UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 21st (2/2024) meeting held on 07.06.2024, the Syndicate in its 67th (3/2024) meeting held on 12.07.2024 approved revised curricula of following programs for implementation w.e.f. Fall 2024:

i.	M.Sc (Hons.) in Plant Pathology	(Annex-'**A**')
ii.	Ph.D in Plant Pathology	(Annex-'**B**')

(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/24/772

Dated: 03.10.2024

Distribution:

- Chairman, Department of Plant Pathology
- Controller of Examinations
- Director Academics

C.C:

- Dean, Faculty of Agriculture
- Director, QEC
- Additional Registrar (Affiliation & Registration)
- Secretary to the Vice-Chancellor
- PA to Registrar
- Notification File

Annex-'A' & 'B'

Scheme of Studies of M.Sc. (Hons.) Plant Pathology & PhD in Plant Pathology

Annex-'A'

DEPARTMENT OF PLANT PATHOLOGY

Faculty of Agriculture

M.Sc. (Hons.) Plant Pathology

Semester-I

Category	Course Code	Course Title	Credit Hours
Deficiency-1*	PLPT-63XX	*To be selected from list*	4(3-1)
Compulsory-1	PLPT-71XX	*To be selected from list*	3(2-1)/ 3(3-0)
Compulsory-2	PLPT-71XX	*To be selected from list*	3(2-1)
Elective-1	PLPT-71XX	*To be selected from list*	3(2-1)
Elective-2	PLPT-71XX	*To be selected from list*	3(2-1)

Semester Credit Hours: 12-16

Semester-II

Category	Course Code	Course Title	Credit Hours
Deficiency-2*	PLPT-63XX	*To be selected from list*	3(2-1)
Compulsory-3	PLPT-71XX	*To be selected from list*	3(2-1)/ 3(3-0)
Compulsory-4	STAT-71XX	*To be selected from list*	3(3-0)
Elective-3	PLPT-71XX	*To be selected from list*	3(2-1)

Semester Credit Hours: 09-12

Semester-III

Category	Course Code	Course Title	Credit Hours
Deficiency-3*	PLPT-63XX	*To be selected from list*	3(2-1)
Elective-4	PLPT-71XX	*To be selected from list*	3(2-1)
Elective-5	PLPT-71XX	*To be selected from list*	1(1-0)
Elective-6	PLPT-71XX	*To be selected from list*	1(1-0)

*For intra-disciplinary admitted candidates only **Semester Credit Hours: 5-8**

Semester-IV

Compulsory-5		Thesis	6(0-6)	Completion of course work

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1. **List of Compulsory Courses:**

Sr. No.	Course Code	Course Title	Credit Hours
1.	PLPT-7101	Mycology-I	3(2-1)
2.	PLPT-7104	Fungal Plant Pathology	3(2-1)
3.	PLPT-7115	Plant Pathology and International Agri. Trade	3(2-1)
4.	STAT-7151	Statistical Methods for Agricultural Research-I	3(3-0)

2. **List of Elective Courses:**

Sr. No.	Course Code	Course Title	Credit Hours
1.	PLPT-7102	Mycology-II	3(2-1)
2.	PLPT-7105	Plant Virology	3(2-1)
3.	PLPT-7106	Plant Bacteriology	3(2-1)
4.	PLPT-7107	Plant Nematology	3(2-1)
5.	PLPT-7108	Seed Pathology	3(2-1)
6.	PLPT-7109	Special Problem	1(1-0)
7.	PLPT-7110	Seminar	1(1-0)
8.	PLPT-7112	Vector Transmission of Plant Diseases	3(2-1)
11.	PLPT-7111	Integrated Plant Disease Management	3(2-1)
9.	PLPT-7113	Forest and Shade Tree Pathology	3(2-1)
10.	PLPT-7114	Biological Control of Plant Pathogens	3(2-1)

3. **List of Deficiency Courses:**

Sr. No.	Course Code	Course Title	Credit Hours
1.	PLPT-6303	Introductory Mycology	4(3-1)
2.	PLPT-6304	Introduction to Plant Parasitic Nematodes	3(2-1)
3.	PLPT-6305	Introduction to Plant Prokaryotes	3(2-1)
4.	PLPT-6306	Introduction to Plant Viruses	3(2-1)

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PLPT-7101 **Mycology-I** **3(2-1)**

To study taxonomy and nomenclature of fungi and fungi-like organisms of agricultural importance. The kingdom Protista and its significance and systematic position and distinguishing characters of the genera of Plasmodiophoromycota in nomenclature will provide detail information on fungal systematics. Furthermore, importance and life cycle of plant pathogens from different classifications especially the life cycles of *Plasmodiophora*, *Spongospora,* Peronosporales, Sclerosporales and Pythiales groups are the main focus of this course. The important characters and classification of oomycota will provide comprehensive details of Oomycetes. The biological features of Chytridials and Synchytrium and evolution of orders into new phyla are also the focus of this course. During the practical, collection, preservation and identification of mycological specimens and use of key for identification of fungi is the main concern of the course. Moreover, keys for the identification of different fungi is also included in the course. The students will be able to identify and classify the fungi at the end of the course.

