# **GURU KASHI UNIVERSITY**



M.Sc. Plant Pathology

Session : 2023-24

**Department of Plant Protection** 

# Graduate Outcomes of the programme

The program is designed to provide knowledge of identification and distribution of all plant pathogenic groups, principle of diseases management, diseases etiology and epidemiology. Emphasize on to acquire in depth knowledge on molecular level host-pathogen interactions, development of disease resistance in plants, Phytosanitory measures.

# **Program Learning Outcomes**

After completing the programme, the learner will be able to:

- 1 Comprehend the principles and methodologies used in Plant Pathology.
- Possess deep insight of fungal systematic, fungal structures, their role in identification and recent developments in fungal classification including chemo and molecular taxonomy.
- 3 Understand genetics and variability among fungi and their economic and industrial importance.
- Develop advanced understanding on characterization, identification of bacteria, pathogenesis, mechanism of disease development and recent approach in bacterial disease management.
- 5 Imbibe coherentknowledge in history of plant viruses, their biological properties, diagnostics and management.
- Familiarizewith various methods/techniques/instruments used in the study of plant diseases/pathogens and to acquaint with seed-borne diseases, their nature, detection, transmission, epidemiology, impacts/ losses and management.
- Pursue analysis in Identification, characterization and isolation of novel genes involved in pest resistance and develops understanding about Molecular basis of host plant-insect and pathogen interactions.
- 8 Imbibe coherent knowledge on host pathogen interaction and its application at molecular level and transmission of pathogen by vectors, their biological & molecular interaction and management.
- 9 Apply acquired knowledge to understand principles and practices of integrated disease/ pest management in different crops.
- Develop deep understanding on post-harvest diseases, factors governing postharvest problems, stages of diseases development, integrated approach in

# Course Structure of the M.Sc. Plant Pathology

		M. Sc. (Plant Pathology	7)		Se	ssion	: 2023-24
		Program S	tructure				
Sr.	Course	Course Title	Type of	,	ours Week		Total
No.	Code		Course	L	T	P	Credits
		Semes	ter I				
1	MPP101	Mycology	Major	3	0	2	4
2	MPP103	Principles of Plant Pathology	Major	3	О	0	3
3	MEN301	Minor (CBCS)					
4	MEN203	Biological control of insect pest and weeds	Minor (CBCS)	2	0	2	3
5	MAR121	Agriculture statistics	Supporting	3	0	2	4
6	MAR125	Library and Information Services	Common	0	0	4	2
7	MPP100	Master Research	Thesis Research	_	_	-	4NC
		Total Credits	1100001011				16+4NC
		Semes	ter II		-		
8	MPP201	Plant Pathogenic Prokaryotes	Major	2	0	2	3
9	MPP202	Molecular Approaches in Plant Protection	Major	2	0	2	3
10	MPP203	Post Harvest Diseases	Major	2	0	2	3
11	MPP204	Plant Quarantine and Regulations	Minor	2	0	0	2
12	MPP205	Seminar	Seminar	_	-	-	2
14	MAR206	Fundamentals of Computer Applications	Supporting		-	4	2
13	MPP100	Master Research	Thesis Research	-	_	_	5NC
		Total Credits					15+5NC
		Semest	ter III				
15	MPP301	Techniques for Detection and Diagnosis of Plant	Major	2	0	2	3

					P		S) (
		Diseases					·
16	MPP302	Integrated Disease Management	Major	2	0	2	3
18	MEN204	Host-Plant Resistance to Insects	Minor (CBCS)	1	0	2	2
19	MEN4O4	Insect vectors of plant pathogens	Minor (CBCS)	1	U	4	2
20	MAR304	Technical writing and communication skills	Common	0	0	4	2
17	MPP100	Master Research	Thesis Research	-	-	-	10NC
		Total Credits					10+10 NC

