalyani Publishers, Ludhiana, Punjab. pp. 190.

Course Title: Plant Virology
Course Code: MPP105

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Acquire basic knowledge of biology, classification nomenclature and survival of phytopathogenic viruses
- 2 Understand the structure of plant virus, genome organization, replication and movement of viruses
- 3 Learn about the isolation and purification, estimation of virus titre and purity, electron microscopy, protein and nucleic acid based diagnostics.
- 4 Study the origin and evolution, mechanism of resistance
- 5 Understand genetic engineering, ecology, and management of plant viruses

Course Content

Unit I

8 hours

History of plant viruses, their composition and structure. Symptomatology of important plant viral diseases, transmission, chemical and physical properties. Host virus interaction and virus vector relationship.

Unit II

7 hours

Virus nomenclature and classification, genome organization, replication and movement. Isolation, purification, electron microscopy, protein and nucleic acid based diagnostics.

Unit III

9 hours

Mycoviruses, phytoplasmaarbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, and prions. Origin and evolution, mechanism of resistance and genetic engineering of plant viruses.

Unit IV

6 hours

Study of representative viral/mycoplasmal diseases, emphasizing their distribution, symptomatology, etiology, epidemiology and principles of plant viral disease control.

Transaction Mode

Lecture, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Walkey, D. 2012. *Applied Plant Virology*, 2nd edition. Springer, Philippines. pp. 352.
2. Kolte, S.J. and Tewari, A.K. 2011. *The Elements of Plant Virology: Basic Concepts and Practical Class Exercises*. Kalyani Publishers, Ludhiana, Punjab. pp. 213.
3. Hull, R. 2013. *Plant Virology*. 5th edn. Academic Press, New York. pp. 1118.

Course Title: Integrated Plant Disease Management
Course Code: MPP106

L	T	P	Credits
2	0	0	2

Total Hours: 30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study importance of integrated disease management.
- 2 Understand the concept and tools of integrated disease management
- 3 Learn about the various components of integrated disease management, their limitations and implications
- 4 Study about the development of IDM for the control of diseases
- 5 Familiarize with the IDM adaptation in important crops, rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard, pearl millet, Kharif pulses, vegetable and fruit crops

Course Content

Unit I **6 hours**

Introduction, definition, concept and tools of disease management.

Unit I **9 hours**

Components of integrated disease management, their limitations and implications.

Unit I **5 hours**

Development of IDM and its adaptation in important crops, rice, wheat, cotton, sugarcane.

Unit I **10 hours**

Development of IDM and its adaptation in important crops chickpea, rapeseed mustard, pearl millet, Kharif pulses, vegetable and fruit crops.

Transaction Mode

Lecture, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Sharma, R.C. and Sharma, J.N.2018. *Integrated Plant Disease Management*, Scientific Publisher, Jodhpur. pp. 362.
2. Nagarajan, S. 2013. *Dynamics of Plant Diseases*, Allied Publishers, New Delhi, India. pp. 120.
3. Mehrotra, R.S. 2011. *Plant Pathology*, McGraw Hill Education, New York, United States. pp. 910.
4. Gupta, V.K. and Sharma, R.C. (Eds). 1995. *Integrated Disease Management and Plant Health*. Scientific Publ., Jodhpur. pp. 319.

Course Title: Molecular Approaches in Plant Protection

Course Code: MPP107

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand the basic concepts and principles to study host pathogen relationship
- 2 Learn about the recognition system and signal transduction of pathogens
- 3 Acquire basic knowledge about induction of defense responses- pathogenesis related proteins, HR, reactive oxygen species, phytoalexins and systemic acquired resistance, programmed cell death, viral induced gene silencing
- 4 Study the importance of biotechnology in disease management
- 5 Understand the biosafety issues related to GM crops

Course Content

Unit I **12 hours**

Recent concepts of molecular biology and techniques used in plant protection. Genes of interest in plant protection. Identification, characterization and isolation of novel genes involved in pest resistance.

Unit II **6 hours**

Molecular basis of host plant-insect and pathogen interactions. PR-proteins and G-proteins. Molecular characterization of biodiversity-insects and pathogens.

