DAV UNIVERSITY JALANDHAR

FACULTY OF AGRICULTURAL SCIENCES

COURSE CURRICULUM

FOR

M.Sc. Ag. (Plant Pathology)

1st to 4th SEMESTER

Examinations 2023-2024 session onwards

Applicable for admissions in 2023

M. Sc (Agriculture) Plant Pathology

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEO1: To encourage students to be creative and innovative to meet the needs of agro based industry by providing a dynamic learning environment

PEO2: To develop competent human resource in teaching and research in crop production, crop improvement, plant protection and marketing to meet national and global challenges

PEO3: Developing entrepreneurial skills in students to be 'Job providers rather than Job seekers

PEO4: To develop skills of ethical integrity and professional engagement among students to be the voice of farmers and represent them in various national and international forums

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: Enable students to develop skills to be the leaders of agro industry

PSO2: To be conversant with the latest state of the art innovations in agricultural sciences

PSO3: Students acquire skills in subsidiary agriculture occupations like dairy, bee keeping, mushroom cultivation and organic farming etc.

PSO4: In-depth knowledge of agriculture and skills to solve the problems of farming community enable students to be a good policy maker by framing policies for the upliftment of farmers

Program Outcomes (POs)

After successful completion of the program, the students will be able to:

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity cantered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Outline of the Courses

<table>
<tr><td>Course Code</td><td colspan="7">AGS650</td></tr>
<tr><td>Course Title</td><td colspan="7">Mycology</td></tr>
<tr><td>Hours</td><td colspan="7">45 L:2, T:0, P:2</td></tr>
<tr><td>Credits</td><td colspan="7">3</td></tr>
<tr><td>Type</td><td colspan="7">Core Course</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On the completion of the course, the student will gain the following knowledge and skills:
CO1: Understand the general characteristics and basic concepts of Mycology
CO2: Understand the history of Mycology and the importance of Fungi
CO3: Understand the classification and reproduction in fungi
CO4: Understand the different groups of fungi, variability and symbiotic relations of fungi</td></tr>
<tr><td>Examination Type</td><td colspan="7">Theory + Practical</td></tr>
<tr><td>Assessment Tools</td><td>Written Quiz</td><td>Assignment/Project Work</td><td>MSE</td><td>MSP</td><td>ESE</td><td>ESP</td><td>ABL/PBL</td></tr>
<tr><td>Weightage</td><td>10%</td><td>0</td><td>25%</td><td>0</td><td>35%</td><td>25%</td><td>5%</td></tr>
<tr><td>Syllabus</td><td colspan="6">UNIT I (7 hours)
Introduction to fungi, definition of different terms, characters and basic concepts.</td><td>CO1</td></tr>
<tr><td></td><td colspan="6">UNIT II (8 hours)
Importance of mycology in agriculture. Importance of fungi and historical background.</td><td>CO2</td></tr>
<tr><td></td><td colspan="6">UNIT III: (10 hours)
Concepts of nomenclature and classification, fungal biodiversity and reproduction in fungi.</td><td>CO3</td></tr>
<tr><td></td><td colspan="6">UNIT IV (5 hours)
The comparative morphology, ultrastructure, characters of different groups of fungi up togeneric level, Classification of fungi. Lichens and variability in fungi.</td><td>CO4</td></tr>
</table>

	Practical (15 hours) Detailed comparative study of different groups of fungi; collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.	

Reference Books:

1. Ainsworth GC, Sparrow FK & Susman HS. 1973. The Fungi – An AdvancedTreatise. Vol. IV (A & B). Academic Press, New York.
2. Alexopoulos CJ, Mims CW & Blackwell M.2000. Introductory Mycology.5th Ed.John Wiley & Sons, New York.
3. Mehrotra RS & Arneja KR. 1990. An Introductory Mycology. Wiley Eastern, NewDelhi.
4. Singh RS. 1982. Plant Pathogens – The Fungi. Oxford &IBH, New Delhi.