		Semes	ter IV				
21	MPP401	Plant Virology	Major	3	0	2	4
22	MPP402	Fungal Diseases of Plants	Minor	2	0	2	3
23	MAR402	Intellectual Property and its Management in Agriculture	Common	2	0	0	2
24	MPP100	Master Research	Thesis Research	-	-	-	13 NC
	_	Total Credits					9+11 NC
		Grand total					50+30 NC

- CBCS- Choice Based Credit System
  NC- Non Credit

# **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: [30 Marks]C. End-Term Exam: [40 Marks]

D. 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.

#### Semester I

Course Title: Mycology Course Code: MPP101

L	T	P	Credits
2	0	2	3

#### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner 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 Analyze the different structures produced by fungi and their identification
- 4 Demonstrate 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 (Theory)**

Unit I 8hours

Introduction, definition of different terms, basic concepts. Importance of mycologyin agriculture, relation of fungi to human affairs. History of mycology. Importanceof culture collection and herbarium of fungi. Somatic characters and reproductionin fungi. Modern concept of nomenclature and classification, Classification ofkingdom fungi: Stramenopila and Protists.

Unit II 7hours

in The general characteristics of protists and life cvcle the PhylaPlasmodiophoromycota, Dictyosteliomycota, Acrasiomycota and Myxomycota.Kingdom Stramenopila: characters and life cycles of respective genera under Hypochytriomycota, Oomycota and Labyrinthulomycota.

Unit III 9hours

Kingdom fungi: General characters, ultrastructure and life cycle patterns inrepresentative genera under Chytridiomycota, Zygomycota, Ascomycota; Archiascomycetes, Ascomycetous yeasts, Pyrenomycetes, Plectomycetes, Discomycetes, Loculoascomycetes, Erysiphales and anamorphs of scomycetousfungi.

Unit IV 6hours

Basidiomycota; general characters, mode of reproduction, types of basidiocarps andeconomic importance of Hymenomycetes. Uridinales and Ustilaginales; variability,host specificity and life cycle pattern in rusts and smuts. Mitosporic fungi; statusof asexual fungi, their teliomorphic relationships, Molecular characterization ofplant pathogenic fungi.

# **Course Contents (Practical)**

30 hours

- Detailed comparative study of different groups of fungi;
- Collection of cultures and live specimens;
- Saccardoan classification and classification based on conidiogenesis;
- Vegetative structures and different types of fruiting bodies produced by slime molds, stramenopiles and true fungi;
- Myxomycotina: Fructification, plasmodiocarp, sporangia, plasmodium and aethalia.Oomycota;
- Somatic and reproductory structures of Pythium, Phytophthora, downy mildewsand Albugo, Zygomycetes: Sexual and asexual structures of Mucor, Rhizopus, General characters of VAM fungi. Ascomycetes; fruiting structures, Erysiphales, and Eurotiales;
- General identification characters of Pyrenomycetes, Discomycetes, Loculoascomycetes and Laboulbenio-mycetes, Basidiomycetes; characters, ultrastructures and life cycle patterns in Ustilaginomycetes and Teliomycetes, Deuteromycetes;
- Characters of Hyphomycetes and Coelomycetes and their teliomorphic and anamorphic states, Collection, preservation, culturing and identification of plantparasitic fungi;
- Application of molecular approaches and techniques for identification of fungalpathogens.

### **Transaction Mode**

Lecture, Seminar, Peer Group Discussion, Self-Learning, CollaborativeLearning and Cooperative Learning

- 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, 1<sup>st</sup> edition. New Central Book Agency (NCBA), Kolkata, West Bengal. Pp. 774.

