

# **P.G. DEPARTMENT OF AGRICULTURE**

## **SYLLABUS**

**For**

**M.Sc. Ag. (Plant Pathology)**

**(Semester: I–IV)**

**Session: 2021-22**

**KHALSA COLLEGE AMRITSAR-143001**

## M.Sc. Ag. (Plant Pathology)

### SEMESTER-I

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assesment	Grand Total
			Th.	Pract.	Th.	Pract.		
1	PPL-511	Mycology	4	3	75	37	38	150
2	PPL-512	Principles of Plant Pathology	4	6	75	37	38	150
3	PPL-513	Integrated Disease Management	4	3	75	37	38	150
4	TWC-514	Technical Writing and Communication Skills	2	0	50	-	-	<b>50 (NC)</b>
5	ENT-532/ NEM-410 (Minor)	Integrated Pest Management/ Plant Nematology	4	6	75	37	38	150
6	STA-415	Statistical Methods for Research Workers	4	3	75	37	38	150
7		Research Work (Synopsis)	-	2	-	-		-
	<b>Total</b>		<b>20</b>	<b>21</b>	<b>375</b>	<b>185</b>	<b>190</b>	<b>750</b>

## M.Sc. Ag. (Plant Pathology)

### SEMESTER-II

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assesment	Grand Total
			Th.	Pract.	Th.	Pract.		
1	PPL-521	Plant Virology	4	3	75	37	38	150
2	PPL-522	Plant Bacteriology	4	6	75	37	38	150
3	PPL-523	Fungal Diseases of Plant	4	3	75	37	38	150
4	PPL-524/ PPL-524	Ecology of Plant Pathogens/ Principles and Procedures of Certification	4	3	75	37	38	150
5	ENT-542/ NEM-420 (Minor)	Storage Entomology/ Nematode Diseases of Crops	4	6	75	37	38	150
6	STA-425	Experimental Designs for Research Worker	4	3	75	37	38	150
7		Research Work (Synopsis)	-	2	-	-	-	-
	<b>Total</b>		<b>24</b>	<b>26</b>	<b>450</b>	<b>222</b>	<b>228</b>	<b>900</b>

## M.Sc. Ag. (Plant Pathology)

### SEMESTER-III

Sr. No	Course Code	Subject	Periods per week		Marks		Internal Assesment*	Grand Total
			Th	Pract	Th	Pract		
1	PPL-531	Epidemiology and Forecasting of Plant Diseases	4	3	75	37	38	150
2	PPL-532	Quarantine in Plant Protection	4	6	75	37	38	150
3	ENT-531 (Minor)	Biological Control of Insect Pests	4	3	75	37	38	150
4.		Credit Seminar	3	--	100	--	--	100
5		Research Work (Thesis)	--	4	--	--	--	S/US
	<b>Total</b>		<b>15</b>	<b>16</b>	<b>325</b>	<b>111</b>	<b>114</b>	<b>550</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

## M.Sc. Ag. (Plant Pathology)

### SEMESTER-IV

Sr. No.	Course Code	Subject	Periods per week		Marks		Internal Assesment*	Grand Total
			Th	Pract	Th	Pract		
1.	PPL-541	Detection and Diagnosis of Plant Diseases	4	3	50	25	25	100
2.	PPL-542	Chemicals In Plant Disease Management	4	3	50	25	25	100
3.		Research Work (Thesis)	--	4	--	--	--	S/US
		<b>Total</b>	<b>08</b>	<b>10</b>	<b>100</b>	<b>50</b>	<b>50</b>	<b>200</b>

\*Total Internal Assessment to be given = 25% (House Test - 10%; Attendance - 10%; Conduct & Academic, Extra Curricular Activities - 5%).

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

### Mycology

PPL-511

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week : 04+3

#### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

#### Theory:

**Section A:** Introduction, basic concepts and terminology. Mycology in relation to agriculture and mankind. History of mycology. Concepts of nomenclature and classification.

**Section B:** Fungal biodiversity. Reproduction in fungi, Comparative morphology, ultrastructure and characters of different groups of fungi up to generic level of Divisions Myxomycota and Eumycota.