Contents

1. Evolution of classification of Fungi and Fungi-like organisms: the Six Kingdom System
2. Kingdom Protista: Significance, general characteristics and systematic position of Myxomycota, Plasmodiophoromycota, Acrasiomycota and Dictyosteliomycota. Distinguishing characters of the genera of Plasmodiophoromycota
3. Life cycles of *Plasmodiophora* and *Spongospora*
4. Kingdom Straminopila: Importance, morphology, biology, taxonomy and nomenclature of Hyphochytridiomycota, Labyrinthulomycota and Oomycota
5. Important characters and classification of Oomycota up to orders and families level
6. Importance and life cycles of plant pathogens in Peronosporales, Sclerosporales and Pythiales
7. Kingdom Fungi: General characters, importance and classification up to phyla. Chytridiomycota General Characteristics and classification up to orders level
8. Biology of *Synchytrium.* Evolution of orders into new phyla

Practical

1 Collection, preservation, culturing and identification of mycological specimens with special reference to taxa of agricultural importance
2 Use of keys for identification

Recommended Texts

1 Kirk, P.M., Stalpers, J.A., Minter, D.W., & Cannon, P.F. (2011). *Dictionary of fungi* (10th ed.). UK, CABI.
2 Lemke, P.A., & Esser, K. (2001). *The Mycota, Volume VII, Systematics and Evolution, Part A.* Singapore, Springer.

Suggested Readings

1 Kimatu, J.N. (2018). *Advances in Plant Pathology.* Switzerland, Intech Open.
2 Liliane, E.P., & Petrini, O. (2013). *Identifying Moulds: A Practical Guide.* UK, Science Publishers.

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PLPT-7104 **Fungal Plant Pathology** **3(2-1)**

The main emphasis of this course is to study the fungal pathogens, pathogenesis and their management. This course was designed to provide a comprehensive information to students on the history of fungal disease and losses caused by different plant pathogenic fungi. The clear observations on symptoms caused by fungal pathogens will be illustrated. The infection process and disease development is also the main part of this course. Moreover, this course will provide the effects on plant physiological traits by the attack of fungal pathogens. The relationship between pathogens disease cycle and epidemics formation is also included in the course. Furthermore, students will be equipped with the methods of plant disease management by chemical to biological tools. Mechanisms of host defense, changes in plant structures and physiology by pathogen attacks and variations in fungal pathogens is also the focus of this course. The students will gain all information on fungal plant pathology during the course.

Contents

1 History of fungal plant diseases; losses caused by plant pathogenic fungi
2 Survival and dissemination of plant pathogenic fungi
3 Stages in establishment of infection by fungal pathogens
4 Mechanisms of host defense
5 Effects of pathogens on plant physiological functions
6 Symptoms caused by fungal pathogens
7 Relationships between disease cycles and epidemics
8 Mechanisms and stages of variation in fungal pathogens
9 Genetics of virulence in fungal pathogens and resistance in host plants
10 Chemical and non-chemical methods for disease management
11 Study and management of important diseases caused by various groups of fungi and fungi-like organisms

Practical

1 Symptomatology of fungal plant diseases
2 Techniques for isolation, identification, sub-culturing and preservation of fungal plant pathogens; methods for confirmation of pathogenicity of various groups of plant pathogenic fungi
3 *In vitro* evaluation of fungicides and bio-control agents against fungal pathogens
4 Demonstration of chemical and non-chemical methods of plant disease management

Recommended Texts

1. Archana, S., & Indrakant, K.S. (2018). *Molecular aspects of Plant Pathogens*. Singapore, Springer.
2. Narayanasamy, P. (2008). *Molecular Biology in Plant Pathogenesis and Disease Management*. Singapore, Springer.

Suggested Readings

1 Dighton, J., & James, F.W. (2017). *The Fungal Community: Its Organization and Role in the Ecosystem*. UK, CRC Press.
2 Schumann, G., & D'Arcy, C. (2010). *Essential Plant Pathology*. USA, APS Press.

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PLPT-7115 **Plant Pathology and International Agri. Trade** **3(2-1)**

By the completion of this course students will be able to know the historical perspectives of plant quarantine measures, understand the biosecurity mechanism and inspection procedure, know the rules regarding import and export of seed and agricultural commodities, and assess the SPS measures under WTO and biosecurity inspection procedure.

Contents

1. Plant quarantine concepts and principles
2. Plant and seed related issues of domestic and exotic quarantine object
3. Domestic and International quarantine standards; Plant quarantine Act 1976 (Rules, 1967, 2019) and Seed Act, 1976 (Seed Amendment Act-2015) and their implementation in plant and seed import/export
4. Outbreak of some important diseases introduced into Pakistan and elsewhere during import of plant, seed and food items
5. Introduction to SPS measure under WTO regime and its relation to bio-security
6. Inspection procedures and measures adopted under IPC and NAPHIS in Pakistan during import/export of agricultural commodities; Pest risk analysis; Good Agricultural Practices (GAP); Standards, Certification and accreditation for GAP
7. Intellectual Property Organization (IPO) of Pakistan and IPO Act, 2012.

Practical

1. Visit to port of entry (dry, air and seaports)
2. Practical demonstration of inspection of import/export consignments and collection of samples for analysis of various plants and seed/ planting material against various diseases
3. Identification of diseases, inspection procedures and measures adopted under IPC and NAPHIS in Pakistan during import/export consignments
4. Visit to seed testing station of Federal Seed Certification and Registration Department and Department of Plant Protection.

Recommended Texts

1. Anderson, K., C. McRae and D. Wilson. 2012. The Economics of Quarantine and the SPS Agreement. The University of Adelaide Press, Adelaide, Australia.
2. Borkar, S.G. 2022. Plant Quarantine: An Approach to Restrict Invasive Alien Species. New India Publishing Agency, New Delhi, India.

Suggested Readings

1. Devorshak, C. 2012. Plant Pest Risk Analysis, Concepts and Application, CABI International, Wallingford, UK.
2. Gordh, G. and S. McKirdy. 2013. The Handbook of Plant Biosecurity: Principles and Practices for the Identification, Containment and Control of Organisms that threaten Agriculture and Environment Globally. Springer, New York, USA.
3. Ravindra, K. and A. Gupta. 2020. Seed-Borne Diseases of Agricultural Crops: Detection, Diagnosis & Management. Springer, Singapore.