Course Title: Principles of Plant Pathology

**Course Code: MPP103** 

L	T	P	Credits
3	0	0	3

### **Total Hours -45**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- Examine the importance, terminology and concepts of plant diseases. To study the History and growth of plant pathology.
- 2 Catalogue 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 biofertilizers, 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 9hours

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 9hours

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

Unit III 12hours

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

Unit IV 15hours

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, Self-Learning, Collaborative Learning and Cooperative Learning

- **1.** Agrios, G.N. 2005. Plant Pathology. 5<sup>th</sup> 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. 2<sup>nd</sup> 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: Toxicology of Insecticide

**Course Code: MEN301** 

L	T	P	Credits
2	0	2	3

#### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- Recognize the major classes of insecticide and understand their mode of action
- 2 Demonstrate the various processes involved in toxic dynamics of insecticides
- 3 Get awareness regarding the limitations of insecticide use such as resistance and environmental contamination
- 4 Develop a basic understanding on performing insect bioassays
- 5 Get acquaintance with pesticides acts.

### **Course Content**

Unit-I 6 hours

Theory: Definition of toxicology, importance, scope, basic principles of insecticide toxicology and its relationship with other disciplines.

Unit-II 10 hours

Structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, neonicotinoids, oxadiazines, phenylpyrozoles, botanicals and new promising compounds etc. Criteria, methods, problems and solutions of bioassay. Evaluation of insecticide toxicity, joint action of insecticides, synergism, potentiation and antagonism. Factors affecting toxicity of insecticides, selectivity and phytotoxicity.

Unit-III 8 hours

Insecticide metabolism, pest resistance to insecticides, mechanisms and types of resistance, Insecticide resistance management and pest resurgence. Insecticide residues, their significance and environmental implications.

Unit-IV 6hours

Insecticide Act, registration and quality control of insecticides, safe use of insecticides, diagnosis and treatment of insecticide poisoning

# **Course Content (Practical)**

30 hours

• Insecticide formulation and mixtures, quality control of pesticide formulations.

- Working out doses and concentrations of pesticides for laboratory and field evaluation for their bio-efficacy, bioassay techniques, probity analysis, evaluation of insecticide toxicity and joint action.
- Toxicity to beneficial insects.
- Preparation of working standard solutions of pesticides, Sampling, extraction, clean-up
- Estimation of insecticide residues by various methods, calculations and interpretation of data, visit to toxicology laboratories

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

- 1. Chattopadhyay, S.B. 1985. Principles and Pcroedures of Plant Protection. Oxford & IBH, New Delhi.
- 2. Gupta, H.C.L.1999. Insecticides: Toxicology and Uses. Agrotech Publ., Udaipur.
- 3. Ishaaya, I. and Degheele, (Eds.). 1998. Insecticides with Novel Modes of Action. Narosa Publ. House, New Delhi.
- 4. Matsumura, F. 1985. Toxicology of Insecticides. Plenum Press, New York.
- 5. Perry, A.S., Yamamoto, I., Ishaaya, I. and Perry, R. 1998. Insecticides in Agriculture and Environment. Narosa Publ. House, New Delhi.
- 6. Prakash, A. and Rao, J. 1997. Botanical Pesticides in Agriculture. Lewis Publ., New York.

Course Title: Bio-control of insect pests

**Course Code: MEN203** 

L	T	P	Credits
2	0	2	3

### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Comprehend the economic importance of different categories of insects and microbes
- 2 Discover 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 biofertilizer and biofertilizers production

# **Course Content (Theory)**

Unit I 08hours

Principles and scope of biological control. Techniques in biological control. Biology and host seeking 11 inferti of predatory and parasitic groups of insects.

Unit II 07hours

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 09hours

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 06 hours

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

### **Course Content (Practical)**

- 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.

Lecture, Seminar, e-Tutoring, Dialogue, Peer Group Discussion, Self-Learning

- 1. Prasad, T.V. 2019. Handbook of Entomology. New Vishal Publications, New Delhi. 3<sup>rd</sup>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: MAR105** 

L	Т	P	Credits
3	0	2	4

#### **Total Hours-60**

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

- Enumerate statistical principles apply in all the areas of experimental work
- 2 Recognize the requirement at the national level and farm level for agriculture policy making,
- 3 Get familiarize with decision making, agriculture development and estimates agriculture and national income
- Discover 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 Compile knowledge about land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste

#### **Course Content**

Unit I 10hours

Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation; Hypothesis testing.