Unit III **8 hours**

Molecular biology of baculoviruses. Molecular mechanisms of genetically engineered plants for pest resistance and pesticide resistance.

Unit IV **4 hours**

Improvement of biocontrol agents and useful insects using molecular techniques. Bio-safety related issues.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Marshall, G. 1994. *Molecular Biology in Crop Protection*. Springer, Netherlands. pp. 283.
2. Nagarajan, S. 2013. *Dynamics of Plant Diseases*. Allied Publishers, New Delhi, India. pp. 120.
3. Mehrotra, R.S. 2011. *Plant Pathology*. McGraw Hill Education, New York, United States. pp. 910.

Course Title: Quarantine in Plant Protection
Course Code: MPP108

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: After successful completion of this course, the students will be able to:

- 1 Acquire knowledge on the principles and the role of plant quarantine at national and international level.
- 2 Learn about the quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status.
- 3 Study of plant protection organization in India, acts related to registration of pesticides and transgenics.
- 4 Learn about the history of quarantine legislations, PQ order 2003, environmental acts,
- 5 Study of Industrial registration; APEDA, import and export of bio-control agents.

Course Content

Unit I **15 hours**

Definition of pest and pesticides and transgenics as per Govt. notification. Relative importance and quarantine for domestic and international. Quarantine restrictions in the movement of agricultural produce including seeds and planting material.

Unit II **10 hours**

Case histories of exotic pests and diseases and their status. Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine 156 legislations. PQ Order 2003. Environmental Acts and APEDA.

Unit III **8 hours**

Industrial registration. Import and Export of bio-control agents. Special requirements for biopesticide registration. Identification of pest and disease free areas. Contamination of food with toxigens of micro-organisms and their elimination.

Unit IV **12 hours**

Symptomatic diagnosis and other techniques to detect pest/pathogen infestations. VHT and other safer techniques of disinfestations and salvaging of infected material. WTO regulations. Non-tariff barriers. Pest risk analysis and good laboratory practices for pesticide laboratories. Pesticide industry. Sanitary and phytosanitary measures.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Kahn, R. 1988. *Plant Protection & Quarantine*. CRC Press, Boca Raton, Florida, United States. pp. 248.
2. Ebbels, D.L. 2003. *Principles of Plant health & quarantine*. Central Science Laboratory, York, UK. pp. 228.
3. Mehrotra, R.S. 2011. *Plant Pathology*, McGraw Hill Education, New York, United States. pp. 910.

Course Title: Post Harvest Diseases**Course Code: MPP109**

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand methods of post harvest technology and its role in providing better quality produce to the consumer.
- 2 Understand functional foods and nutraceuticals Understand utilization of the produce and methods for shelf-life extension.
- 3 Learn quality control and various standards required for domestic and export market
- 4 Study about feasibility of implementing integrated disease management programs (IDMP) in agricultural crops
- 5 Acquire knowledge about management of post harvest diseases

Course Content**Unit I****5 hours**

Concept of post harvest diseases, definitions, importance with reference to environment and health. Postharvest diseases of fruits and vegetables. Factors governing post-harvest problems.

Unit II**9 hours**

Role of physical environment, agro-ecosystem leading to quiescent infection. Concept of microbial associations, rhizosphere/ rhizoplane colonization, competitive saprophytic ability, antibiosis, induced resistance.

Unit III**8 hours**

Operational mechanisms and cultural practices in perpetuation of pathogens. Operational mechanisms, handling and its relevance in control. Management of aflatoxigenic and mycotoxigenic fungi. Antagonists, their relationship and role as biocontrol agents. Chemicals in controlling post-harvest diseases.

Unit IV**8 hours**

Merits and demerits of phyto-extracts in controlling post-harvest diseases. Integrated approach in controlling diseases and improving the shelf life of produce. Codex Alimentarius for agro-product and commodity.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings

1. Narayanasamy, P. 2005. *Postharvest Pathogens and Disease Management*. John Wiley & Sons, New Jersey, United States. pp. 672.

2. Singh, D., Sharma, R.R., Devappa, V. and Kamil, D. 2021. *Postharvest Handling and Diseases of Horticultural Produce*.CRC Press. London. pp.454.
3. Snowden,A.L. 1992.*Post-Harvest Diseases and Disorders of Fruits and Vegetables*. Volume 2: Vegetables CRC Press, London. pp. 642.

