P.G. DEPARTMENT OF AGRICULTURE

SYLLABUS FOR THE BATCH FROM THE YEAR

2024 TO YEAR 2026

Programme Code: MPPL- 2019

Programme Name: M.Sc. Ag. (Plant Pathology)

(Semester I-IV)

Examinations: 2024-26

Khalsa College, Amritsar

Programme Outcomes (POs):

1. Students will impart detailed knowledge of Plant Pathology and specific knowledge of its allied branches.

2. Students will learn about different Plant Pathogens, their classification and nomenclature.

3. Students will impart knowledge about basic concepts, principal and terminology of plant pathology.

4. Students will get detailed information regarding management of plant pathogens.

5. Students will have working knowledge of statistical methods and will be able to design basic statistical analyses and evaluate basic statistical information.

Programme Specific Outcomes (PSOs):

1. To impart knowledge to the students on basic concepts, terminology of plant pathology, quarantine restriction in movements of agricultural products

2. To impart knowledge on classification and identification of plant pathogens, history ,importance, rule and regulation of quarantine.

3. To impart knowledge to the students about application of biological, cultural, chemical and biocontrol agents and to study about compatibility and integration in IDM

4. To impart knowledge to the students on collection, identification and preservation of specimens of plant pathogenic fungi,bacteria nematodes etc

5. To impart knowledge to the students on history, importance and principles of plant pathology and understanding of insect pest management strategies and will also learn about new advancements in pest management in fields and in warehouses

6. To impart knowledge to the students about measuring diseases, spore dispersal and trapping of different plant diseases and to study about weather recording, survey, multiplication of inoculums of diseased samples and their reporting.

7. To impart knowledge to the students on principles, growth, reproduction, survival and dispersal of important plant pathogens their symptomatology

8. To impart knowledge to the students on different serological and molecular techniques for plant disease detection and seed certification

9. To impart knowledge to the students about acquaintance with formulation of different fungicides and plant protection appliances, formulation of fungicides, bactericides and nematicides used in different *in vitro* techniques

10. To impart knowledge to the students on basic concepts and terminology of plant viral pathogens, nematodes and their symptomatology and different methods for testing vegetative propagules.

11. To impart knowledge to the students about different staining methods, biochemical and serological characterization of bacteria , plant DNA extraction and their purification, Agarose gel electrophoresis, Homogenization of leaves and subcellular fractionation by centrifugation

12. Students will have working knowledge of statistical methods and will be able to design basic statistical analyses , evaluate basic statistical information..

13provides information to the student about how to collect material related to their research,data analysis, how to write thesis, use scientific language in thesis, and how to publish the research paper in different journals

M. Sc. Ag. (PLANT PATHOLOGY) 2024-26

SEMESTER-I

Course Code	Course title	Credit hours	Marks	Total Marks	Page Number
			Theory+Practical+ I. Assesment		
PPL-511	Mycology	3(2+1)	50+25+25	100	8-9
PPL-512	Principles of Plant Pathology	3(2+1)	50+25+25	100	10-11
ENT-532 (Minor)	Biological control of Insect Pest and weeds	3(2+1)	50+25+25	100	12-13
STAT-511	Statistical Methods for Applied/Social Sciences	4(3+1)	57+18+25	100	14-15
*PGS-511	Technical writing & communication skills	1(0+1)	100(Pr)	100	16-17
*PGS- 512	Library & Information Service	1(0+1)	100(Pr)	100	18
*PPL-599	Masters' Research	5(0+5)	---	S/US	19
Total		20(13+7*)			

*Non- Credit Course

Total Internal Assessment = 25 Marks (House Test- 10 Marks Attendance- 10 Marks; Conduct & Academic, Extra Curricular activities- 5 Marks).

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SEMESTER-II

Course Code	Course title	Credit hours	Marks	Total Marks	Page Number
			Theory+Practical+ I. Assesment		
PPL-521	Plant Virology	3(2+1)	50+25+25	100	20-21
PPL-522	Plant Pathogenic Prokaryotes	3(2+1)	50+25+25	100	22-23
ENT-522 (Minor)	Toxicology of Insecticides	3(2+1)	50+25+25	100	24-25
PPL-523 (Supporting)	Molecular Approaches for Plant Protection	3(2+1)	50+25+25	100	26-27
*PGS-521	Agricultural Research, Research Ethics and Rural Development Programmes	1(1+0)	100(Th)	100	28-29
*PPL-599	Masters' Research	5(0+5)	---	S/US	30
Total		18(12+6*)			

`*Non- Credit Course

Total Internal Assessment = 25 Marks (House Test- 10 Marks Attendance- 10 Marks; Conduct & Academic, Extra Curricular activities- 5 Marks).

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SEMESTER-III

Course Code	Course title	Credit hours	Marks	Total Marks	Page Number
			Theory+Practical+ I. Assesment		
PPL-531	Plant Nematology	3(2+1)	50+25+25	100	31-32
PPL-532	Techniques in Detection and Diagnosis of Plant Diseases	2(0+2)	0+75+25	100	33-34
PPL- 533	Disease resistance in Plants	2(2+0)	75+0+25	100	35-36
ENT-533 (Minor)	Concept of Integrated Pest Management	2(2+0)	75+0+25	100	37-38
PPL-591	Credit Seminar	1(0+1)	100	100	39
*PGS-531	Intellectual Property & its management in Agriculture	1(1+0)	100(Th)	100	40-41
*PPL-599	Masters'Research	10(0+10)	--	S/US	42
Total		21(10+11*)			

*Non- Credit Course

Total Internal Assessment = 25 Marks (House Test- 10 Marks Attendance- 10 Marks; Conduct & Academic, Extra Curricular activities- 5 Marks).