Course Code	**AGS651**						
Course Title	Plant Bacteriology						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understanding about phytopathogenic bacteria, major events in history of Plant Bacteriology, their classification and important diseases caused by the phytopathogenic bacteria CO2: Learn about growth, nutrition and reproduction in phytopathogenic bacteria and different methods of their preservation CO3: Learn about bacteriophages, L-form bacteria, bdellovibrios and role of antibiotics and mode of action in management of phytopathogenic bacteria CO4: Learn about the different modes of survival and dissemination/spread in phytopathogenic bacteria						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (10 hours)** History and introduction to phytopathogenic bacteria, MLOs, Spiroplasma and other fastidious prokarya. Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic bacteria and important diseases caused by them						**CO1**
	UNIT II (10 hours) Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic bacteria.						**CO2**
	Unit III: (5 hours)						**CO3**

	General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic ihibs and their mode of action against phytopathogenic bacteria	
	UNIT IV (5 hours) Survival and dissemination of phytopathogenic bacteria.	**CO4**
	Practical (15 hours) Isolation, purification, identification and host inoculation of phytopathogenic bacteria, staining methods, biochemical and serological characterization, isolation of plasmid and use of antibacterial chemicals/antibiotics.	

Reference Books:

1. Jayaraman J and Verma JP. 2002. Fundamentals of Plant Bacteriology. KalyaniPubl., Ludhiana.
2. Verma JP 1998 The Bacteria, MPH Publishing, New Delhi
3. Kalyan K Mondal 2011 Plant Bacteriology, Kalyani Publishers, Ludhiana

<table>
<tr><td>Course Code</td><td colspan="7">AGS652</td></tr>
<tr><td>Course Title</td><td colspan="7">Principles of Plant Pathology</td></tr>
<tr><td>Hours</td><td colspan="7">45 L:3, T:0, P:0</td></tr>
<tr><td>Credits</td><td colspan="7">3</td></tr>
<tr><td>Type</td><td colspan="7">Core Course</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">CO1: Learn about basic concepts in Plant Pathology, historical developments and growth in the field of Plant Pathology, components of disease and classification of plant diseases

CO2: Learn about pathogenesis and steps involved in it and role of environment and host nutrition on disease development

CO3: Learn about host-parasite interactions and mechanism of infection mediated by toxins, enzymes, growth regulators and defense strategies involving structural and induced defenses employed against them

CO4: Learn about the genetic basis of disease resistance, role of R genes, genetic engineering and disease management strategies</td></tr>
<tr><td>Examination Type</td><td colspan="7">Theory + Practical</td></tr>
<tr><td>Assessment Tools</td><td>Written Quiz</td><td>Assignment/Project Work</td><td>MSE</td><td>MSP</td><td>ESE</td><td>ESP</td><td>ABL/PBL</td></tr>
<tr><td>Weightage</td><td>10%</td><td>10%</td><td>25%</td><td>0</td><td>50%</td><td>0</td><td>5%</td></tr>
<tr><td>Syllabus</td><td colspan="6">UNIT I (10 hours)
Importance, definitions and concepts of plant disease, history and growth of plant pathology, biotic and abiotic causes and classification of plant diseases.</td><td>CO1</td></tr>
<tr><td></td><td colspan="6">UNIT II (15 hours)
Pathogenesis-survival, growth, reproduction and disposal of important plant pathogens, role of environment and host nutrition on disease development</td><td>CO2</td></tr>
<tr><td></td><td colspan="6">Unit III: (10 hours)
Host parasite interactions, recognition concept and infection, symptomatology, mechanism of infection-</td><td>CO3</td></tr>
</table>

	role of enzymes, toxins, growth regulators, defense strategies- oxidative burst, phenolics, phytoalexins, PR proteins, elicitors, altered plant metabolism as affected by plant pathogens.	
	UNIT IV (10 hours) Genetics of resistance, 'R' genes, mechanism of genetic variation in pathogens, molecular basis for resistance, marker assisted selection, genetic engineering for disease resistance, disease management strategies.	**CO4**