Course Title: Fungal Diseases of Plants
Course Code: MPP110

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Learn about diagnostics of fungal diseases on field crops and post harvest crops
- 2 Study of virulence analysis and genetic diversity
- 3 Acquire knowledge about disease distribution, symptomatology, etiology, epidemiology and control
- 4 Understand the description of important phytopathogenic genera
- 5 Study about identification of fungal cultures and biocontrol agents

Course Content

Unit I	8 hours
Nomenclature, classification and general characterization of fungi.	
Unit II	8 hours
Description of important phytopathogenic genera.	
Unit III	6 hours
Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control.	
Unit IV	8 hours
Post harvest diseases in transit and storage and their management.	

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. *Introductory Mycology*. Fourth edition. Wiley Publishing, Inc., New Delhi. pp. 800.
2. Harshberger, J.W. 2010. *A Text-Book of Mycology and Plant Pathology*. Nabu Press, Charleston, South Carolina. pp. 780.
3. Hait, G. 2017. *A Textbook of Mycology*, 1st edition. New Central Book Agency (NCBA), Kolkata, West Bengal. pp. 774.

Course Title: Bio-control of insect pests
Course Code: MPP111

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand the economic importance of different categories of insects and microbes
- 2 Study the potential of useful insects and microbes in agricultural pest management
- 3 Learn about evaluating efficacy of various biocontrol agents
- 4 Study of mass production of natural enemies of pest insects
- 5 Acquire knowledge about mass production of microbial strains in biopesticide and biofertilizer production

Course Content

Unit I

8 hours

Principles and scope of biological control. Techniques in biological control. Biology and host seeking behaviour of predatory and parasitic groups of insects.

Unit II

7 hours

Role of insect pathogens and their mode of action. Biological control of weeds using insects. Techniques for mass production of quality biocontrol agents.

Unit III

9 hours

Various formulations and economics of bioagents. Field application and evaluation. Analysis of successful biological control projects. Trends and future possibilities of biological control.

Unit IV

6 hours

Importation of natural enemies and quarantine regulations. Biotechnology in biological control. Semiochemicals in biological control.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Prasad, T.V. 2019. *Handbook of Entomology*. New Vishal Publications, New Delhi. 3rd edition. pp. 496.
2. Shields, V.D.C. 2018. *Biological Control of Pest and Vector Insects*. INTECH. Princes Gate Court, London.

3. Jamal, A. 2017. *Biological Control of Insects Pests*. Anmol Publications Pvt. Ltd. pp. 264.

Course Title: Agriculture statistics
Course Code: MPP112

L	T	P	Credits
2	0	0	2

Total Hours:45

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Study about statistical principles apply in all the areas of experimental work
- 2 Understand the requirement at the national level and farm level for agriculture policy making,
- 3 Helps to develop decision making, agriculture development and estimates agriculture and national income
- 4 Study the importance of statistics in agriculture, helps to ascertain the volume of crop that needs to be produced based on output and demand of previous year
- 5 Acquire knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste

Course Content

Unit I **10 hours**
 Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation; Hypothesis testing.

Unit II **15 hours**
 Concept of p-value. Tests of significance-t, F and chi-square (X^2); Data transformation and missing plot techniques.

Unit III **15 hours**
 Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs.

Unit IV **5 hours**
 Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.

Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. pp. 361.

2. Gupta, S.C. and Kapoor, V.K. 2014. *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.pp. 230.
3. Snecdecor, G.W. and Cochran, W.G. 1989. *Statistical Methods*, 8th Edition. Wiley-Blackwell. Pp.524.
4. Rangaswamy, R. 2016. *Textbook of Agricultural Statistics*.New Age International (P) Ltd. New Delhi. pp. 531.

Course Code: MPP113

0	0	2	1
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Total Hours:15

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Acquire basic information regarding nomenclature, historical development and classification of fungi.
- 2 Classify the importance of mycology in agriculture, relation of fungi to human affairs, history of mycology
- 3 Learn the different structures produced by fungi and their identification
- 4 Understand the comparative morphology, ultrastructure, characters of different groups of fungi up to generic level
- 5 Investigate about the importance of mycorrhiza & lichens, types, fungal genetics and variability in fungi.