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SEMESTER-IV

Course Code	Course title	Credit hours	Marks	Total Marks	Page Number
			Theory+Practical+I. Assesment		
PPL-541	Diseases of Field and Medicinal Crops	3(2+1)	50+25+25	100	43-44
*PGS-541	Basic Concepts in Laboratory Techniques	1(0+1)	100(Pr)	100	45
*PPL- 599	*Master's Research	10(0+10)	--	S/US	46
	Total	14(3+11*)			

*Non- Credit Course

Total Internal Assessment = 25% (House Test- 10 Marks Attendance- 10 Marks; Conduct & Academic, Extra Curricular activities- 5 Marks).

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SEMESTER-I

PPL-511 **Mycology (Major)**

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objectives

The course aims to:

1.To impart knowledge to the students on basic concepts and terminology of plant pathology.

2. To impart knowledge on classification and identification of plant pathogens based on their classification

Theory:

Unit I

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

Unit II

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

Unit III

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

Unit IV

Basidiomycota; general characters, mode of reproduction, types of basidiocarps and economic importance of Hymenomycetes. Uridinales and Ustilaginales; variability, host

specificity and life cycle pattern in rusts and smuts. Mitosporic fungi; status of asexual fungi, their teliomorphic relationships, Molecular characterization of plant pathogenic fungi

Practical

- 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 mildews and 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 plant parasitic fungi
- Application of molecular approaches and techniques for identification of fungal pathogens

Suggested Reading

Ainsworth GC, Sparrow FK and Susman HS. 1973. The Fungi – An Advanced Treatise. Vol. IV
(A & B). Academic Press, New York.
Alexopoulos CJ, Mims CW and Blackwell M.2000. Introductory Mycology. 5th Ed. John Wiley
& Sons, New York.
Maheshwari R. 2016. Fungi: Experimental Methods in Biology 2nd edn. CRC Press, US.
Mehrotra RS and Arneja KR. 1990. An Introductory Mycology. Wiley Eastern, New Delhi.
Sarbhoy AK. 2000. Text book of Mycology. ICAR, New Delhi.
Singh RS. 1982. Plant Pathogens – The Fungi. Oxford & IBH, New Delhi.
Webster J. 1980. Introduction to Fungi. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

Course Outcomes:

The student will be able:

1.Thorough knowledge of plant pathogen nomenclature and classification
2.Developing skill to identify different groups of fungi
3.Knowledge on collection, identification and preservation of specimens of plant pathogenic fungi

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SEMESTER-I

PPL-512 Principles of Plant Pathology (Major)

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objectives

The course aims to:

1. To impart knowledge to the students on history and importance of plant pathology
2. To impart knowledge on various principles involved in the plant diseases

Theory

Unit I

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases.

Unit II

Growth, reproduction, survival and dispersal of important plant pathogens, role ofenvironment and host nutrition on disease development.

Unit III

Host parasite interaction, recognition concept and infection, symptomatology, diseasedevelopment- role of enzymes, toxins, growth regulators; defense strategies-oxidativeburst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism asaffected by plant pathogens.

Unit IV

Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens;molecular basis for resistance; marker-assisted selection; genetic engineering fordisease resistance.

Practical

• Basic plant pathological techniques;

• Isolation, inoculation and purification of plant pathogens and proving Koch'spostulates;
• Techniques to study variability in different plant pathogens;
• Purification of enzymes, toxins and their bioassay;
• Estimation of growth regulators, phenols, phytoalexins in resistant and susceptibleplants.

Suggested Reading

Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
Heitefuss R and Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin,
New York.
Mehrotra RS and Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.
Singh RP. 2012. Plant Pathology 2nd edn. Kalyani Publishers, New Delhi.
Singh RS. 2017. Introduction to Principles of Plant Pathology. 5th edn. MedTech, New Delhi.
Singh DP and Singh A. 2007. Disease and Insect Resistance in Plants. Oxford & IBH, New
Delhi.
Upadhyay RK. and Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving
Biotechnology. Oxford & IBH, New Delhi.

Course Outcomes:

The student will be able:

1. Thorough knowledge on principles, growth, reproduction, survival and dispersal of important plant pathogens and their symptomatology
2. Study of Biotic and abiotic causes of plant diseases and its management
3. Knowledge on different serological and molecular techniques for plant disease detection

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SEMESTER-I

ENT- 531 Biological control of Insect Pest and Weeds (Minor)

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks(10).

Course Objectives

The course aims to:

- To study the concept, history and scope, ecological basis of biological control, natural enemies: predators, parasitoids and insect pathogens (mode of action, application, epizootics), advantages and disadvantages, characteristics of bio-control agents
- To learn about procedure of biological control: introduction; enhancement of bio control agents (introduction, conservation, mass culture, augmentation, release, monitoring and importation); rearing techniques of bio-control agents and their host insects; role of biological control in IPM

Theory

Unit I

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation. History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes.