Reference Books:

1. Agrios GN 2005 Plant Pathology 5th edition Academic Press New York
2. Mehrotra RS and Aggarwal A 2003 Plant Pathology 2nd edition Oxford and IBH, New Delhi
3. Singh RS 2002 Introduction to Principles of Plant Pathology Oxford and IBH, New Delhi

Course Code	**AGS653**						
Course Title	Mushroom production technology						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand the classification of mushroom and spawn production **CO2:** To understand substrate preparation, composting and casing methodologies **CO3:** To understand setting-up a mushroom farm **CO4:** To understand various diseases/pests and economics of mushroom production						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (10 hours)** Historical development of mushroom cultivation and present status, taxonomy, classification, uses of mushrooms, edible and poisonous mushrooms. Maintenance of pure culture, preparation of spawn and facilities required for establishing commercial spawn laboratory and strain improvement.						**CO1**
	UNIT II (5 hours) Preparation of substrate for mushroom cultivation, long, short and indoor composting methods, formulae for different composts and their computation, qualities and testing of compost, uses of spent mushroom compost/substrate, spawning and spawn						**CO2**

	run, casingpreparation and its application.	
	Unit III (10 hours) Setting up mushroom farm for seasonal and environmentally control cultivation, requirement and maintenance of temperature, relative humidity, CO2, ventilation in cropping rooms, cultivation technology of *Agaricus bisporus, Pleurotus* sp., *Calocybe indica, Lentinus edodes* and *Ganoderma lucidum.*	**CO3**
	UNIT IV (5 hours) Insect pests, diseases and abnormalities of cultivated mushroom and their management, post-harvest processing and value addition, economics of mushroom cultivation, biotechnology and mushroom cultivation.	**CO4**
	Practical (15 hours) Preparation of spawn, compost, spawning, casing, harvesting and postharvest handling of edible mushroom; identification of various pathogens, competitors of various mushroom.	

Reference Books:

1. Suman, B. C. and Sharma, V. P.2007. Mushroom Cultivation in India. Daya Publishing House, New Delhi.
2. Pandey R.K. and Ghosh S. K. 1999. A Handbook of Mushroom Cultivation. Emkay Publications, New Delhi.

Course Code	**AGS654**						
Course Title	**Post-harvest Diseases**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand the nature of post-harvest diseases and their management using plant extracts **CO2:** To understand the types of post-harvest diseases due to biotic and abiotic causes and their management **CO3:** To understand factors affecting post-harvest diseases and isolation/characterization of post-harvest pathogens **CO4:** To understand integrated approach in managing post-harvest diseases and health hazards associated with post-harvest diseases/mycotoxins						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (5 hours)** Concept of post-harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as preharvest and post-harvest, merits and demerits of biological/ phytoextracts in controlling post-harvest diseases.						**CO1**
	UNIT II (5 hours) Types of post-harvest problems both by biotic and abiotic causes, rhizosphere colonization, competitive, saprophytic ability, antibiosis, induced resistance, microbial associations, concept, operational mechanisms and its relevance in control.						**CO2**

	Unit III (15 hours) Factors governing post-harvest problems both as biotic and abiotic, role of physical environment, agro-ecosystem leading to quiescent infection, operational mechanisms and cultural practices in perpetuation of pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post-harvest diseases, comparative approaches to control plant pathogens by resident and introduced antagonists. Isolation, characterization and maintenance of pathogens, role of different storage.	**CO3**
	UNIT IV (5 hours) Integrated approach in controlling diseases and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentarius for each product and commodity.	**CO4**
	Practical (15 hours) Isolation, characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions. Comparative efficacy of different chemicals, fungicides, phytoextracts and bioagents.	

Reference Books:

1. Pathak VN. 1970. Diseases of Fruit Crops and their Control. IBH Publ., New Delhi.
2. Chaddha KL & Pareek OP. 1992. Advances in Horticulture Vol. IV, Malhotra Publ.House, New Delhi.