Course Contents

Detailed comparative study of different groups of fungi; collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi. Comparative study of different groups of fungi up to generic level of Divisions Myxomycota and Eumycota emphasizing subdivisions Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

Suggested Readings

4. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. *Introductory Mycology*. Fourth edition. Wiley Publishing, Inc., New Delhi. pp. 800.
5. Harshberger, J.W. 2010. *A Text-Book of Mycology and Plant Pathology*. Nabu Press, Charleston, South Carolina. pp. 780.
6. Hait, G. 2017. *A Textbook of Mycology*, 1st edition. New Central Book Agency (NCBA), Kolkata, West Bengal. pp. 774.

Course Title: Lab- Detection and Diagnosis of Plant Diseases

Course Code: MPP114

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand the methods to prove Koch's postulates with biotroph and necrotroph pathogens in Lab.
- 2 Learn about the preservation of plant pathogens and disease specimens.
- 3 Understand the use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.
- 4 Get Familiar with the use of Microscopic techniques and staining methods, chromatography, phase contrast and electron microscopy, spectrophotometer, ultracentrifuge and electrophoretic apparatus.
- 5 Understand the serological and molecular techniques for detection of plant pathogens.

Course Content

Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens. Preservation of plant pathogens and disease specimens, use of centrifuge, pH meter, micrometer, haemocytometer, camera lucida. 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 manuscripts

Suggested Readings:

1. Meena, A. K., Godara, S. L. and Meena, P. N. 2020. *Detection and Diagnosis of Plant Diseases*. Scientific Publishers, Jodhpur, Rajasthan. pp. 124.
2. Boonham, N., Tomlinson, J. and Mumford, R. 2016. *Molecular Methods in Plant Disease Diagnostics, Principles and Protocols*. CABI Publishing. New Delhi. pp. 212.
3. Kumar, P. Tiwari, A.K., Kamle, M. Abbas, Z. Singh, P. 2019. *Plant Pathogens, Detection and Management for Sustainable Agriculture*. Apple Academic Press, Florida, USA. pp.362.

Course Title: Lab- Plant Bacteriology

Course Code: MPP115

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand the basic knowledge on biology, classification and nomenclature, survival, phytopathogenic prokaryotic bacteria
- 2 Acquire basic information regarding about phytoplasma, Bdellovibrios and bacteriophages
- 3 Develop methodology for identification and preservation of bacterial cultures.
- 4 Provide insights of understanding in disease distribution, symptomatology, etiology, epidemiology and control
- 5 Analyze the role of bacteria in agriculture and as biocontrol agents

Course Content

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

Suggested readings:

1. Goto, M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York. pp. 952.
2. Mount, M.S. and Lacy, G.H. 1982. *Phytopathogenic Prokaryotes*. Vols. I Academic Press, New York. pp. 560.
3. Mondal, K.K. 2011. *Plant Bacteriology*. Kalyani Publishers, Ludhiana, Punjab. pp. 190.

Course Title: Lab- Plant Virology
Course Code: MPP116

L	T	P	Credits
0	0	2	1

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Acquire basic knowledge of biology, classification nomenclature and survival of phytopathogenic viruses
- 2 Understand the structure of plant virus, genome organization, replication and movement of viruses
- 3 Learn about the isolation and purification, estimation of virus titre and purity, electron microscopy, protein and nucleic acid based diagnostics.
- 4 Study the origin and evolution, mechanism of resistance
- 5 Understand genetic engineering, ecology, and management of plant viruses

Course Content

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

Suggested readings:

1. Walkey, D. 2012. *Applied Plant Virology*, 2nd edition. Springer, Philippines. pp. 352.
2. Kolte, S.J. and Tewari, A.K. 2011. *The Elements of Plant Virology: Basic Concepts and Practical Class Exercises*. Kalyani Publishers, Ludhiana, Punjab. pp. 213.
3. Hull, R. 2013. *Plant Virology*. 5th edn. Academic Press, New York. pp. 1118.