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STAT-7151 Statistical Methods for Agricultural Research-I 3(3-0)

This course designed for MSc (Hons)/MPhil programs of agriculture sciences. This course provides the applied statistics background for survey and experimental work in Agriculture. Case studies and critical examples are used to work through commonly experienced research problems (from sampling designs to the ethical consideration) and to explain how they may be approached, solved or prevented with statistical means. The importance of statistical science in agriculture is obvious, where the collection, analysis and interpretation of numerical data are concerned. Statistical principles apply in all areas of experimental work and they have a very important role in agricultural experiments. Statistics plays an important role in experimentation. While many scientific problems could be solved by different statistical procedures. Furthermore, some statistical softwares knowledge will be provided to the students to improve their analytical skills. These activities are further supports the student's research.

Contents

1. Importance of Statistics in agriculture research
2. Selection of statistical tools based on scale of measurements
3. Analysis of Count and Frequency data
4. Measures of central tendency and dispersion
5. Some concepts of hypothesis testing. T, Z, Chi-square and F tests. Contingency Tables
6. Diversity Indices
7. Concept of ANOVA and its types
8. Correlation Analysis: Simple correlation, multiple correlation, and Partial correlation
9. Regression Analysis: Simple and multiple regression
10. Generalized linear models: logistic regression, Poisson regression, Gamma regression, Inverse Gaussian regression
11. Non-linear regression
12. Dose Response Curves

Recommended Texts

1. Montgomery, D.C. (2017). *Design and analysis of experiments* (9th ed.). New York: John Wiley & Sons.
2. Rao, G.N. (2007). *Statistics for agricultural sciences* (2nd ed.). India, BS Publication.

Suggested Readings

1. Lawal, B. (2014). *Applied statistical methods in agriculture, health and life sciences*. USA: Springer.
2. Sahu, P.K. (2016). *Applied statistics for agriculture, veterinary, fishery, dairy and allied fields*. USA: Springer.
3. Gbur, E.E., Stroup, W.W., McCarter, K. S., Durham, S., Young, L. J., Christman, M., West, M. & Kramer, M. (2012). *Analysis of generalized linear mixed models in the agricultural and natural resources sciences*. USA: Soil Science Society of America.

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PLPT-7102 **Mycology-II** **3(2-1)**

The main aim of this course is to study the taxonomy and nomenclature of fungi of agricultural importance. General characters and various types of asexual reproductive structures of Zygomycota is included. In addition, the role of fungal hormones in sexual reproduction and evolution of Glomeromycota are the main contents of the course. The morphological characters, reproduction and life cycle of Ascomycota with special emphasis on ascosporogenesis and conidiogenesis is also included in the course. Moreover, importance of plant pathogens and classification in Pakistan is also the main concern of this course. Principles and systems of classification of fungi and all the developmental stages of fungi are the concerns of the course. During the practical, collection, preservation and identification of mycological specimens and use of key for identification of fungi is the main concern of the course. Moreover, keys for the identification of different fungi is also included in the course.

Contents

1 Zygomycota: General characters, various types of asexual reproductive structures
2 Zygosporogenesis: role of hormones in sexual reproduction; classification up to order level
3 Classification of Mucorales and Endogonales up to families and characteristics of important genera
4 Evolution of Glomeromycota
5 Ascomycota: Morphology, reproduction, life cycle patterns, sexual compatibility and parasexuality. Types of asci, centra and ascocarps. Ascosporogenesis and conidiogenesis
6 Principles and systems of classification of Ascomycota and mitosporic fungi
7 Classification and life cycle of plant pathogenic species of agricultural importance in Pakistan. Ascolichens, general characters, anatomy and distribution in Pakistan
8 Basidiomycota: Introduction to Basidiomycetes
9 Somatic structure, reproduction, basidiocarp developmental patterns, types of basidia and basidiospores
10 Principles and systems of classification; life cycle and classification of taxa of agricultural importance. Basidiolichens and their taxonomy

Practical

1 Collection, preservation, culturing and identification of mycological specimens with special reference to taxa of agricultural importance
2 Use of keys for identification

Recommended Texts

1 Burchett, S., & Burchett, S. (2018). *Plant Pathology.* UK, CRC Press.
2 Horst, R.K. (2018). *Westcott's Plant Disease Handbook.* Singapore, Springer.

Suggested Readings

1 Liliane, E., Petrini-Klieber, L.E., & Petrini, O. (2013). *Identifying Moulds: A Practical Guide.* UK, Science Publishers.
2 Webster, J., & Weber, R. (2007). *Introduction to Fungi.* UK, Cambridge University Press.
3 Kimatu, J.N. (2018). *Advances in Plant Pathology.* Switzerland, Intech Open.

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PLPT-7105 **Plant Virology** **3(2-1)**

The main aim of this course is to study basic and advanced concepts of plant viruses and the diseases caused by viruses and virus like organisms. This course will provide a detailed knowledge to students about the taxonomy and distribution of plant viruses across the regions and also the effects of viruses on plants. Moreover, virus structures and taxonomy is also the main content of the course. The recent trends in virus transmission and movement in plants is also the concern of this course. The focus of this course is also to discuss physiology of virus infected plants and virus like organisms. The management strategies used for plant viruses will also be studied with special emphasis on economically important plant viruses in Pakistan. Moreover, advanced techniques for the diagnosis and purification of plant viruses will be transferred to students during practical classes. The students will also gain expertise for newly emerging trends viral research.