Unit II 15hours

Concept of p-value. Tests of significance-t, F and chi-square (X<sup>2</sup>); Data transformation and missing plot techniques.

Unit III 15hours

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

Unit IV 5hours

Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.

### **Course Content (Practical)**

30 hours

- 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.

Lecture, Seminar, e-Team Teaching, e-Tutoring

- 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. <u>Snecdecor</u>, G.W. and <u>Cochran</u>, W.G. 1989. Statistical Methods, 8<sup>th</sup> Edition. Wiley-Blackwell. Pp.524.
- 4. Rangaswamy, R. 2016. Textbook of Agricultural Statistics. <u>New Age International (P) Ltd.</u> New Delhi. pp. 531.

Course Title: Lab-Library and Information services

Course Code: MAR106

L	T	P	Credits
0	0	2	1

#### **Total Hours-30**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 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.

### **Transaction Mode**

• Lecture, Seminar, e-Team Teaching, e-Tutoring

# 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. 2<sup>nd</sup> edition. AKB Publication. Jaipur. pp. 250.

Course Title: Master Research

Course Code: MPP23100

L	T	P	Credits
1	-	-	4NC

**Learning Outcomes:** After completion of this course, the learner 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.

#### Semester II

Course Title: Plant Pathogenic Prokaryotes

**Course Code: MPP201** 

L	T	P	Credits
2	0	2	3

#### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner 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, bdelbovibrios 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 Generalize the role of bacteria in agriculture and as biocontrol agents.

#### **Course Content**

Unit I 6hours

Prokaryotic cell: History and development of Plant bacteriology, history of plantbacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and grampositive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccaridestructure; Membrane transport; fimbrae and pili (Type IV pili); Mechanism offlagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (Slayer;capsule); the bacterial chromosomes and plasmids; Operon and otherstructures in cytoplasm; Morphological feature of fastidious bacteria. spiroplasmasand Phytoplasmas.

Unit II

**hours**Growth and nutritional requirements. Infection mechanism, role of virulence factors in expression of symptoms. Survival and dispersal of phytopathogenic prokaryotes. Taxonomy of phytopathogenic prokarya: Taxonomic ranks hierarchy; Identification, Classification and nomenclature of bacteria, phytoplasma and spiroplasma. The codes of Nomenclature and characteristics. Biochemical and molecular characterization of phytopathogenic prokaryotes.

Unit III 8hours

Variability among phytopathogenic prokarya: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteria conjugation; transformation; transduction); and horizontal gene transfer.

Unit IV 7hours

Bacteriophages, L form of bacteria, plasmids and bdellovibrios: Structure; Infectionof host cells; phage multiplication cycle; Classification of phages, Use of phages inplant pathology/ bacteriology, Lysogenic conversion; H Plasmids and their types, plasmid borne phenotypes. Introduction to bacteriocins. Strategies for management of diseases caused by phytopathogenic prokaryotes.

## **Course Content (Practical)**

30 hours

- Study of symptoms produced by phytopathogenic prokaryotes;
- Isolation, enumeration, purification, identification and host inoculation ofphytopathogenic bacteria;
- Stains and staining methods;
- Biochemical and serological characterization;
- Isolation of genomic DNA plasmid;
- Use of antibacterial chemicals/ antibiotics;
- Isolation of fluorescent Pseudomonas:
- Preservation of bacterial cultures;
- Identification of prokaryotic organisms by using 16S rDNA, and other genesequences;
- Diagnosis and management of important diseases caused by bacteria andmollicutes.

### **Transaction Mode**

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

- **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. IA cademic Press, New York. pp. 560.
- **3.** Mondal, K.K. 2011. Plant Bacteriology.Kalyani Publishers, Ludhiana, Punjab. pp. 190.