Course Title: Lab- Integrated Plant Disease Management
Course Code: MPP117

L	T	P	Credits
0	0	2	1

Total Hours: 15

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study the introduction and definition of IDM.
- 2 Understand the concept and tools of disease management.
- 3 Learn about the various components of integrated disease management, their limitations and implications.
- 4 Study about the development of IDM for the control of diseases.
- 5 Familiarize with the IDM adaptation in important crops, rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard, pearl millet, Kharif pulses, vegetable and fruit crops.

Course Content

Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM. Demonstration of IDM in certain crops as project work.

Suggested readings:

1. Sharma, R.C. and Sharma, J.N.2018. *Integrated Plant Disease Management*, Scientific Publisher, Jodhpur. pp. 362.
2. Nagarajan, S.2013. *Dynamics of Plant Diseases*, Allied Publishers, New Delhi, India. pp. 120.
3. Mehrotra, R.S. 2011. *Plant Pathology*, McGraw Hill Education, New York, United States. pp. 910.
4. Gupta, V.K. and Sharma, R.C. (Eds). 1995. *Integrated Disease Management and Plant Health*. Scientific Publ., Jodhpur. pp. 319.

Course Title: Lab- Molecular Approaches in Plant Protection

Course Code: MPP118

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Understand the basic concepts and principles to study host pathogen relationship
- 2 Learn about the recognition system and signal transduction of pathogens
- 3 Acquire basic knowledge about induction of defense responses- pathogenesis related proteins, HR, reactive oxygen species, phytoalexins and systemic acquired resistance, programmed cell death, viral induced gene silencing
- 4 Study the importance of biotechnology in disease management
- 5 Understand the biosafety issues related to GM crops

Course Content

Molecular characterization of pest populations. Detection of biotypes/races. Establishment of phylogenetic relationships/dendrograms. Detection of Cry-gene and estimation of cry-toxin; characterization of capsid proteins of insect viruses. Detection of disease induced biochemical changes at molecular level.

Suggested readings:

- 1 Marshall, G. 1994. *Molecular Biology in Crop Protection*. Springer, Netherlands. pp. 283.
- 2 Nagarajan, S. 2013. *Dynamics of Plant Diseases*. Allied Publishers, New Delhi, India. pp. 120.
- 3 Mehrotra, R.S. 2011. *Plant Pathology*. McGraw Hill Education, New York, United States. pp. 910.

Course Title: Lab- Post Harvest Diseases

Course Code: MPP119

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Understand methods of post harvest technology and its role in providing better quality produce to the consumer.
- 2 Understand functional foods and nutraceuticals Understand utilization of the produce and methods for shelf-life extension.
- 3 Learn quality control and various standards required for domestic and export market
- 4 Study about feasibility of implementing integrated disease management programs (IDMP) in agricultural crops
- 5 Acquire knowledge about management of post harvest diseases

Course Content

Isolation, characterization and maintenance of important post-harvest pathogens. Role of different storage conditions for disease development. Application of antagonists against pathogens under in vitro and in vivo conditions. Comparative efficacy of different chemicals, fungicides, phyto-extracts and bioagents.

Suggested readings

1. Narayanasamy, P. 2005. *Postharvest Pathogens and Disease Management*. John Wiley & Sons, New Jersey, United States. pp. 672.
2. Singh, D., Sharma, R.R., Devappa, V. and Kamil, D. 2021. *Postharvest Handling and Diseases of Horticultural Produce*. CRC Press. London. pp.454.
3. Snowden, A.L. 1992. *Post-Harvest Diseases and Disorders of Fruits and Vegetables*. Volume 2: Vegetables CRC Press, London. pp. 642.

Course Title: Lab -Fungal Diseases of Plants
Course Code: MPP120

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Learn about diagnostics of fungal diseases on field crops and post harvest crops.

- 2 Study of virulence analysis and genetic diversity
- 3 Acquire knowledge about disease distribution, symptomatology, etiology, epidemiology and control
- 4 Understand the description of important phytopathogenic genera
- 5 Study about identification of fungal cultures and biocontrol agents

Course Content

Characteristics of important phytopathogenic genera and of fungi and their identification. Macro and microscopic diagnosis of representative diseases of various crop.