Contents

1. History and scope of plant virology
2. Taxonomy and nomenclature; effects of viruses on plants
3. Recent trends in virus transmission and movement in plants
4. Structure of plant viruses
5. Virus purification, replication, gene organization
6. Physiology of virus infected plants
7. Virus-vector-host interactions
8. Natural and acquired resistance to virus infection
9. Management of plant viruses
10. Study of economically important viral diseases in Pakistan

Practical

1. Field diagnosis of plant virus diseases
2. Isolation and purification of plant viruses
3. Basic virus characterization
4. Serological techniques
5. Electron microscopy
6. Molecular techniques in virus detection

Recommended Texts

1 Rajarshi, K.G. (2019). *Plant Viruses*. UK, Taylor and Fracis.

2 Foster, G.D., Johansen, I.E., Hong, Y., & Nagy, P.D. (2008). *Plant Virology Protocols – From Viral Sequence to Protein Function* (2nd ed.). USA, Humana Press.

Suggested Readings

1 Sastry, K.S., Bikash, M., & John, H. (2018). *Encyclopedia of plant viruses and viroids*. Singapore, Springer.

2 Hull, R. (2009). *Comparative Plant Virology* (2nd ed.). USA, Academic Press.

3 Hull, R. (2002). *Matthews' Plant Virology* (4th ed.). Netherlands, Elsevier.

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PLPT-7106 **Plant Bacteriology** **3(2-1)**

The main focus of this course is to study basic and applied concepts of plant pathogenic and allied bacteria. The students will gain knowledge of phytobacteriology and allied field of studies such as, pathogenic bacteria and beneficial bacteria. Ecology and spread of bacteria as plant pathogens and plant symptoms is also the focus. The survival mechanisms and communication between bacteria will also be studied during the course. The host defense response and induction of hypersenstive response during the infection of bacterial pathogens will provide genetic level understandings. The students will go through the important bacterial diseases and management approaches. Moreover, beneficial bacteria such as nitrogen fixing, plant growth promoting and effective microorganisms and their functioning is also the part of discussion in this course. During the practical classes, students will learn the basic to advanced techniques to study bacterial isolation and biochemical assays for identification and the symptoms development on plants.

Contents

1. History of phytobacteriology
2. Economic importance and characteristics of plant pathogenic bacteria
3. Taxonomy and nomenclature, morphology, nutrition, growth and reproduction
4. Survival mechanism in bacteria
5. Bacterial pathogenesis and symptomology
6. Hypersensitive reaction and host-specificity
7. Ecology and spread of plant pathogenic bacteria
8. Bacteriophages and bacteriocins
9. Study of important bacterial diseases in Pakistan and their management
10. Nitrogen fixing and nitrifying bacteria
11. Plant growth promoting rhizobacteria (PGPR)
12. Effective microorganisms (EM)

Practical

1 Isolation, purification and identification of plant pathogenic bacteria on the basis of morphological, biochemical and molecular techniques
2 Inoculation techniques and pathogenicity tests
3 Demonstration of plant disease symptoms exhibited by bacteria/fastidious bacteria and mollicutes
4 Sensitivity tests
5 Characterization of bacteria using phages

Recommended Texts

1 Thind, B.S. (2019). *Phytopathogenic Bacteria and Plant Diseases*. UK, Taylor and Francis.
2 Sayyed, R.Z., Reddy, M.S., & Antonius, S. (2019). *Plant Growth Promoting Rhizobacteria (PGPR): Prospects for Sustainable Agriculture*. Singapore, Verlag, Springer.

Suggested Readings

1 Sayyed, R.Z., & Tabassum, B. (2019). *Plant Growth Promoting Rhizobacteria for Sustainable Stress Management* (Vol. 2): *Rhizobacteria in Biotic Stress Management*. Singapore, Verlag, Springer.
2 Jayarman, J., & Verma, J.P.(2002). *Fundamentals of Plant Bacteriology*. India, Kalyani Publishers.
3 Janse, J.D. (2008). *Phytobacteriology: Principles and Practice*. UK, CABI.

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PLPT-7107 **Plant Nematology** 3(2-1)

The main aim of this course is to acquaint students with the basic and applied concepts of plant parasitic nematodes. The importance of agriculturally important plant parasitic nematodes and their responses to environment during survival and infestation will also be discussed. The morphological characters and anatomical features will be demonstrated for clear understandings on nematode diversity and identification. The students will gain knowledge on the concepts and principles of population dynamics and ecology of plant parasitic nematodes. The nematode density and crop yield losses will be correlated. The plant parasitic nematodes and their interactions with the plants, changes in plant integrity and losses. Moreover, nematode microbe interactions in natural ecosystem and advanced phyto nematode research is also the focus. The management approaches for nematodes will also be the part of the course. The students will learn the extraction of nematodes and study their anatomy by staining techniques during the practical sessions.

Contents

1 Importance of plant parasitic nematodes
2 Plant response to nematodes; environmental factors affecting survival and pathogenicity
3 Morphology, anatomy, and reproduction; mode and mechanism of infection
4 Concepts and principles of population dynamics
5 Ecology of soil nematodes
6 Estimation of crop losses
7 Nematode-microbe interactions
8 Molecular techniques for taxonomy
9 Advances in phyto-nematological research with emphasis on nematode density/ plant yield relationships
10 Study of specific nematode diseases of Pakistan
11 Management of plant parasitic nematodes
12 Identification and propagation of entomopathogenic nematodes

Practical

1 Isolation, identification and permanent mounting of important plant parasitic nematodes
2 Pathogenicity tests
3 Collection, handling and diagnosis of diseased plants by symptomatology
4 Integrated management of plant parasitic nematodes

Recommended Texts

1 Sergei, A.S., & John, J.C. (2019). *Plant Parasitic Nematodes in Sustainable Agriculture of North America.* Western USA, Springer.
2 Richard, S., Danny, C., Johannes, H., & Patricia, T. (2018). *Plant Parasitic Nematodes in subtropical and tropical agriculture.* UK, CABI.