Unit II

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa, etc., their mode of action. Biological control of weeds using insects. Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these. Defense mechanisms in insects against pathogens.

Unit III

Mass production of quality bio-control agents- techniques, formulations, economics, field release/ application and evaluation. Development of insectaries, their maintenance.

Unit IV

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control. Semiochemicals in biological control.

Practical

• Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers

• Visits to bio-control laboratories to learn rearing and mass production of egg, egglarval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds

• Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

Suggested Reading

Burges HD and Hussey NW. (Eds). 1971. Microbial Control of Insects and Mites. Academic
Press, London.

De Bach P. 1964. Biological Control of Insect Pests and Weeds. Chapman and Hall, New York.

Dhaliwal GS and Arora R. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani
Publishers, New Delhi.

Gerson H and Smiley RL. 1990. Acarine Biocontrol Agents – An Illustrated Key and Manual.
Chapman and Hall, New York.

Huffaker CB and Messenger PS. 1976. Theory and Practices of Biological Control. Academic
Press, London.

Ignacimuthu SS and Jayaraj S. 2003. Biological Control of Insect Pests. Phoenix Publ., New Delhi.

Saxena AB. 2003. Biological Control of Insect Pests. Anmol Publ., New Delhi.

Van Driesche and Bellows TS. Jr. 1996. Biological Control. Chapman and Hall, New York.

Course Outcomes:

The student will be able:

1. Students will learn about various biocontrol agents used to prevent the attack of pests to promote eco-friendly control methods
2. They will learn the mass multiplication techniques of biocontrol agents through hands-on training and can earn good money from industrial production of biocontrol agents
3. To check the field efficacy of various formulations of biocontrol agents
4. To understand the trends and future possibilities of biological control and study the role of biotechnology and semio chemicals in biological control

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SEMESTER-I

STAT-511 Statistical Methods for Applied/ Social Sciences

Time: 3 Hours **Maximum marks: 100**
Theory: 57
Practical: 18
Internal assessment: 25
Credit hours: 4(3+1)

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. In all nine questions should be asked, of which first question of 9 marks (Comprising of 9 short answer type questions covering the whole syllabus) will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (12).

Course objective: Objective of this course is to acquaint the students with the use of various statistical methods which are used to analyze the research data which will further help the students in better interpretation of the results.

Theory

Section-A: Box-plot, Descriptive statistics:- measures of central tendency, dispersion, Theory of probability:- types and introduction, Introduction to Random variable and Mathematical expectation and their properties.

Section-B: Discrete and continuous probability distributions:- Binomial, Poisson, Normal distribution and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distributions.

Section-C: Simple and multiple correlation coefficient, partial correlation, rank correlation, Simple and multiple linear regression model, test of significance of correlation coefficient and regression coefficients, Coefficient of determination.

Section-D: Non-parametric tests:- sign, Mann-Whitney U-test, Run test for the randomness of a sequence, Median test:- introduction and their applications. Introduction to ANOVA: One way and Two Way, Introduction to Sampling Techniques:- SRS, cluster, stratified, systematic sampling:- introduction and their applications, Transformation of Data.

Practical:

Fitting of distributions ~ Binomial, Poisson, Normal. Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi-square, t and F. Correlation and regression analysis. Non-parametric tests. ANOVA: One way, Two Way.

Suggested Reading:

Goon A.M, Gupta M.K and Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I. The World Press.
Goon A.M, Gupta M.K. and Dasgupta B. 1983. Fundamentals of Statistics. Vol. I. The World Press.
Hoel P.G. 1971. Introduction to Mathematical Statistics. John Wiley.
Hogg R.V and Craig T.T. 1978. Introduction to Mathematical Statistics. Macmillan.
Morrison D.F. 1976. Multivariate Statistical Methods. McGraw Hill.
Hogg RV, McKean JW, Craig AT. 2012. Introduction to Mathematical Statistics 7th Edition.
Siegel S, Johan N & Casellan Jr. 1956. Non-parametric Tests for Behavior Sciences. John Wiley.
Anderson TW. 2009. An Introduction to Multivariate Statistical Analysis, 3rd Ed. John Wiley
http://freestatistics.altervista.org/en/learning.php.
http://www.statsoft.com/textbook/stathome.html.

Course outcomes:

After the successful completion of this course students will:

• Get knowledge on the concept of probability, sampling techniques, mean, standard error
etc.
• Understand the correction and regression analysis.
• Apply T-Test, chi-square and large sample tests.

Note: Students shall be trained to use computer to analysis the data, using available softwares. However, during university examination students will use scientific calculators to analyse the data.

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SEMESTER-I

***PGS-511 Technical Writing & Communications Skills**

Time: 3 Hours **Maximum marks: 100**
Practical: 100
Credit hours: 1(0+1)

Instructions for the Paper Setters:

1. The question paper will consist of nine skill-oriented questions.
2. The first 5 questions carry 8 marks each. There will be internal choice wherever possible. The answer should be in 50-80 words. (5×8=40 Marks)
3. There will be four essay type questions from the entire syllabus. There will be internal choice wherever possible. The answer should be in 250 words. (4×15= 60 Marks)

Course objectives: To equip the students/ scholars with skills to write dissertations, research papers, etc.
To equip the students/ scholars with skills to communicate and articulate in English (verbal as well as
writing).