Course Title: Molecular Approaches in

**Plant Protection** 

**Course Code: MPP202** 

"	c. Pia	nt pa	itnoic	ogy (MPP23)
	т	Т	P	Credits
	נ	-	•	0104165

#### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Comprehend the basic concepts and principles to study host pathogen relationship
- 2 Indicate about the recognition system and signal transduction of pathogens
- Acquire basic knowledge aboutinduction of defense responsespathogenesis 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 Realize the biosafety issues related to GM crops

# Course Content (Theory)

Unit I 12hours

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 6hours

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

Unit III 8hours

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

Unit IV 4hours

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

# **Course Content (Practical)**

30 hours

- 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.

Lecture, Seminar, e-Tutoring, Dialogue, CollaborativeLearning and Cooperative Learning

- 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: Post Harvest Diseases** 

**Course Code: MPP203** 

L	T	P	Credits
2	0	2	3

#### Total Hours-60

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Comprehend 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 Interpret the feasibility of implementing integrated disease management programs (IDMP) in agricultural crops
- 5 Acquire knowledge about management of post harvest diseases

### **Course Content**

Unit I 5hours

Concept of post-harvest diseases, definitions, importance with reference tomanagement and health, principles of plant disease management as pre-arvestand post-harvest, Types of post-harvest problems both by biotic and abiotic factors.

Unit II 9hours

Role of physical environment, agro-ecosystem leading to quiescent infection, operational mechanisms and cultural practices in perpetuation of pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post-harvest diseases, comparative approaches to controlof plant pathogens by resident and introduced antagonists.

Unit III 8hours

Integrated approaches in controlling diseases and improving the shelf life of produceusing nutritional, bio-control agents and other agents, control of aflatoxigenic andmycotoxigenic fungi, application and monitoring for health hazards.

Unit IV 8hours

Study of symptoms, toxicosis of various pathogens, knowledge of CodexAlimentarious for each product and commodity. Physical and biological agents/practices responsible for development/ prevention of post-harvest diseasestraditionaland improved practices.

### **Course Content**

30 hours

- 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.

e-Team Teaching, e-Tutoring, Lecture, Seminar, Peer Group Discussion, CollaborativeLearning and Cooperative Learning

- Narayanasamy, P. 2005. Postharvest Pathogens and Disease Management. John Wiley & Sons, New Jersey, United States. Pp. 672.
- 2. <u>Singh</u>, D., <u>Sharma</u>, R.R., <u>Devappa</u>, V. and <u>Kamil</u>, 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: Plant Quarantine and Regulations

Course Code: MPP204

L	T	P	Credits
2	0	0	2

#### **Total Hours-30**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- Obtain knowledge on the principles and the role of plant quarantine at national and international level.
- Absorb about the quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status.
- 3 Categorize about 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 Formulate Industrial registration; APEDA, import and export of biocontrol agents.

#### **Course Content**

Unit I 15hours

Historical development in plant quarantine, Definitions of pest, and transgenics asper Govt. notification; Organizational set up of plant quarantine in India. Relativeimportance; quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests / diseases and their status.

Unit II 10hours

Acts related to registration of pesticides and transgenics. History of quarantinelegislations, Salient features of PQ Order 2003. Environmental Acts, Industrialregistration; APEDA, Import and Export of bio-control agents.

Unit III 8hours

Identification of pest/ disease free areas; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and other techniquesto detect pest/ pathogen infestations; VHT and other safer techniques of disinfestation/ salvaging of infected material.

Unit IV 12hours

WTO regulations; non-tariff barriers; Pest risk analysis, good laboratory practices for pesticide laboratories; pesticide industry; Sanitary and Phytosanitary measures. Visit to plant quarantine station and PEQ facilities.