Suggested Readings

1 Burdon, J.J., & Laine, A.L. (2019). *Evolutionary Dynamics of Plant-Pathogen Interactions.* UK, Cambridge University Press.
2 Janse, J.D. (2008). *Phytobacteriology: Principles and Practice.* UK, CABI.
3 Luc, M., Sikora, R.A., & Bridge, J. (2005). *Plant Parasitic Nematodes in Subtropical and Tropical Agriculture* (2nd ed.). UK, CABI.

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PLPT-7108 **Seed Pathology** **3(2-1)**

The main focus of this course is to study the effects of plant pathogens on seed health and their management. The students will acquire the knowledge of important see borne fungal and other pathogens. Moreover, histopathological features of healthy and infected seeds will be taught. Mechanisms of seed infection and disease transmission and factors effecting the establishment of pathogens in seed will also be discussed. The important seed borne disease and forecasting of such diseases will be emphasized. Moreover, seed quality control system for pathogen free seed and seed health testing for import and export purposes will also be focused in this course. The students will also learn the seed testing techniques and seed healthy parameters during the practical sessions. Preparation of working sample for seed health testing and visits to seed testing laboratories will also be conducted in this course. This is a special course related to seed pathology to provide best information to students.

Contents

1 Introduction to seed pathology
2 Importance of seed-borne fungal, bacterial, viral and nematode diseases
3 Histopathology of healthy and infected seeds/planting materials
4 Mechanism of seed infection and disease transmission
5 Factors affecting establishment of pathogens in seed
6 Seed abnormalities and losses
7 Seed quality control system for disease free seed production, processing and certification with special reference to Pakistan
8 Seed crops and seed standards
9 Seed treatment and equipment, Seed processing and storage;
10 Seed health testing of consignment during export/import and testing of germplasm material
11 Seed borne pathogens and their health hazards
12 Description of important seed-borne diseases, forecasting of seed-borne diseases
13 Accreditation of seed health testing/seed pathology labs
14 Seed borne diseases and bioterrorism
15 Seed-borne pathogens: identification, preservation, incidence and mode of seed transmission
16 Effect of different chemicals and antagonistic microorganisms on seed-borne pathogens and seed germination

Practical

1 Field crop inspection for disease assessment; seed sampling according to International Seed Testing Association (ISTA) methods
2 Preparation of working sample for seed health testing and visits to seed testing laboratories and seed processing plants
3 Maintenance of culture collection of identified seed-borne pathogens

Recommended Texts

1 Burchett, S., & Burchett, S. (2018). *Plant Pathology*. UK, CRC Press.
2 Frantzen, J. (2007). *Epidemiology and Plant Ecology: Principles and Applications*. USA, World Scientific Publishing Company.

Suggested Readings

1 Kimatu, J.N. (2018). *Advances in Plant Pathology*. Switzerland, Intech Open.
2 Cooke, B.M. (2004). *The Epidemiology of Plant Diseases*. Singapore, Verlag, Springer.
3 Bhutta, A.R. (2010). *Textbook of Introductory Seed Pathology*. Islamabad, Pakistan, HEC.

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PLPT-7109 **Special Problem** **1(1-0)**

The special problem is intended to instruct students on proper techniques for scientific research and methodologies. The students are expected to prepare directed assignment and collect information and material related to current research interest. Special problem means an assignment that is expected to be temporary and is designated as a special assignment by the academic supervisor in its sole discretion. The main purpose of special problem is to increase the learning capabilities of students. The more we use our brains, the more they develop. Students learn a lot more when they read or practice something by themselves. Similarly, the purpose of assignments is to increase the practical skills of students. The main objectives of special problem assigned to students are: to enhance the knowledge of a subject, helps to develop writing skills and to enhance time management and organizing skills. It enhances your planning and organizing skills: The special problem make you do your work by prioritizing the needs and time frames. It helps you in completing all your tasks very peacefully instead of creating any panic. Scopes for improvement: Special problem writing work gives students a lot of scopes to improve themselves.

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PLPT-7110 **Seminar** **1(1-0)**

The seminar is intended to instruct students on proper techniques for presentation of scientific material. Each student is expected to prepare and present a scientific seminar and to submit written documentation supporting that seminar. A seminar is a form of academic instruction, either at an academic institution or offered by a commercial or professional organization. It has the function of bringing together small groups for recurring meetings, focusing each time on some particular subject, in which everyone present is requested to participate. Seminars provide a chance to interact with experts from the specific field. Discussing about the relevant topics of the particular subject, students tend to learn about the latest information and new skills related to the concerned subject. Seminars are important and beneficial for those who have difficulty learning in a typical classroom setting where reading and writing are required. There is often a sense of friendship associated with seminar attendance, because everyone is attending with a like interest in learning about a subject important to them. Attending a seminar has numerous benefits, including improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence.

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PLPT-7112 **Vector Transmission of Plant Diseases** **3(2-1)**

The main aim of this course is to study the role of insects in plant disease transmission. The vectors for virus transmission such as nematodes, insects, fungal like organisms and mode of transmission is the focus of the course. The students will acquire the knowledge of mode of transmission of and dissemination of plant pathogens by vectors. Moreover, ecology and vector-plant interactions and factors affecting the vector transmission will be focused. Furthermore, students will work in collaboration with other departments to explore the insect vectors that are responsible to cause plant diseases. The course will also focus on management of plant disease transmitted by vectors. Moreover, methods of rearing and handling of insect vectors for further experiments will also the focused. The demonstration of mode of transmission of plant pathogens by vectors will also be studied. The students will unravel the mechanisms of pathogen acquisition by vectors and find potential ways to manage such vectors.