Practical:

Various forms of scientific writings- theses, technical papers, reviews, 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, précis, citations, etc.; Commonly used abbreviations in the theses and research communications; Illustrations, photographs and drawings with suitable captions; pagination numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups. Editing and proof-reading. Writing of a review article; Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors), Concord, Collocation, Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech; Participation in group discussion; Facing an interview; Presentation of scientific papers.

Suggested Reading:

Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
Collins' Cobuild English Dictionary. 1995.
Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.
Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
James HS. 1994. Handbook for Technical Writing. NTC Business Books.
Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
Mohan K. 2005. Speaking English Effectively. MacMillan India.
Richard WS. 1969. Technical Writing.
Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
Wren PC and Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

Course outcomes: After the successful completion of this course students will be able to:

• Understand various stages of the writing process and apply them to technical and workplace writing tasks

• Integrate material collected from primary and secondary sources with their own ideas in research papers

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SEMESTER-I

***PGS-512 Library and Information Services**

Time: 3 Hours **Maximum marks: 100**
Practical: 100
Credit hours:1(0+1)

Instructions for the Paper Setters:

1. The question paper will consist of nine skill-oriented questions.
2. The first 5 questions carry 8 marks each. There will be internal choice wherever possible. The answer should be in 50-80 words. (5×8=40 Marks)
3. There will be four essay type questions from the entire syllabus. There will be internal choice wherever possible. The answer should be in 250 words. (4×15= 60 Marks)

Course objective: To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines, etc.) of information search.

Practical:

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/ Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e- resources access methods.

Course outcomes:

- Understand the definitions, descriptions, process explanations and other common forms of technical writing.
- Understand how to follow the stages of the writing process and apply them to technical and workplace writing tasks
- Synthesize and integrate material collected from primary and secondary sources with their own ideas while writing research papers.

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SEMESTER- I

***PPL-599** **Masters' Research**

S/US **Credit Hour: 5(0+5)**

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SEMESTER-II

PPL-521 **Plant Virology (Major)**

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objectives

The course aims to:

1. To impart knowledge to the students on basic concepts and terminology of plant viral pathogens and their symptomatology
2. To impart knowledge on classification and identification of plant viral pathogens, their epidemiology and management
3. Studies on other virus like organisms

Theory:

Unit I

History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, arbo and baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions. Origin and evolution of viruses and their nomenclature and classification

Unit II

Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatical changes. Transmission of viruses and virus-vector relationship. Isolation and purification of viruses

Unit III

Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques. Natural (R-genes) and engineering resistance to plant viruses

Unit IV

Virus epidemiology and ecology (spread of plant viruses in fields, host range and survival). Management of diseases caused by plant viruses.

Practical:

• Study of symptoms caused by plant viruses (followed by field visit)
• Isolation and biological purification of plant virus cultures
• Bioassay of virus cultures on indicator plants and host differentials
• Transmission of plant viruses (Mechanical, graft and vector and study of disease development)
• Plant virus purification (clarification, concentration, centrifugation, high resolution separation and analysis of virions), Electron microscopy for studying viral particle morphology
• Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid (Non-PCR–LAMP, Later flow micro array and PCR based techniques)
• Exposure to basic bio-informatic tools for viral genome analysis and their utilization in developing detection protocols and population studies (BLASTn tool, Primer designing software, Bioedit tool, Claustal X/W, MEGA Software)

Suggested Reading

Bos L. 1964. Symptoms of Virus Diseases in Plants. Oxford & IBH., New Delhi.
Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ and Watson L. 1995. Virus of Plants: Descriptions
and Lists from VIDE Database. CABI, Wallington.
Gibbs A and Harrison B. 1976. Plant Virology – The Principles. Edward Arnold, London.
Hull
R. 2002. Mathew's Plant Virology. 4th Ed. Academic Press, New York.
Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Oxford & IBH,
New Delhi.
Wilson C. 2014. Applied Plant Virology. CABI Publishing England.

Course Outcomes:

The student will be able:

1. Thorough knowledge on symptoms, transmission, assay of viruses and their physical properties
2. To study about different serological tests, electron microscopy and molecular diagnostics techniques
3. Diagnosis of representative viral diseases and different principles of plant viral diseases

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SEMESTER-II

PPL-522 **Plant Pathogenic Prokaryotes (Major)**

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objectives

The course aims to:

1. To impart knowledge to the students on basic concepts and terminology of plant pathogenic prokaryotes
2. To impart knowledge on classification and identification of plant pathogenic prokarotes, symptomatology and disease management

Theory:

Unit I

Prokaryotic cell: History and development of Plant bacteriology, history of plant bacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and gram positive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccaride structure; Membrane transport; fimbrae and pili (Type IV pili); Mechanism of flagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (Slayer; capsule); the bacterial chromosomes and plasmids; Operon and other structures in cytoplasm; Morphological feature of fastidious bacteria, spiroplasmas and Phytoplasmas

Unit II

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.

Unit III

Biochemical and molecular characterization of phytopathogenic prokaryotes. Variability among phytopathogenic prokarya: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteriaconjugation; transformation; transduction); and horizontal gene transfer.

Unit IV

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

Practical

Study of symptoms produced by phytopathogenic prokaryotes

- Isolation, enumeration, purification, identification and host inoculation of phytopathogenic 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 gene sequences
- Diagnosis and management of important diseases caused by bacteria and mollicutes.