Course Code	**AGS655**						
Course Title	**Diseases of fruits, plantation and ornamental crops**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand the symptoms, epidemiology and management of temperate fruits, citrus and mango **CO2:** To understand the symptoms, epidemiology and management of tropical and sub-tropical fruits **CO3:** To understand the symptoms, epidemiology and management of plantation crops **CO4:** To understand the symptoms, epidemiology and management of ornamental crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (15 hours)** Introduction, symptoms, etiology, epidemiology and management of different diseases of fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus and mango						**CO1**
	UNIT II (5 hours) Introduction, symptoms, etiology, epidemiology and management of different diseases offruits like grapes, guava, *ber*, banana, pineapple, papaya, fig, pomegranate, date palm						**CO2**
	UNIT III (5 hours)						**CO3**

	Introduction, symptoms, etiology, epidemiology and management of different diseases of plantation crops such as tea, coffee, rubber and coconut;	
	UNIT IV (5 hours) Introduction, symptoms, etiology, epidemiology and management of different diseases of ornamental plants such as roses, gladiolus, tulip, carnation, orchids, marigold, chrysanthemum.	**CO4**
	Practical (15 hours) Detailed study of symptoms and host parasite relationship of representativediseases of plantation crops. Collection and dry preservation of diseased specimens ofimportant crops.	

Reference Books:

1. Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, NewDelhi.
2. Singh RS. 2007. Plant Diseases. 8th Ed. Oxford &IBH, New Delhi.

Course Code	**AGS656**						
Course Title	**Diseases of vegetable and spice crops**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand nature, symptoms, epidemiology and management of diseases of bulb crops, leafy vegetables and crucifers **CO2:** To know about nature, symptoms, epidemiology and management of diseases of cucurbits and solanaceous vegetable crops **CO3:** To learn about nature, symptoms, epidemiology and management of diseases of vegetable crops under protected cultivation **CO4:** To learn about nature, symptoms, epidemiology and management of major spice crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (5 hours)** Nature, prevalence, symptoms, factors affecting disease development and management of bulb crops, leafy vegetables and crucifers						**CO1**
	UNIT II (10 hours) Nature, prevalence, symptoms, factors affecting disease development and management ofcucurbits and solanaceous vegetables.						**CO2**
	UNIT III (10 hours) Nature, prevalence, symptoms, factors affecting disease development and management under protected cultivation						**CO3**

	UNIT IV (5 hours) Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger.	**CO4**
	Practical (15 hours) Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.	

Reference Books:

1. Singh RS. 1999. Diseases of Vegetable Crops. Oxford & IBH, New Delhi.
2. Gupta SK and Thind TS. 2006. Disease Problem in Vegetable Production. Scientific Publ., Jodhpur.
3. Gupta VK and Paul YS. 2001. Diseases of vegetable crops. Kalyani Publishers, Ludhiana

Course Code	**AGS657**						
Course Title	**Diseases of Field and Medicinal crops**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand nature, symptoms, epidemiology and management of diseases of cereal and pulses crops **CO2:** To know about nature, symptoms, epidemiology and management of diseases of oilseed and cash crops **CO3:** To learn about nature, symptoms, epidemiology and management of diseases of fodder and legume crops **CO4:** To learn about nature, symptoms, epidemiology and management of medicinal crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (10 hours)** Diseases of Cereal and Pulse crops- wheat, barley, rice, pearl millet, sorghum, maize, gram, common bean, urd bean, mung bean, lentil, pigeon pea and soybean.						**CO1**
	UNIT II (10hours) Diseases of Oilseed and Cash crops- rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor, cotton and sugarcane.						**CO2**
	Unit III (5 hours) Diseases of Fodder legume crops- berseem, oats, guar, lucerne, cowpea						**CO3**

	UNIT IV (5 hours) Medicinal crops- plantago, liquorice, mulathi, sacred basil, mentha, ashwagandha, *Aloe vera.*	**CO4**
	Practical (15 hours) 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.	