Suggested readings:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. *Introductory Mycology*. Fourth edition. Wiley Publishing, Inc., New Delhi. pp. 800.
2. Harshberger, J.W. 2010. *A Text-Book of Mycology and Plant Pathology*. Nabu Press, Charleston, South Carolina. pp. 780.
3. Hait, G. 2017. *A Textbook of Mycology*, 1st edition. New Central Book Agency (NCBA), Kolkata, West Bengal. pp. 774.

Course Title: Lab - Bio-control of insect pests
Course Code: MPP121

L	T	P	Credits
0	0	2	1

Total Hours:15

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Understand the economic importance of different categories of insects and microbes
- 2 Study the potential of useful insects and microbes in agricultural pest management
- 3 Learn about evaluating efficacy of various biocontrol agents
- 4 Study of mass production of natural enemies of pest insects
- 5 Acquire knowledge about mass production of microbial strains in biopesticide and biofertilizer production

Course Content

Identification of common natural enemies of crop pests and weed killers. Techniques for rearing of natural enemies. Visits (only where logistically feasible) to bio-control laboratories to learn rearing and mass production of natural enemies of crop pests and weeds and their laboratory hosts. Field collection of parasitoids and predators. Hands-on training in culturing and identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

Suggested readings:

1. Prasad, T.V. 2019. *Handbook of Entomology*. New Vishal Publications, New Delhi. 3rd edition. pp. 496.
2. Shields, V.D.C. 2018. *Biological Control of Pest and Vector Insects*. INTECH. Princes Gate Court, London.
3. Jamal, A. 2017. *Biological Control of Insects Pests*. Anmol Publications Pvt. Ltd. pp. 264.

Course Title: Lab- Agriculture statistics

Course Code: MPP122

L	T	P	Credits
0	0	2	1

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study about statistical principles apply in all the areas of experimental work
- 2 Understand the requirement at the national level and farm level for agriculture policy making,
- 3 Helps to develop decision making, agriculture development and estimates agriculture and national income
- 4 Study the importance of statistics in agriculture, helps to ascertain the volume of crop that needs to be produced based on output and demand of previous year
- 5 Acquire knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste

Course Content

Correlation analysis. Regression analysis (exponential, power function, quadratic, multi-variate, selection of variables, validation of models, ANOVA and testing of hypothesis). Tests of significance (Z-test, t-test, F-test and Chi-square test). Analysis of variance. Completely randomized design. Randomized block and latin square designs. Missing plot and analysis of covariance. 23, 24 and 33 simple and confounded experiments. Split plot designs. Factorial in split plot designs.

Suggested readings:

1. Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. pp. 361.
2. Gupta, S.C. and Kapoor, V.K. 2014. Fundamentals of Mathematical Statistics. Sultan Chand & Sons, New Delhi. pp. 230.
3. Snecdecor, G.W. and Cochran, W.G. 1989. Statistical Methods, 8th Edition. Wiley-Blackwell. Pp.524.
4. Rangaswamy, R. 2016. Textbook of Agricultural Statistics.New Age International (P) Ltd. New Delhi. pp. 531.

Course Title: Credit Seminar I

Course Code: MPP123

L	T	P	Credits
NA	NA	NA	1

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Show competence in identifying relevant information, defining and explaining topics under discussion
- 2 Present the classical and innovative work related to plant pathology subject.
- 3 Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
- 4 Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject
- 5 To ask appropriate questions, use evidence to support claims, respond to a range of questions

Course Content

Seminar topic will be suggested by faculty

Course Title: Credit Seminar II

Course Code: MPP124

L	T	P	Credits
NA	NA	NA	1

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Show competence in identifying relevant information, defining and explaining topics under discussion
- 2 Present the classical and innovative work related to plant pathology subject.
- 3 Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
- 4 Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject
- 5 To ask appropriate questions, use evidence to support claims, respond to a range of questions

Course Title: Fundamentals of Computer Applications Lab

Course Code: MPP125

L	T	P	Credits
0	0	2	1NC

Learning Outcomes: On successful completion of this course, the students will able to:

- 1 Learn and understand about basics of MS-Word, Excel, preparation of Graphs
- 2 Read, understand, and interpret material on technology. They will have an appreciation for some of the ideas, issues, and problems involved in writing about technology and in workplace writing.
- 3 Understand the operating systems, peripheral devices, networking, multimedia and internet
- 4 Familiarize with basic sources and methods of research and documentation on topics in technology, including on-line research.
- 5 Students will be able to synthesize and integrate material from primary and secondary sources with their own ideas in research papers.