Suggested Reading

Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
Jayaraman J and Verma JP. 2002. Fundamentals of Plant Bacteriology. Kalyani Publishers,
Ludhiana.
Mount MS and Lacy GH. 1982. Phytopathogenic Prokaryotes. Vols. I, II Academic Press, New
York.
Salle AJ. 1979. Fundamental Principles of Bacteriology 7th edn.
Verma JP, Varma A and Kumar D. (Eds). 1995. Detection of Plant Pathogens and their Management. Angkor Publ., New Delhi.

Course Outcomes:

The student will be able:

1. Thorough knowledgeabout isolation, purification, identification and host inoculation of phytopathogenic prokaryotes
2. To know about different staining methods, biochemical and serological characterization of plant pathogenic prokarotes
3. To study about isolation of plasmid and use of antibacterial chemicals/antibiotics
4. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria

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SEMESTER-II

ENT- 522 Toxicology of Insecticides (Minor)

Time: 3 Hours **Max. Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hr: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (15).

Course Objectives

The course aims to:

1. Outline the history of insecticides
2. Recognize the major classes of insecticide and understand their mode of action
3. List and describe processes involved in toxic dynamics of insecticides
4. Become aware of the limitations of insecticide use such as resistance and environmental contamination
5. Develop a basic understanding on performing insect bioassay

Theory:

Section A

Definition and scope of insecticide toxicology; history of chemical control; pesticide use andpesticide industry in India; Classification of insecticides and acaricides based on mode ofentry, mode of action and chemical nature; categorization of insecticides on the basis oftoxicity – criteria for bees, beneficial insects and other insects in general; structure and modeof action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines,neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials,botanicals, new promising compounds/ new insecticide molecules; nanopesticides;drawbacks of insecticide abuse.

Section B

Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides-synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticidecompatibility, selectivity and phytotoxicity. bioassay definition, objectives, criteria, factors,problems and solutions.

Section C

Insecticide metabolism; insect-pest resistance to insecticides; mechanisms and types ofresistance; insecticide resistance management and pest resurgence.

Section D

Insecticide residues, their significance and environmental implications; procedures ofinsecticide residue analysis. Insecticide Act, registration procedures, label claim, and

qualitycontrol of insecticides; safe use of insecticides; diagnosis and treatment of insecticidepoisoning.

Practical:

• Insecticide formulations and mixtures;
• Laboratory and field evaluation of bio-efficacy of insecticides;
• Bioassay techniques;
• Probit analysis;
• Evaluation of insecticide toxicity;
• Toxicity to beneficial insects;
• Pesticide appliances;
• Working out doses and concentrations of pesticides;
• Procedures of residue analysis.

Suggested Readings:

Chattopadhyay SB. 1985. Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi.

Dodia DA, Petel IS and Petal GM. 2008. Botanical Pesticides for Pest Management. Scientific Publisher (India), Jodhpur.

Dovener RA, Mueninghoff JC and Volgar GC. 2002. Pesticides formulation and delivery systems: meeting the challenges of the current crop protection industry. ASTM, USA

Gupta HCL.1999. Insecticides: Toxicology and Uses. Agrotech Publ., Udaipur.

Ishaaya I and Degheele (Eds.). 1998. Insecticides with Novel Modes of Action. Narosa Publ. House, New Delhi.

Ishaaya I and Degheele D. 1998. Insecticides with Novel Modes of Action: Mechanism and Application. Norosa Publishing House, New Delhi.

Krieger RI. 2001. Handbook of Pesticide Toxicology. Vol-II. Academic Press. Orlando Florida. Mathews GA. 2002. Pesticide Application Methods. 4th Ed. Intercept. UK.

Matsumura F. 1985. Toxicology of Insecticides. Plenum Press, New York.

Otto D and Weber B. 1991. Insecticides: Mechanism of Action and Resistance. Intercept Ltd., UK. Pedigo LP and Marlin ER. 2009. Entomology and Pest Management, 6th Edition, Pearson

Course Outcomes:

The student will be able:

1. Students will get to know about importance, scope and basic principle of insecticide toxicology and its relationships with other disciplines
2. To learn about the structure and mode of action of different groups of insecticides including botanicals and new promising compounds
3. Students will learn the mechanisms of resistance development in insects against insecticides and how we can manage the problem of insecticide resistance
4. To be able to evaluate toxicity of insecticides and to understand the factors affecting toxicity of insecticides. They will also learn about Insecticide Act 1968, safe handling of insecticides and treatment in case of insecticide poisoning
5. Students will get acquainted with different methods of estimation of insecticide residues.

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SEMESTER-II

PPL-523 Molecular Approaches for Plant Protection (Supporting)

Time: 3 Hour **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objectives

The course aims to:

- To impart knowledge to the students on basic concepts of plant genome, molecular markers, gene flow in plants and marker assisted breeding
- To impart knowledge on various molecular techniques

Theory:

Unit I

Plant genome: nuclear and cytoplasmic, Significance of organelle genome, Genome size and complexity. Modern gene concept: gene structure, structural and functional genes.

Unit II

Molecular markers: Morphological markers, hybridization based marker (RFLP), PCR based markers (RAQPD, AFLP, SNP, SCAR, SSR). Development of SCAR and SSR markers.