**Section C:** Emphasizing sub- divisions Mastigomycotina Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

**Section D:** Types of Lichens and importance, fungal genetics and variability in fungi.

#### Practical:

Comparative study of different groups of fungi up to generic level of Divisions Myxomycota and Eumycota emphasizing sub-divisions Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

PPL-512

### Principles of Plant Pathology

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week : 04+6

#### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

#### Theory:

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

**Section B:** Role of environment and host nutrition on disease development. Host parasite interaction, recognition concept and infection. Symptomatology, disease development. Role of enzymes, toxins, growth regulators.

**Section C:** Defense strategies, oxidative burst, phenolics, phytoalexins, PR proteins and elicitors. Altered plant metabolism as affected by plant pathogens.

**Section D:** Genetics of resistance, 'R' genes, mechanism of genetic variation in pathogens, molecular basis for resistance, marker-assisted selection and genetic engineering for disease resistance. Disease management strategies.

#### Practical:

Growth, reproduction, survival and dispersal of important plant pathogens and their symptomatology

Study of Biotic and abiotic causes of plant diseases and its management

Serological and molecular techniques for detection of plant pathogens.

Molecular techniques to study variability in different plant pathogens

Various disease management strategies

Evaluation of fungicides and bactericides.

Screening techniques for measuring resistance of host plant

Demonstration of gene transfer techniques- direct and indirect methods.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

**PPL-513**

**Time: 3 Hours**

**Integrated Disease Management**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week : 04+3**

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

**Section A:** Introduction, definition, concept and tools of disease management. Components of integrated disease management, their limitations and implications.

**Section B:** Development of IDM and its adaptation in important crops, rice, wheat, cotton.

**Section C:** Development of IDM and its adaptation in important crops sugarcane, chickpea, rapeseed mustard, pearl millet,

**Section D:** Development of IDM and its adaptation in important crops Kharif pulses, vegetable and fruit crops.

### **Practical:**

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



# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

TWC-514

Technical Writing and Communication skills

Time: 3 Hours

Max. Marks: 50

Theory: 50

Periods per week: 02+0

### Instructions for the Paper Setters:

- 1) The question paper will consist of seven skill-oriented questions.
- 2) The first 6 Questions carry 5 marks each. There will be internal choice wherever possible (6x5=30 Marks).
- 3) There will be one essay type question out of two parts of the course. The student has to attempt any one of the two in about 150 words (1x7=7 Marks)

### Course Contents:

1. **Technical Writing**-Various forms of technical writing-theses, technical papers, reviews, electronic communication etc; qualities of technical writing; parts of research communications- title page, content page, authorship, preface, introduction, review of literature, materials and methods, experimental results, documentation; photographs and drawings with suitable captions; pagination; citations; writing of abstracts; précis; synopsis; editing and proof reading.
2. **Communication Skills**-defining communication; types of communication- verbal and non-verbal; assertive communication; using language for effective communication; paraphrasing; vocabulary building- word roots, prefixes.

### Recommended Books:

1. *Oxford Guide to Effective Writing and Speaking* by John Seely.  
*The Written Word* by Vandana R Singh, Oxford University Press

SEMESTER-I

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-III

ENT-532

Integrated Pest Management

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal Assessment=30

Periods per week : 04+6

### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory

#### Section A

History and origin. Definition and evolution of various related terminologies.

Concept and philosophy of IPM. Ecological principles of IPM. Constraints in IPM implementation.

Types and methods of determination of crop losses and economic thresholds.

#### Section B

Integration of different pest management methods.

Use of semiochemicals in pest management programmes.

Pest survey and surveillance, forecasting, types of surveys (Fixed and rapid survey including remote sensing methods) different sampling techniques, factors affecting surveys.

#### Section C

Political, social and legal implications of IPM.

Pest and pesticide risk analysis, assessment and management, Pest quarantine measures and cost benefit ratios.

#### Section D

Case studies of successful IPM programmes for Cotton, Rice, Sugarcane, Vegetable crops and fruit crops. National and international set-ups for integrated pest management.

### Practicals

1. Characterization of agro-ecosystems.
2. Sampling methods and factors affecting sampling.
3. Population estimation methods.
4. Crop loss assessments, potential losses, avoidable losses, unavoidable losses.
5. Computation of EIL and ETL.
6. Crop modelling, designing and implementing IPM system.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

NEM-410

Plant Nematology (Minor)

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week : 04+6

### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory:

**Section A:** History and economic importance of plant parasitic nematodes. General characteristics, identification, their classification and relationship with other organisms.