Contents

1 Insects, nematodes and fungus-like organisms as vectors of plant diseases
2 Modes of transmission and dissemination of plant pathogens by vectors
3 Ecology and vector-plant relationship
4 Factors affecting vector transmission
5 Symptomatology, etiology, epidemiology and management of major fungal, bacterial and viral plant diseases transmitted by vectors.
6 Identification of nematodes and fungus-like organisms as vectors of plant pathogens

Practical

1 Methods of rearing and handling insect vectors for plant pathogenic studies
2 Demonstration of modes of transmission of plant pathogens by vectors

Recommended Texts

1 Paul, B., & Johan, A. (2019). *Plant Diseases and Biosecurity*. UK, Oxford University Press.
2 Leach, J.G. (2007). *Insect Transmission of Plant Diseases*. India, Daya Publishing House.

Suggested Readings

1 Kumar, R.V. (2019). *Gemini viruses: Impact, Challenges and Approaches*. Singapore, Springer.
2 Vaishali, J.P., & Satte, T.V. (2003). *Insect Predator and Pest Management*. India, Daya Publishing House.
3 Vanemden, H.F., & Service, M. (2004). *Pest and Vector Control*. UK, Cambridge University Press.

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PLPT-7111 **Integrated Plant Disease Management** **3(2-1)**

The main focus of this course is to acquaint the students with integrated plant disease management practices. In this course, students will acquire the information on concepts and principles of integrated disease management and application. In this contest, biological and environmental monitoring for sustainable disease management will be targeted. Moreover, role of advanced techniques of biotechnology, remote sensing and information technology will be gathered for the students. The cultural practices and evaluation of biocontrol agents will also be focused during the studies. Plant disease management strategies and application is the focus and biological and environmental monitoring for disease control is also the part of discussion of the course. The bio-safety regulations for the application of biological control agents will also be emphasized. The development of IPDM model will be priority for the students during the course. The students will be able to transfer the integrated technologies to the end users for sustainable agriculture.

Contents

1 Introduction, history, concepts, prospects, principles, components and challenges in Integrated Plant Disease Management (IPDM)
2 Different plant disease management strategies, their integration and application
3 Biological and environmental monitoring for sustainable disease management
4 Role of biotechnology, remote sensing and information technology in IPDM
5 Disinfection and pesticides application
6 Resistance problems
7 Production and evaluation of bio-control agents
8 Biosafety regulations regarding release of biocontrol agents
9 Role of community in IPDM
10 Technology transfer in IPDM.

Practical

1 Integration of different methods for plant disease control
2 Development of IPDM model

Recommended Texts

1 Oliver, R., Park, R.F., & Rojas, E.C. (2018). *Integrated Disease Management of Wheat and Barley*. USA, Burleigh Dodds Science Publishing Limited.
2 Balaji, A. (2018). *Handbook of Plant Disease Identification and Management*. UK, Taylor and Francis.

Suggested Readings

1 Kannan, V.R., & Batas, K.K. (2019). *Sustainable Approaches to Controlling Plant Pathogenic Bacteria*. UK, Taylor and Francis.
2 Arya, A.O., & Perello, A.E. (2010). *Management of Fungal Plant Pathogens*. UK, CABI.
3 Razdan, V.K., & Sabitha, M. (2009). *Integrated Disease Management: Concepts and Practices*. Singapore, Springer.

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PLPT-7113 **Forest and Shade Tree Pathology** **3(2-1)**

The main focus of this course is to study the forest and shade tree diseases and their management. The forest ranges in Pakistan and departmental setups of forests will be elaborated to students. The students will learn the importance and introduction to forest diseases and the ecology and epidemiology are the main aim of the course. The spread of forest diseases due to biotic and abiotic factors will be studied. The disease relation with epidemiological factors will be forecasted for timely management. The healthy and disease free nursery plants development will be emphasized and management of the diseases by different approaches will be demonstrated during the course. Moreover, disease management systems based on cultural and chemical practices will be the focus. During the practical course, students will learn about the identification of different diseases by visiting different national institutes working in forest and shade tree pathology will be emphasized.

Contents

1. Importance of forest and shade tree diseases
2. Introduction to forest and shade tree diseases and their ecology, epidemiology and quantification of losses
3. Forest operations in relation to development and spread of abiotic and biotic diseases
4. Studies on specific diseases of representative groups
5. Nursery plants and shade trees
6. Management of important diseases

Practical

1. Survey and collection of diseased specimens
2. Study visits to national institutions working in forest and shade tree pathology
3. Identification and preservation of causal agents
4. Disease management based on cultural and chemical methods

Recommended Texts

1. Agrios, G.N. (2005). *Plant Pathology* (5th ed.). Netherlands. Elsevier Academic Press.
2. Bhutta, A.R. (2010). *Introductory Seed Pathology*. Islamabad, Pakistan, Publisher HEC.

Suggested Readings

1. Khan, A.H. (1898). *Pathology of Trees* (2nd Vol.). Faisalabad, Pakistan, University of Agriculture.
2. Manson, P.D. (1991). *Tree Disease, Concepts* (2nd ed.). USA, Prentice Hall Eaglewood Cliff.
3. Strouts, R.G., & Winter, T.G. (1994). *Diagnosis of Ill-health in Trees*. London, UK, H.M.S.O Publishers.

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PLPT-7114 **Biological Control of Plant Pathogens** 3(2-1)

The main aim of this course is to manage Plant pathogens through biological approaches. The importance and application of biocontrol agents for commercial purposes is the main focus. The students will gain the information on types of interactions of biological control agents and factors involved in the development and application of bio-control agents. The mechanisms of antagonism by bio-control agents will also be focused and different approaches for the successful application of such agents will be also delivered. The mass production and marketing of these microbes will be discussed and keep in practical sessions. The students will learn all means of biological control of plant pathogens in which, cultural control, allelopathic chemicals, composts and compost extracts, host defense induction and biofumigation. Furthermore, nutrients management for plant growth will also provide additional information to manage soil fertility for disease control. Moreover, discovery of indigenous biocontrol agents and mass production and commercialization is also the focus of this course.