Unit III

Gene flow in plants (Mapping population, QTL mapping, Marker Assisted Selection (MAS), Gene pyramiding, Screening and Validation

Unit IV

Marker Assisted breeding in transgenic: Herbicide resistance, Pest and disease resistance and quality enhancement, DNA fingerprinting, Qualitative real time assay, DNA clip and micro error

Practical

Plant DNA extraction, Purification of DNA , Agarose gel electrophoresis, Homogenization of leaves, sub cellular fractionation by centrifugation, Polymerase chain reaction to amplify a plant gene, PCR by using SSR and SCAR markers and DNA fingerprinting

Suggested Readings:

Marshall, G. and Walters, D. (1994) Molecular Biology in Crop Protection, London (United Kingdom) Chapman & Hall

Narayanasamy, P. (2008) Molecular biology in Plant Pathogenesis and Disease Management, Springer Dordrecht

Course Outcomes:

The student will be able:

1. Thorough knowledgeabout Plant DNA extraction and their purification, Agarose gel electrophoresis, Homogenization of leaves and sub cellular fractionation by centrifugation
2. To study about isolation of plasmid and use of antibacterial chemicals/antibiotics
3. To study about different markers and DNA fingerprinting against Plant diseases

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SEMESTER-II

***PGS-521 Agricultural Research, Research Ethics and Rural Development Programmes**

Time: 3 Hours **Maximum marks: 100**

Theory: 100

Credit hours: 1 (1+0)

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. There will be total of five questions, out of which first question of 20 marks (Comprising of 10 short answer type questions of 2 mark each) covering the whole syllabus will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (20).

Course objective: the main objective of the course is to enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government

Theory:

Section A: History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR):

Section B: International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility. Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

Section C: Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme,

Section D: Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings:

1. Bhalla GS and Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
2. Punia MS. Manual on International Research and Research Ethics. CCS Haryana Agricultural University, Hisar.
3. Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
4. Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

Course Outcomes:

After successful competeion of this course students are expected:

• To be familiar with the national and international institutions involved in research and about
various research ethics and the problems faced by researchers.

• To be aquainted with the various rural development programmes and the problems being faced
in the implementation of the policies designed for rural development.

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SEMESTER- II

***PPL-599** **Masters' Research**

S/US **Credit Hour: 5(0+5)**

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SEMESTER-III

PPL 531 **Plant Nematology (Major)**

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (15).

Course Objectives

The course aims to:

1. To impart knowledge to the students on basic concepts of Nematodes, their classification and their economic importance with relation to agriculture, horticulture and forestry
2. To impart knowledge on Gross morphology of Plant parasitic nematodes and importance of Nematodes in International Trade and Quarantine
3. To know about Principle and practices of Nematode management; Integrated Nematode Management.

Theory

Unit I

Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry

Unit II

Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology. Types of parasitism; nature of damage and general symptomatology

Unit III

Interaction of plant-parasitic nematodes with other organisms. Unit IV Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes

Unit IV

Principles and practices of nematode management; integrated nematode management. Emerging nematode problems, Importance of nematodes in international trade and quarantine.

Practical

- Studies on kinds of nematodes- free-living, animal, insect and plant parasites
- Nematode extraction from soil
- Extraction of migratory endoparasites, staining for sedentary endoparasites
- Examination of different life stages of important plant parasitic nematodes, their symptoms and histopathology.

Suggested Reading

Dropkin VH. 1980. An Introduction to Plant Nematology. John Wiley & Sons, New York.
Maggenti AR. 1981. General Nematology. Springer-Verlag, New York.
Perry RN and Moens M. 2013. Plant Nematology. 2nd Ed. CABI Publishing: Wallingford, UK.
Perry RN, Moens M, and Starr JL. 2009. Root-knot nematodes, CABI Publishing: Wallingford,
UK.
Sikora RA, Coyne D, Hallman J and Timper P. 2018. Plant Parasitic Nematodes in Subtropical
and Tropical Agriculture.3rd edn. CABI Publishing, England.
Thorne G. 1961. Principles of Nematology. McGraw Hill, New Delhi.
Walia RK and Bajaj HK. 2003. Text Book on Introductory Plant Nematology. ICAR, New Delhi.
Walia RK and Khan MR. 2018. A Compendium of Nematode Diseases of Crop Plants, ICAR AICRP (Nematodes), IARI, New Delhi.

Course Outcomes:

The student will be able:

1. Thorough knowledge about Nematodes, their habitats and diversity and their economic Importance to agriculture, horticulture and forestry
2. To know about Extraction of migratory endoparasites, staining for Sedentary endoparasites
3. To study about different life stages of important plant parasitic nematodes with their symptoms and histopathology

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SEMESTER-III

PPL 532 Techniques in Detection and Diagnosis of Plant Diseases (Major)

Time: 3 Hours

Maximum Marks: 100
Theory:50
Practical: 25
Internal assessment: 25
Credit hours: 2(0+2)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (15).