**Section B:** Morphology and biology of important genera, namely Meloidogyne, Heterodera, Globodera, Anguina,

**Section C:** Morphology and biology of important genera, namely Rotylenchulus, Ditylenchus, Tylenchulus, Pratylenchus,

**Section D:** Morphology and biology of important genera, namely Radopholus and virus vectors. Principles and methods of control.

**Practical:** Methods of survey, collection of soil and plant samples. Extraction of nematodes and population estimation. Preparation of temporary and permanent mounts. Study of morphological characteristics and disease symptoms. Application of nematicides.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-I

**STA-415: Statistical Methods for Research Workers**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week : 04+3**

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

Probability and fitting of standard frequency distribution, sampling techniques, sampling distributions, mean and standard error, simple partial, multiple and intra- class correlation and multiple regression, tests of significance, students'-t, chi-square and large sample tests, confidence intervals, analysis of variance for one way and two way classification with equal cell frequencies, transformation of data.

### **Practical:**

Fitting of distributions, samples and sampling distributions, correlation and regression, tests of significance and analysis of variance.

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

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**PPL-521**

**Time: 3 Hours**

**Plant Virology**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week : 04+3

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

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

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

**Section C:** Mycoviruses, phytoplasma arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, and prions. Origin and evolution, mechanism of resistance and genetic engineering of plant viruses.

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

### **Practical:**

Study of symptoms caused by viruses, transmission, assay of viruses, physical properties, isolation and purification, method of raising antisera, serological tests, electron microscopy and ultratomy, molecular diagnostics. Diagnosis of representative viral diseases.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II Plant Bacteriology

PPL-522

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week : 04+6

### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory:

**Section A:** History of bacteriology and introduction to phytopathogenic procarya. Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic procarya.

**Section B:** Survival and dissemination of phytopathogenic bacteria. Important diseases caused by procarya. Growth, nutrition requirements, reproduction, preservation of bacterial cultures.

**Section C:** Variability among phytopathogenic procarya. General biology of bacteriophages, L-form bacteria, plasmids and bdellovibrios.

**Section D:** Procaryotic inhibitors and their mode of action against phytopathogenic bacteria.

### Practical:

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

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**PPL-523**

**Fungal Diseases of Plant**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week : 04+3**

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

**Section A:** Nomenclature, classification and general characterization of fungi. Description of important phytopathogenic genera.

**Section B:** Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control of field crops, pulse crops.

**Section C:** Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control of vegetable crops, horticultural crops.

**Section D:** Study of representative fungal diseases with emphasis on their distribution, symptomatology, etiology, epidemiology and control of ornamental crops. Post harvest diseases in transit and storage and their management.

### **Practical:**

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

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**PPL-524**

**Ecology of Plant Pathogens**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week : 04+3

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

**Section A:** Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi. Dispersal, survival and dormancy of plant pathogens.

**Section B:** Types of biocontrol agents. Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis.

**Section C:** Role of rhizosphere, phylloshere and spermosphere in disease development in relation to crop sequences.

**Section D:** Suppressive soils, biological control, concepts and potentialities for managing soil borne pathogens.

**Practical:** Importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi, Dispersal, survival and dormancy of plant pathogens. Different types of biocontrol agents. Role of rhizosphere, phylloshere and spermosphere in disease development in relation to crop sequences.



# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**PPL-524**

**Principles and Procedures of Certification**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

Periods per week : 04+3

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

**Section A:** Introduction to certification. International scenario of certification and role of ISTA, EPPO, OECD etc. in certification and quality control

**Section B:** National Regulatory mechanism and certification system including seed certification, minimum seed certification standards. National status of seed health in seed certification.

**Section C:** Methods for testing vegetative propagules and in vitro cultures and genetic identity, physical purity, germination percentage, seed health etc. Fixing tolerance limits for diseases and insect pests in certification and quality control programmes.

**Section D:** Accreditation of seed testing laboratories. Role of seed/ planting material health certification in national and international trade.