Contents

1. History and importance of biological control
2. Biological control and types of biological interaction
3. Factors involved in biological control
4. Different biocontrol approaches like antagonistic microorganisms, allelopathy, plant and pathogen-derived resistance
5. Methods for stimulation of indigenous biocontrol agents
6. Mass production and commercialization of biocontrol agents
7. Study of different biological agents, mechanism of biocontrol at macro and molecular level

Practical

1. Isolation, identification, purification and application of biocontrol agents under laboratory and field conditions
2. Preparation of plant products and their evaluation against various plant pathogens
3. Demonstration of mechanisms of biocontrol

Recommended Texts

1 Butt, T.M., Jackson, C., & Magan, N. (2001). *Fungi as Biocontrol Agents: Progress, Problems and Potential*. UK, CABI.

2 Ravindra, K., & Anuja, G. (2019). *Seed Borne Diseases of Agricultural Crops: Detection, Diagnosis & Management*. Singapore, Springer.

Suggested Readings

1 Horst, R.K. (2018). *Westcott's Plant Disease Handbook*. Singapore, Springer.

2 Copping, L.G. (2009). *The Manual of Biocontrol Agents: A World Compendium*. UK, CABI.

3 Gnanamanickam, S.S. (2002). *Biological Control of Crop Diseases*. New York, USA, Marcel Dekker.

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PLPT-6303 **Introductory Mycology** **4(3-1)**

About 80,000 to 120,000 species of fungi have been described to date, although the total number of species is estimated at around 1.5 million. This would render fungi one of the least-explored biodiversity resources of our planet. It is notoriously difficult to delimit fungi as a group against other eukaryotes, and debates over the inclusion or exclusion of certain groups have been going on for well over a century. In recent years, the main arguments have been between taxonomists striving towards a phylogenetic definition based especially on the similarity of relevant DNA sequences, and others who take a biological approach to the subject and regard fungi as organisms sharing all or many key ecological or physiological characteristics "the union of fungi". The objective of this course is to study the basic and applied aspects of fungi and fungi like organisms. The course will cover in detail morphology and classification of fungi and fungi-like organisms belonging to Plasmodiophoromycota, Oomycota, Chytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota and Mitosporic fungi. The course will also cover history and importance of fungi and fungi-like organisms.

Contents

1. History and significance of fungi
2. Methods of reproduction
3. Anamorph, teleomorph and holomorph
4. Evolution of classification of fungi and fungi-like organisms
5. Ecology, genetics and dissemination of fungi
6. Interaction of fungi with hosts/vectors
7. General characters
8. Economic importance of various phyla
9. Study of morphology and classification of economically important fungi and fungi-like organisms belonging to Plasmodiophoromycota, Oomycota, Chytridiomycota, Zygomycota, Glomeromycota, Ascomycota, Basidiomycota and Mitosporic fungi
10. Study of life histories of fungi of agricultural, scientific and industrial importance

Practical

1. Collection, isolation, mounting, identification and preservation of fungi from various sources

2. Use of diagnostic keys for identification of important fungi

3. Comparative study of representatives of various phyla

Recommended Texts

1. Verekar, S.A., & Deshmukh, S.K. (2017). *Keratinophilic fungi distribution, pathogenicity and biotechnological potentials.* In *Developments in fungal biology and applied mycology.* Singapore, Springer.
2. Johri, R.M. (2005). *A Textbook of Fungi. Dominant Publishers and Distributors.* India, Dominant Publisher.

Suggested Readings

1. Deshmukh, S. K., Misra, J.K., Tewari, J.P., & Papp, T. (2016). *Fungi: Applications and Management Strategies.* UK, CRC Press.
2. Noble, R.T. (2014). *Identifying Moulds: A Practical Guide.* Journal of North Carolina, Carolina, Academy of Science.

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PLPT-6304 **Introduction to Plant Parasitic Nematodes** **3(2-1)**

Nematodes are an important group of plant parasitic organisms, causing crop losses directly by their parasitic activities on the plants they infect and also indirectly by acting as vectors for plant viruses. There are 17 orders of nematodes but only two contain plant pathogens, the Tylenchida and the Dorylaimida with virus vectors found only in the latter. As an example, *Ditylenchus dipsaci* attacks over 450 different plant species, including many weeds and is one of the most devastating nematode specie. Important economic hosts include onion, leek, pea, oats and maize as well as ornamentals such as Narcissus and tulip. When soil is heavily infested losses may be total. The objective of this course is to acquaint the students with basic and applied aspects of plant parasitic nematodes. The course will cover taxonomy of plant parasitic nematodes according to feeding habits, fungivores, omnivores, predators and parasites including cellular changes brought during feeding. The course will also cover study of important nematode diseases, symptoms, etiology and their management.

Theory

1. Introduction to phylum nematoda and related phyla
2. Abundance and importance of plant parasitic nematodes
3. Nematode morphology and anatomy including study of their various systems viz. digestive, reproductive and nervous
4. Taxonomy of plant parasitic nematodes according to feeding habits, fungivores, omnivores, predators and parasites including cellular changes brought during feeding
5. Study of important nematode diseases, symptoms, etiology and their management

Practical

1. Sampling, extraction, staining and identification of nematodes from soil and infested plant materials
2. Preparation of temporary and permanent slides to study morphological features of nematodes
3. Staining of nematodes and their egg masses in roots
4. Demonstration of nematode inflicted foliage and root symptoms

Recommended Texts

1. Sergei, A.S., & John, J.C.(2019). *Plant Parasitic Nematodes in Sustainable Agriculture of North America*. USA, Springer.
2. Agrios, G. N. (2005). *Plant Pathology* (5th ed.). Burlington, MA. USA, Elsevier Academic Press.