#### **Transaction Mode**

e-Team Teaching, e-Tutoring, Lecture, Seminar, Dialogue, Peer Group Discussion

- 1. Kahn, R. 1988. Plant Protection & Quarantine. CRCPress, 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: Fundamentals of Computer

**Applications** 

Course Code: MAR206

M.	M.Sc. Plant pathology (MPP23)					
	L	T	P	Credits		
	0	0	4	2		
,	Total Hours-60					

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 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 Recognize 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 Synthesize and integrate material from primary and secondary sources with their own ideas in research papers.

## **Course Content (Practical)**

60 Hours

- 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).

- **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: Credit Seminar Course Code: MPP23205

L	T	P	Credits
-	-	-	1

**Learning Outcomes:** After completion of this course, the learner will be 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.
- Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
- Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject
- To ask appropriate questions, use evidence to support claims, respond to a range of questions

Course Title: Master Research

**Course Code: MPP100** 

L	T	P	Credits
_	-	-	5NC

**Learning Outcomes:** After completion of this course, the learner 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.

#### Semester III

Course Title: Techniques for Detection and Diagnosis of PlantDiseases

and Diagnosis of FlantDisc

**Course Code: MPP301** 

L	Т	P	Credits
2	0	2	3

#### **Total Hours-45**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 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 10hours

Isolation of pathogens using selective media, pure culture techniques. Methods to prove Koch's postulates with biotroph and necrotroph pathogens.

Unit II 05hours

Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.

Unit III 10hours

Microscopic techniques and staining methods, chromatography, phase contrast and electron microscopy, spectrophotometer, ultracentrifuge and electrophoretic apparatus.

Unit IV 05hours

Serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides and bactericides. Data collection and preparation of reports.

### **Course Content (Practical)**

30 hours

• Detection of plant pathogens 1. Based on visual symptoms, 2. Biochemical test 3. Using microscopic techniques, 4. Cultural studies; (use of selective media to isolatepathogens). 5. Biological assays (indicator hosts, differential hosts) 6. Serologicalassays Pure culture techniques, use of selective media to isolate pathogens.

- Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of manuscripts
- Phenotypic and genotypic tests for identification of plant pathogens;
- Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer regionsequences-prokaryotic organisms; and eukaryotic organism by ITS region) andwhole genome sequencing;

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

- 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: Integrated Plant Disease Management

**Course Code: MPP302** 

L	T	P	Credits
2	0	2	3

### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Study importance of integrated disease management.
- 2 Appreciate 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 6hours

Introduction, definition, concept and tools of disease management.

Unit I 9hours

Components of integrated disease management, their limitations and implications.

Unit I 5hours

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

Unit I 10hours

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

#### **Course Content**

30 hours

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

# **Transaction Mode**

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

- 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: Host Plant Resistance

to insect's pests

Course Code: MEN204

L	Т	P	Credits
1	0	1	2

### **Total Hours-45**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Apart knowledge on the sources of resistant plants to insect pest.
- 2 Learn about various factors affecting plant resistance to insects.
- 3 Apply various techniques of plant resistance to insect pest
- 4 Acquaint with the breeding techniques for insect resistance in crops.
- 5 Acquire knowledge about role of biotechnology.

#### **Course Content**

Unit-I 4hours

History, importance, principles and classification of Host-Plant Resistance, Components and mechanisms of resistance.

Unit-II 4hours

Insect and host plant relationships. Theories and basis of host-plant selection. Chemical ecology. Tritrophic relations. Volatiles and secondary plant substances.

Unit-III 4hours

Basis of resistance. Factors affecting plant resistance including biotypes and measures to combat them. Screening techniques. Breeding for insect resistance in crop plants.

Unit-IV 3hours

Exploitation of wild plant species and gene transfer. Role of biotechnology in plant resistance to insects.

# **Course Content (Practical)**

**Total Hours-30** 

- Screening techniques for measuring resistance.
- Measurement of plant characters and working out their correlations with plant resistance.
- Testing of resistance in important crops.
- Demonstration of antibiosis, tolerance and antixenosis.