**Practical:** Introduction to certification, National Regulatory mechanism and certification system, National status of seed health in seed certification, Fixing tolerance limits for diseases and insect pests in certification and quality control programmes, Role of seed/ planting material health certification in national and international trade.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**ENT-542**

**Storage Entomology**

**Time: 3 Hours**

**Max. Marks: 100**

**Theory: 50**

**Practical: 25**

**Internal assessment 15+5=25**

**Periods per week: 4+3**

### **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 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

#### **Unit-I**

Introduction, history and concepts of storage entomology. Post-harvest losses. Factors responsible for grain losses. Important pests namely insects, mites, rodents and birds associated with stored grains and agricultural products.

#### **Unit-II**

Important micro-organisms associated with stored grains and agricultural products. Association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage. Sources of infestation.

#### **Unit-III**

Type of losses in stored grains and their effect on quality including biochemical changes. Ecology of insect pests of stored commodities. Stored grain deterioration process. Type of storage structures. Ideal storage conditions. Management of rodent and bird pests.

#### **Unit-IV**

Preventive and curative measures for the management of insect pests of stored grains. Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

### **Practical:**

Collection and identification of stored grains insect pests and their nature of damage. Detection of insect infestation in stored food grains and estimation of stored losses. Determination of micro flora of grains. Determination of grain moisture. Familiarization of storage structures. Laboratory culturing of stored grain pests. Demonstration of preventive and curative measures including fumigation techniques. Field visits to grain markets, central and FCI warehouses, IGSMRI and commercial silos.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

NEM-420

Nematode Diseases of Crops (Minor)

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week: 04+6

### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory:

**Section A:** Diagnosis of Nematode diseases, their causal organisms, distribution, host range, biology, life cycle, nature of damage, symptoms and management in different crops. Nematode parasites as primary or secondary pathogens. Disease concept terminology. Interaction of nematodes with other organisms.

**Section B:** Detailed account of ear-cockle, tundu and molya diseases of wheat. Cyst, rice root nematode, ufra and white tip diseases of rice. Lesion and cyst nematodes of maize and sorghum. Root knot, reniform, lesion, lance nematode, sugar beet cyst, pigeon pea cyst and soybean cyst nematode problems on pulses, sugar cane, fibre, fodder and oilseed crops.

**Section C:** Root-knot, reniform, stem and bulb nematode, potato cyst nematode on vegetable crops. Nematode problems of protected cultivation. Root-knot and reniform nematode on fruit crops.

**Section D:** Slow decline of citrus. Mushroom nematode problems. Burrowing nematode problem of banana, spices and condiments, Root-knot and lesion nematode diseases of coffee and tea. Red ring disease of coconut and pine wilt disease.

### Practical:

Diagnosis of causal organisms. Identification of different life cycle stages. Study of symptoms and histopathology of nematode damage in different crops and field diagnosis of nematode problems.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-II

**STA-425: Experimental Designs for Research Workers**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week : 04+3**

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

**Note:** Students are allowed to use scientific calculator in University examinations; statistical tables will be provided to students in examinations. No rigorous mathematical proofs are expected from students; stress will be on application only.

### **Theory**

Need for designing of experiments- characteristics of a good design, basic principles- randomization, replication and local control, uniformity trials- size and shape of plots and blocks, analysis of variance and interpretation of data, completely randomized, randomized block and latin square design, multiple comparison tests, factorial experiments- interpretation of main effects and interactions, orthogonality and partitioning of degrees of freedom confounding in  $2^3$ ,  $2^4$  and  $3^3$  designs, split and strip plot designs, crossover designs and balanced incomplete block designs, response surface designs, switch over trials and long term experiments; Selection of experimental design, mechanical errors in field experiments and methods of reducing it, presentation of research results.

### **Practical:**

**Time: 3 Hours**

cross over and balanced incomplete block designs.

**Note:** Students shall be trained to use computer to analysis the data, using available software's. However, during university examination students are allowed to use scientific calculators to analysis is the data.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-III

**PPL 531**

**Epidemiology and Forecasting of Plant Diseases**

**Time: 3 Hours**

**Max. Marks: 150**

**Theory: 75**

**Practical: 37**

**Internal assessment: 38**

**Periods per week : 04+3**

### **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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### **Theory:**

**Section A:** Epidemic concept and historical development, pathometry and crop growth stages, epidemic growth and analysis.

**Section B:** Common and natural logarithms, function fitting area under disease progress curve and correction factors, inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens.