Suggested Readings

1. Richard, S., Danny, C ., Johannes, H., &Patricia, T. (2018). *Plant Parasitic Nematodes in subtropical and tropical agriculture*. UK, CABI.
2. Luc, M., Sikora, R., & Bridge, J. (2005). *Plant Parasitic Nematodes in Tropical and Subtropical Agriculture*. UK, CABI.
3. Ownley, B.H., & Trigiano, R.N. (2016). *Plant Pathology concepts and laboratory exercises*. UK, CRC press.
4. Perry, R.N., & Moens, M. (2006). *Plant Nematology*. UK, CABI.

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PLPT-6305 **Introduction to Plant Prokaryotes** **3(2-1)**

Bacteria causing plant disease were originally classified in five genera – the Gram-positive Corynebacterium and the Gram-negative Agrobacterium, Erwinia, Pseudomonas and Xanthomonas – but to these must be added the Actinomycetes. In the last two decades the classification has begun to be extensively revised. For example, the plant pathogenic coryneform bacteria are generally classified in the genera Curtobacterium, Arthrobacter, Rhodococcus and Clavibacter although some authors still retain the old nomenclature. Species of Corynebacterium, Curtobacterium, Arthrobacter, Rhodococcus and Clavibacter cause diseases on a number of crop plants. For example, potatoes are infected by *Clavibacter michiganensis* subsp. *sepedonicus*. Symptoms consist of wilting of leaves which become pale green to yellow and develop necrotic areas but these are easily confused with other wilts and foliage diseases, and natural senescence. The objective of this course is to introduce basic and applied concepts of plant associated bacteria and mollicutes. The course will cover morphology, reproduction, physiology and cultural characteristics of bacteria and mollicutes. The course will also cover different bacterial diseases history, symptoms, etiology, epidemiology and their management. General characteristics of bacteria and mollicutes will also be discussed in detail in this course.

Theory

1. Introduction, economic importance, general characteristics
2. Morphology, reproduction and physiology; cultural characteristics
3. Mode of infection and transmission of bacteria and mollicutes and their management
4. Study of specific prokaryotic plant diseases in Pakistan

Practical

1. Isolation, purification, identification and preservation of plant pathogenic prokaryotes
2. Hypersensitive reactions and pathogenicity tests
3. Inoculum preparation and testing with known concentration

Recommended Texts

1. Thind, B.S. (2019). *Phytopathogenic Bacteria and Plant Diseases*. UK, Taylor and Francis.
2. Agrios, G. N. (2005). *Plant Pathology* (5th ed.). Burlington, MA. USA, Elsevier Academic Press.

Suggested Readings

1. Kannanm, V.R., & Batas, K.K. (2019). *Sustainable Approaches to Controlling Plant Pathogenic Bacteria*. UK, Taylor and Francis.
2. Jackson, R.W. (2009). *Plant Pathogenic Bacteria: Genomics and Molecular Biology*. UK, Caister Academic Press.
3. Janse, J.D. (2008). *Phytobacteriology: Principles and Practice*. UK, CABI.
4. Mukesh, S. (2006). *Introductory Phytobacteriology*. India, Eastern Book Corporation.

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PLPT-6306 **Introduction to Plant Viruses** **3(2-1)**

There are over 700 known plant viruses, many of which cause catastrophic diseases and have wide host ranges. They have been classified into three families and 32 groups. These are based on morphology, the type of nucleic acid they contain (RNA or DNA), whether the nucleic acid is single- or double-stranded, whether it exists as a single unit or is divided, and the means of transmission. For example, furoviruses are fungal-transmitted, rod-shaped, single-stranded RNA viruses with divided, typically bipartite genomes. Increasingly, serological and nucleic acid techniques are being used to establish the identity or relatedness of plant viruses. The objective of this course is to introduce students to the basic and applied concepts of plant viruses. The course will cover morphology, reproduction, physiology, composition, structure and classification of viruses. The course will also cover different virus diseases history, symptoms, etiology, epidemiology and their management. General characteristics of viruses will also be discussed in detail in this course.

Theory

1. Introduction, history and importance, morphology, composition and structure
2. Classification of plant viruses, their replication, transmission and movement
3. Symptomatology
4. Serology and serological methods
5. Ecology and epidemiology
6. Management
7. Study of specific virus diseases in Pakistan

Practical

1. Field visits and study of virus infected plants
2. Methods of virus transmission (mechanical inoculation, grafting, insect vectors)
3. Virus detection through biological (indicator hosts and host range) and serological methods (ELISA, Immunodiffusion) and molecular methods (polymerase chain reaction)

Recommended Texts

1. Saxena, S., & Tiwari, A.K. (2018) *Begomoviruses: Occurrence and Management in Asia and Africa.* Singapore, Springer, Verlag.
2. Ahlawat, Y.S. (2010). *Diagnosis of Plant Viruses and Allied Pathogens*. India, Stadium Press.

Suggested Readings

1. Rajarshi, K.G. (2019). *Plant Viruses*. UK, Taylor and Fracis.
2. Bashir, M., & Hassan, S. (1998). *Diagnostic Methods for Plant Viruses*. Islamabad, Pakistan, Pakistan Agricultural Research Council.
3. Hull, R. (2009). *Comparative Plant Virology* (2nd ed.). New York, Academic Press.
4. Loebenstein, G., & Thottappilly, G. (2004). *Virus and Virus-like Diseases of Major Crops in Developing Countries*. Singapore, Springer Press.

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