Course Content

Ms-word: creating a document, saving and editing, use of options from tool bars, format, insert and tools(spelling and grammar), alignment of text, creating a table, merging cells, column and row width. Ms-excel: entering expressions through the formula tool bar and use of inbuilt functions, sum, average, max, min. Creating graphs and saving with and without data in Ms-excel. Ms-access: creating database, structuring with different types of fields. Ms-power point: preparation of slides on power point. Internet Browsing: browsing a web page and creating of E-Mail ID. Agri. net (ARIS).

Suggested Readings:

1. Salaria, R.S. 2017. *Computer Fundamentals*. Daryaganj, New Delhi. pp. 486.
2. Manish, S. and Bhatt, A. 2016. *Computers in Agriculture: Fundamentals and Applications*. New India Publishing Agency. New Delhi. pp. 190.
3. Manjunath, B.E. 2010. *Computer Basics*. Vasan Publications, Bengaluru, Karnataka. pp. 356.

Course Title: Library and Information services Lab
Course Code: MPP126

L	T	P	Credits
0	0	2	1NC

Learning Outcomes: On successful completion of this course, the students will able to:

Statement

- 1 Identify library services and availability of resources in order to develop a realistic overall plan for research
- 2 Use general information resources to increase familiarity with the topic and disciplinary vocabulary
- 3 Learn about the research topic, question or thesis to achieve a manageable focus appropriate to the assignment criteria, available resources, and evidence needed to support thesis
- 4 Identify keywords, synonyms and related terms in order to flexibly
- 5 Effectively search information resources

Course Content

Introduction to Library and its services; five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources.

Suggested readings:

1. Gita, S. 2012. *Library and Information Services*. LAP Lambert Academic Publishing, USA. pp. 76.
2. Kishore, A. 2021. *A Conceptual approach to library and information science A complete self study guide*. 2nd edition. AKB Publication. Jaipur. pp. 250.

Course Title: Technical writing and communication skills Lab

Course Code: MPP127

L	T	P	Credits
0	0	2	1NC

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Understand and know how to follow the stages of the writing process (prewriting/writing/rewriting) and
- 2 Apply them to technical and workplace writing tasks
- 3 Produce a set of documents related to technology and writing in the workplace and will have improved their ability to write clearly and accurately
- 4 Understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing
- 5 Familiarise with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation

Course Content

Various forms of scientific writings: theses, technical papers, review, manuals etc., various parts of thesis and research communications: title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion; writing of abstracts, summaries, precis, citations etc. commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; paginations, numbering of tables and illustrations; writing of numbers and dates in scientific write-ups; editing and proof reading; writing a review article, access methods.

Suggested readings:

1. Day, R.A. and Gastel, B. 2011. *How to Write and Publish a Scientific Paper*, 7th Edition. Greenwood Press, United States. pp. 300.
2. Laplante, P.A. 2011. *Technical Writing: A Practical Guide for Engineers and Scientists*. CRC Press, London. pp. 250.
3. Greenlaw, R. 2012. *Technical Writing, Presentational Skills and Online Communication: Professional Tools and Insights*. Idea Group, U.S. pp. 247.

Course Title: Master Research
Course Code: MPP128

L	T	P	Credits
NA	NA	NA	24NC

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
- 2 Negotiate, plan, design and execute a research-based project,
- 3 Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format
- 4 Learn the methodology of planning, layout, data recording, analysis, interpretation and report writing of plant pathology experiments
- 5 Familiarize with indexing databases, citation databases: web of science, scopus, etc.