Course Objectives

The course aims to:

1. To impart knowledge to the students about detection and diagnosis of various plant pathogens, their isolation, preservation
2. To impart knowledge on various plant pathological lab techniques

Practical

- Detection of plant pathogens 1. Based on visual symptoms, 2. Biochemical test 3. Using microscopic techniques, 4. Cultural studies; (use of selective media to isolate pathogens). 5. Biological assays (indicator hosts, differential hosts) 6. Serological assays 7. Nucleic acid based techniques (Non-PCR–LAMP, Later flow microarray and PCR based- multiplex, nested, qPCR, immune capture PCR, etc.)
- Phenotypic and genotypic tests for identification of plant pathogens
- Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer region sequences-prokaryotic organisms; and eukaryotic organism by ITS region) and whole genome sequencing
- Volatile compounds profiling by using GC-MS and LC-MS
- FAME analysis, Fluorescence in-situ Hybridization (FISH), Flow Cytometry, Phage display technique, biosensors for detection of plant pathogens
- Genotypic tools such as genome/ specific gene sequence homology comparison by BLAST (NCBI and EMBL and electron microscopy techniques of plant virus detection and diagnosis.

Suggested Reading

Baudoin ABAM, Hooper GR, Mathre DE and Carroll RB. 1990. Laboratory Exercises in Plant Pathology: An Instructional Kit. Scientific Publ., Jodhpur.
Dhingra OD and Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
Fox RTV. 1993. Principles of Diagnostic Techniques in Plant Pathology, CABI Wallington.
Forster D and Taylor SC. 1998. Plant Virology Protocols: From Virus Isolation to Transgenic
Resistance. Methods in Molecular Biology. Humana Press, Totowa, New Jersey.
Mathews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Boca Raton, Tokyo.
Matthews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Florida.
Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Cent. Agic. Pub. Doc. Wageningen.
Pathak VN. 1984. Laboratory Manual of Plant Pathology. Oxford & IBH, New Delhi.
Trigiano RN, Windham MT and Windham AS. 2004. Plant Pathology-Concepts and Laboratory
Exercises. CRC Press, Florida.Chakravarti BP. 2005. Methods of Bacterial Plant Pathology. Agrotech, Udaipur.

Course Outcomes:
The student will be able:

1. Thorough knowledge about Proving Koch postulates with biotrophs and necrotroph pathogens
2. To study about pure culture techniques and use of selective media to isolate pathogens and use of hemocytometer, micrometer, centrifuge, pH meter, camera lucida
3. To study about Principles, constriction and working of different microscopic techniques and staining methods
4. To demonstrate evaluation of fungicides and bactericides against different diseases

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SEMESTER-III

PPL 533 Disease resistance in Plant (Major)

Time: 3 Hours

Maximum Marks: 100
Theory:75
Internal assessment:25
Credit hours: 2(2+0)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (15).

Course Objectives

The course aims to:

5. To impart knowledge to the students about history and variability of Plant Pathogens
6. To impart knowledge on disease resistance, Host defence system and hypersensitivity of Plant Pathogens against disease

Theory

Unit I

Intoduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centres as a source of resistance, disease resistance terminologies

Unit II

Disease escape, non-host resistance and disease tolerance. Genetic basis of disease resistance, type of resistance, identification of physiological races of pathogen, disease progression in relation to resitance, stabilizing election pressure in plant pathogen

Unit III

Host defence system,morphological and anatomical resistance, preformed chemicals in host defence, post inflectional chemicals in host defence, phytoelaxins, hypersensitivity and its mechanism

Unit IV

Genetic basis of relationship between pathogen and host, gene for gene concept, protein for protein and immunization basis, management of resistance gene. Strategies for gene deployment

Suggested Reading

Deverall BJ. 1977. Defence Mechanisms in Plants. Cambridge Univ. Press, Cambridge, New York.
Mills Dallice et al.1996. Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction. APS, St Paul, Minnesota.
Parker J. 2008. Molecular Aspects of Plant Diseases Resistance. Blackwell Publ.
Robinson RA. 1976. Plant Pathosystems. Springer Verlag, New York.
Singh BD. 2005. Plant Breeding – Principles and Methods. 7th Ed. Kalyani Publishers, Ludhiana
Van der Plank JE. 1975. Principles of Plant Infection. Academic Press, New York.
Van der Plank JE. 1978. Genetic and Molecular Basis of Plant Pathogenesis. Springer Verlag. New York.
Van der Plank JE. 1982. Host Pathogen Interactions in Plant Disease. Academic Press, New York.
Van der Plank JE. 1984. Disease Resistance in Plants. Academic Press, New York.

Course Outcomes:

The student will be able:

1. Thorough knowledge about Genetic basis of disease resistance their identification and disease progression in relation to resitance
2. To study about Disease escape and disease tolerance; , identification of physiological races of pathogen with relation to resitance
3. To study about Host defence system, morphological and anatomical resistance. Mechanism of chemicals in host defence, phytoelaxins, hypersensitivity and its mechanism.
4. To evaluation Genetic relationship between pathogen and host

SEMESTER-III

ENT- 533 Concept of Integrated Pest Management (Minor)

Time: 3 Hours **Maximum Marks: 100**
Theory: 75
Internal assessment: 25
Credit hours: 2(2+0)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (15).

Course Objectives

The course aims to:

1. Be able to analyse pest problems, determine if management is necessary, and make appropriate recommendations using IPM techniques
2. Be familiar with different methods of pest management - their benefits and limitations
3. Understand the value of beneficial insects

Theory

Unit I

History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons

Unit II

Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects

Unit III

Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical and mechanical methods; semiochemicals, biotechnological and bio-rational approaches in IPM. Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; costbenefit ratios and

partial budgeting; case studies of successful IPM programmes. ITK-s in IPM, area-wide IPM and IPM for organic farming; components of ecological engineering with successful examples.