### **Transaction Mode**

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

- 1. Dhaliwal, G.S.and Singh, R. (Eds). 2004. Host Plant Resistance to Insects Concepts and Applications. Panima Publ., New Delhi.
- 2. Maxwell, F.G.and Jennings, P.R. (Eds). 1980. Breeding Plants Resistant to Insects. John Wiley & Sons, New York.

M.Sc. Plant pathology (MPP23)
3. Painter, R.H.1951. Insect Resistance in Crop Plants. MacMillan, London.

Course Title: Insect vectors of plant pathogens

**Course Code: MEN404** 

M.Sc.	Plant p	gy (MPP23)	
L	T	P	Credits
1	0	2	2

### **Total Hours-45**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Study of typical features of insect vectors of plant pathogens
- 2 Reframe 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 Associate the transmission of viruses through insects
- 5 Learn about disease control mechanisms of insect vectors

### **Course Content**

Unit I 10hours

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

Unit II 05hours

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 10hours

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

Unit IV 05hours

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

#### **Course Content**

30 hours

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

# **Transaction Mode**

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

- 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- Technical writing and

communication skills Course Code: MAR304

L	Т	P	Credits
0	0	4	2

**Learning Outcomes:** After completion of this course, the learner 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.

### **Transaction Mode**

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

- 1. Day, R.A. and Gastel, B. 2011. How to Write and Publish a Scientific Paper, 7th Edition.GreenwoodPress,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: MPP100** 

L	T	P	Credits
	-	-	10NC

**Learning Outcomes:** After completion of this course, the learner 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.

#### Semester IV

Course Title: Plant Virology Course Code: MPP401

L	T	P	Credits
2	0	2	3

#### **Total Hours-60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1 Acquire basic knowledge of biology, classification nomenclature and survival of phytopathogenic viruses
- 2 Summarize 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 8hours

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 7hours

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

Unit III 9hours

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 6hours

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

### **Course Content (Practical)**

30 hours

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

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

- 1. Walkey, D. 2012. Applied Plant Virology, 2nd edition. Springer, Philippines.pp. 352.
- 2. Kolte,S.J. andTewari, 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. 5thedn.AcdemicPress,New York. pp. 1118.

**Course Title: Intellectual Propertyand** 

its Managementin Agriculture

Course Code: MAR402

Tian	t pat.	10108	y (MPP23)
L	T	P	Credits
2	0	0	2

**Total Hours-30** 

**Learning Outcomes:** After completion of this course, the learner will be able to:

- 1. Equip students and stakeholders with
- 2. Distinguish about Intellectual Property Rights (IPR) related protection systems
- 3. Make use of IPR as a tool for wealth and value creation in a knowledge-based economy.
- 4. Prioritize about Protection of plant varieties and farmers' rights.
- 5. Hypothesize NationalBiodiversity protection initiatives.

#### **Course Content**

Unit-I 8 hours

Historical perspectives and need for the introduction of Intellectual Property Rightregime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property Rights (IPR), benefits of securing IPRs.

Unit-I 8 hours

Indian Legislationsfor the protection of various types of Intellectual Properties; Fundamentals ofpatents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks.

Unit-I 5 hours

Protection of plant varieties and farmers' rightsand biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.

Unit-I 7 hours

NationalBiodiversity protection initiatives; Convention on Biological Diversity; InternationalTreaty on Plant Genetic Resources for Food and Agriculture; Licensing oftechnologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

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

# Suggested readings:

- 1. Erbisch FH and Maredia K.1998. Intellectual Property Rights in AgriculturalBiotechnology. CABI.
- 2. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy.McGraw-Hill.
- 3. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies

Course Title: Master Research

**Course Code: MPP100** 

L	T	P	Credits
-	-	-	13NC

**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.