**Section C:** Survey, surveillance and vigilance, crop loss assessment and models. Principles and pre-requisites of forecasting, systems and factors affecting various components of forecastings, some early forecasting

**Section D:** Procedures based on weather and inoculum potential, modelling disease growth and disease prediction.

**Practical:** Measuring diseases, spore dispersal and trapping, weather recording, survey, multiplication of inoculum, computerized data analysis, function fitting, model preparation and validation.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-III

### Quarantine in Plant Protection

PPL 532

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment: 38

Periods per week : 04+3

#### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

#### Theory:

**Section A:** Definition of pest and pesticides and transgenics as per Govt. notification. Relative importance and quarantine for domestic and international. Quarantine restrictions in the movement of agricultural produce including seeds and planting material. Case histories of exotic pests and diseases and their status.

**Section B:** Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine legislations. PQ Order 2003. Environmental Acts and APEDA. Industrial registration. Import and Export of bio-control agents. Special requirements for biopesticide registration.

**Section C:** Identification of pest and disease free areas. Contamination of food with toxigens of micro-organisms and their elimination. Symptomatic diagnosis and other techniques to detect pest/pathogen infestations.

**Section D:** VHT and other safer techniques of disinfestations and salvaging of infected material. WTO regulations. Non-tariff barriers. Pest risk analysis and good laboratory practices for pesticide laboratories. Pesticide industry. Sanitary and phytosanitary measures.

**Practical:** Identification of pest/disease free areas; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-III

ENT-531

Biological Control of Insect Pests

Time: 3 Hours

Max. Marks: 150

Theory: 75

Practical: 37

Internal assessment=38

Periods per week: 04+3

### 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 15 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory

#### Unit- I

Principles and scope of biological control.

Techniques in biological control-Introduction, Inoculation and Augmentation.

Biology and host seeking behaviour of predatory and parasitic groups (Coleoptera, Hymenoptera, Neuroptera, Reduvid bugs) of insects.

#### Unit- II

Role of insect pathogens (Bt, NPV, Entomopathogenic fungi) and their mode of action. Biological control of weeds using insects.

Techniques for mass production of quality biocontrol agents. Various formulations and economics of bioagents. Field application and evaluation.

#### Unit-III

Analysis of successful biological control projects. Trends and future possibilities of biological control.

#### Unit-IV

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

### Practical:

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

**M.Sc. Ag. (Plant Pathology)**

**SEMESTER-III**

**CREDIT SEMINAR**

**Total Marks: 100**

**Periods per week: 03**



# M.Sc. Ag. (Plant Pathology)

## SEMESTER-IV

PPL 541

Detection and Diagnosis of Plant Diseases

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 25

Internal assessment: 25

Periods per week : 04+3

### 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 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory:

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

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

**Section C:** Microscopic techniques and staining methods, chromatography, phase contrast and electron microscopy, spectrophotometer, ultracentrifuge and electrophoretic apparatus. Serological and molecular techniques for detection of plant pathogens.

**Section D:** Evaluation of fungicides and bactericides. Data collection and preparation of reports.

**Practical:** Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens. Use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida. Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens.

# M.Sc. Ag. (Plant Pathology)

## SEMESTER-IV

PPL 542

Chemicals In Plant Disease Management

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 25

Internal assessment: 25

Periods per week : 04+3

### 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 10 marks (Comprising of 10 short answer type questions covering the whole syllabus) will be compulsory.
4. 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).

### Theory:

**Section A:** History and development of chemicals; definition of pesticides and related terms; advantages and disadvantages of chemicals.

**Section B:** Classification of chemicals used in plant disease control and their characteristics. Chemicals in plant disease control, viz., fungicides, bactericides, nematocides, antiviral chemicals and botanicals.

**Section C:** Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides. Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides.

**Section D:** General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.

### Practical:

Acquaintance with formulation of different fungicides and plant protection appliances. Formulation of fungicides, bactericides and nematocides; in vitro evaluation techniques, preparation of different concentrations of chemicals including botanical pesticides based on active ingredients against pathogens; persistence, compatibility with other agro-chemicals; detection of naturally occurring fungicide resistant mutants of pathogen; methods of application of chemicals.

**M.Sc. Ag. (Plant Pathology)**

**SEMESTER-IV**

**RESEARCH WORK**

**S/US**

**Periods per week: 04**