Unit IV

Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.

Suggested Reading

Dhaliwal GS and Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publishers, New Delhi.

Horowitz AR and Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.

Ignacimuthu SS and Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.

Norris RF, Caswell-Chen EP and Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.

Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.

Subramanyam B and Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

Course Outcomes:

The student will be able:

1. Students will get knowledge about origin, history, concept, philosophy and ecological principles of IPM
2. They will be able to assess crop losses, economic thresholds and cost benefit ratios
3. They will be acquainted with different sampling techniques and insect-pest population estimation methods
4. Students will learn about designing and implementation of IPM programmes for different crops and constraints in IPM implementation

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SEMESTER-III

CREDIT SEMINAR

PPL-591 **Maximum Marks: 100**

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SEMESTER-III

***PGS-531 Intellectual Property & its Management in Agriculture**

Time: 3 Hours **Maximum marks: 100**

Theory: 100

Credit hours: 1 (1+0)

Instructions for the Paper Setters:

1. Question paper should be set strictly according to the syllabus.
2. The language of questions should be straight & simple.
3. There will be total of five questions, out of which first question of 20 marks (Comprising of 10 short answer type questions of 2 mark each) covering the whole syllabus will be compulsory.
4. Out of remaining eight questions, two questions should be asked from each section, out of which the candidates are required to attempt one question from each section. All question will carry equal marks (20).

Course Objective: The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledgebased economy.

Theory:

Section A: Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;

Section B: Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection;

Section C: Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity;

Section D: International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings:

1. Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. 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.
4. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
5. Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
6. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.

Course outcomes:

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

- Use different tools of IPR for their rights.
- They will be able to guide the innovative farmers regarding various IPR tools and their use for protection of their rights.

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SEMESTER- III

***PPL-599** **Masters' Research**

S/US **Credit Hour: 10(0+10)**

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SEMESTER-IV

PPL-541 Diseases of Field and Medicinal Crops (Major)

Time: 3 Hours **Maximum Marks: 100**

Theory: 50

Practical: 25

Internal assessment: 25

Credit hours: 3(2+1)

Instructions for the Paper Setters:

- Question paper should be set strictly according to the syllabus.
- The language of questions should be straight & simple.
- In all nine questions should be asked, of which first question of 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
- Of the remaining eight questions, two questions should be asked from each section, of which the candidates are required to attempt one question from each section. All questions carry equal marks (10).

Course Objective: The main aim of this course is: To study about different diseases and management of cereal, oilseeds, fodder, legume and medicinal crops.

Theory

Unit I

Diseases of Cereal crops- Rice, wheat, barley, pearl millet, sorghum and maize. Diseases of Pulse crops- Gram, urdbean, mungbean, lentil, pigeonpea, soybean and cowpea

Unit II

Diseases of Oilseed crops- Rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor. Unit IV Diseases of Cash crops- Cotton, sugarcane

Unit III

Diseases of Fodder legume crops- Berseem, oats, guar, Lucerne

Unit IV

Medicinal crops- Plantago, liquorice, mulathi, rosagrass, sacred basil, mentha, ashwagandha, Aloe vera.

Practical

• Detailed study of symptoms and host parasite relationship of important diseases of above mentioned crops

• Collection and dry preservation of diseased specimens of important crops.

Suggested Reading

Joshi LM, Singh DV and Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.

Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, New Delhi.

Ricanel C, Egan BT, Gillaspie Jr AG and Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
Singh RS. 2017. Plant Diseases. 10th Ed. Medtech, New Delhi.
Singh US, Mukhopadhyay AN, Kumar J and Chaube HS. 1992. Plant Diseases of Internatiobnal Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.

Course outcomes:

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

• Diagnosis Symptoms and host parasite relationship of important diseases of above mentioned crops

• They will be able to Collect and preserve diseased specimens

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SEMESTER-IV

***PGS-541 Basic Concepts in Laboratory Techniques**

Time: 3 Hours **Maximum marks: 100**
Practical: 100
Credit hours: 1(0+1)

Instructions for the Paper Setters:

1. The question paper will consist of nine skill-oriented questions.
2. The first 5 questions carry 8 marks each. There will be internal choice wherever possible. The answer should be in 50-80 words. (5×8=40 Marks)
3. There will be four essay type questions from the entire syllabus. There will be internal choice wherever possible. The answer should be in 250 words. (4×15= 60 Marks)

Course Objectives: To acquaint the students about the basics of commonly used techniques in laboratory. It will also help the students to safely use the Laboratory tools and equipments which will avoid various laboratory accidents.

Practical:

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; Washing, drying and sterilization of glassware; Drying of solvents/ chemicals; Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values; Use and handling of microscope, laminar flow, vacuum pumps, viscometer thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing; Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.

Suggested Readings:

Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press

Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

Course outcomes:

After completion of this course students are expected to:

- Handling the laboratory chemicals and equipments safely.
- Use the laboratory resources precisely.
- Can guide farmers regarding preparation of doses of various agro chemicals in the field.

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SEMESTER- IV

***PPL-599** **Masters' Research**

S/US **Credit Hour: 10(0+10)**