Elective Subject

Course Title: Insect vectors of plant pathogens
Course Code: MPP129

L	T	P	Credits
2	0	0	2

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study of typical features of insect vectors of plant pathogens
- 2 Understand the significance of insect vectors vis-à-vis other pest insects of plants
- 3 Study about the potential of insect vectors in spreading crop diseases
- 4 Understand the transmission of viruses through insects
- 5 Learn about disease control mechanisms of insect vectors

Course Content

Unit I **10 hours**

History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics.

Unit II **05 hours**

Mouth parts and feeding processes of important insect vectors. Efficiency of transmission. Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors.

Unit III **10 hours**

Transmission of plant viruses by insect vectors and mites. Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.

Unit IV **05 hours**

Epidemiology and management of insect transmitted diseases through vector management. Paratransgenesis.

Suggested readings:

1. Butter, N. S. 2021. *Insect vectors and plant pathogens*. CRC Press, Taylor & Francis Group. London. pp. 496.
2. Harris, K.F. and Maramorosch, K. 1980. *Vectors of Plant Pathogens*. Academic Press. United States. pp. 418.

Course Title: Lab-Insect vectors of plant pathogens
Course Code: MPP130

L	T	P	Credits
0	0	2	1

Total Hours:30

Learning Outcomes: On successful completion of this course, the students will be able to:

- 1 Study of typical features of insect vectors of plant pathogens
- 2 Understand the significance of insect vectors vis-à-vis other pest insects of plants
- 3 Study about the potential of insect vectors in spreading crop diseases
- 4 Understand the transmission of viruses through insects
- 5 Learn about disease control mechanisms of insect vectors

Course Content

Identification of common vectors of plant pathogens- culturing and handling of vectors. Demonstration of virus transmission through vectors. Vector virus relationship studies.

Suggested readings:

1. Butter, N. S. 2021. *Insect vectors and plant pathogens*. CRC Press, Taylor & Francis Group. London. pp. 496.
2. Harris, K.F. and Maramorosch, K. 1980. *Vectors of Plant Pathogens*. Academic Press. United States. pp. 418.

Course Title: Weed Management
Course Code: MPP131

L	T	P	Credits
2	0	0	2

Total Credits-30

Learning Outcomes: After completion of this course, the successful students will be able to:

- 1 Identify the weed and its four stages of development.
- 2 Understand the difference between annual, biennial and perennial weeds.
- 3 Give examples of cultural weed controls.
- 4 Know the advantages and disadvantages of the various methods of herbicides applications.
- 5 Manage the weed problems.

Course contents

UNIT I

9 hours

Weed biology, ecology and crop-weed competition including allelopathy. Scope and principles of weed management and control/weed classification, biology, ecology and allopath, crop weed indices. History and development of herbicide.

UNIT II

7hours

Classification and selectivity of herbicides based on chemical, physiological application and selectivity. Mode and mechanism of action of important herbicides. Herbicide structure- activity relationship and factors affecting the efficiency of herbicides.

UNIT III

6 hours

Herbicide formulations and mixtures. Weed control through bio-herbicides, myco-herbicides and allelo-chemicals. Degradation of herbicides in soil and plants. Herbicide resistance in weeds and crops herbicide rotations.

UNIT IV

8 hours

Weed management in major crops and cropping systems. Management of parasitic weeds and special weed problems. Weed shifts in cropping systems. Aquatic and perennial weed control. Integrated weed management. Cost: benefit analysis of weed management.

Course Title: Lab-Weed Management

Course Code: MPP132

L	T	P	Credits
0	0	2	1

Learning Outcomes: On completion of this course, the successful students should be able to:

- 1 Define a weed and its four stages of development.
- 2 Understand the difference between annual, biennial and perennial weeds.
- 3 Help farmers in cultural weed controls.
- 4 Discriminate advantages and disadvantages of the various methods of herbicide applications.
- 5 Learn about the bioassays of herbicide residues.

Course contents

Identification of important crop weeds. Preparation of a weed herbarium. Weed survey in crops and cropping systems. Crop-weed competition studies. Weed indices. Preparation of spray solutions of herbicides for high and low-volume sprayers. Use of various types of spray pumps and nozzles and calculation of swath width. Economics of weed control. Herbicide residue analysis in plant and soil. Bioassay of herbicide residue. Calculation of herbicidal requirement