Reference Books:

1. Joshi LM, Singh DV & Srivastava KD. 1984. Problems and Progress of WheatPathology in South Asia. Malhotra Publ. House, New Delhi.
2. Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, N Delhi.
3. Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. Diseases of Sugarcane,Major Diseases. Academic Press, New York.
4. Singh RS. 2007. Plant Diseases. 8th Ed. Oxford &IBH, New Delhi

Course Code	**AGS658**						
Course Title	**Plant Quarantine**						
Hours	30 L:2, T:0, P:0						
Credits	2						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand the history of plant quarantine regulations (domestic and international) **CO2:** To understand various legislations, acts and orders related to quarantine, transgenics and pesticides **CO3:** To understand symptomatic diagnosis and safer method of disinfection of plant commodities **CO4:** To understand WTO regulations, PRA, sanitary and phytosanitary methods						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Syllabus	**UNIT I (10 hours)** Definition of pest, pesticides and transgenics as per Govt. notification; relative importance; quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status.						**CO1**
	UNIT II (10 hours) Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control agents.						**CO2**

	Unit III (5 hours) Identification of pest/disease free areas; contamination of food with Toxigens and microorganisms, and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations; VHT and other safer techniques of disinfestation/salvaging of infected material.	**CO3**
	UNIT IV (5 hours) WTO regulations; non-tariff barriers; Pest Risk Analysis (PRA), good practices for pesticide laboratories; pesticide industry; Sanitary and Phytosanitary measures.	**CO4**

Reference Books:

1. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
2. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.

Course Code	**AGS659**						
Course Title	Biological control of plant diseases						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand the history, importance and merits/demerits of biological control **CO2:** To understand various mechanisms of biological control **CO3:** To understand different types of BCAs, compatibility of bioagents and factors affecting biological control **CO4:** To understand mass multiplication of BCAs, their role in IDM, delivery system and quality control						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (8 hours)** Concept of biological control, definitions, importance, principles of plant disease management with bio-agents, history of biological control, merits and demerits of biological control.						**CO1**
	UNIT II (10 hours) Types of biological interactions, competition, mycoparasitism, exploitation for hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis, inducedresistance, mycorrhizal associations, operational mechanisms and its relevance in biological control.						**CO2**
	Unit III (8 hours)						**CO3**

	Factors governing biological control, role of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens, pathogens and antagonists and their relationship, biocontrol agents, comparative approaches to biological control of plant pathogens by resident and introduced antagonists, control of soil- borne and foliar diseases. Compatibility of different bioagents.	
	UNIT IV (4 hours) Commercial production of antagonists-mass multiplication and preparation of formulation, their delivery systems, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market. Quality control system of biocontrol agents.	**CO4**
	Practical (15 hours) Isolation, characterization and maintenance of antagonists, methods of study of mechanisms of antagonism *in vitro*, application of antagonists against pathogen *in vivo* conditions. Enumeration of antagonists	

Reference Books:

1. Campbell R. 1989. Biological Control of Microbial Plant Pathogens. CambridgeUniv. Press, Cambridge.
2. Cook RJ & Baker KF. 1983. Nature and Practice of Biological Control of Plant Pathogens. APS, St. Paul, Mennisota.

Course Code	**AGS660**						
Course Title	**Principles of Plant Disease Management**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To understand various mechanisms of plant disease management **CO2:** To understand different types of chemical plant protectants, their formulations and adjuvants used **CO3:** To know the history of the development of various chemical plant protectants **CO4:** To understand nature, properties and mode of action of various antimicrobial chemicals						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (10 hours)** Principles of plant disease management through cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures (IDM- module) of plant diseases. Disease resistance and molecular approach for disease management.						**CO1**
	UNIT II (7 hours) Foliage, seed and soil application of chemicals, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures.						**CO2**
	Unit III (8 hours) History of fungicides, bactericides, antibiotics, concepts of						**CO3**

	pathogen, immobilization, chemical protection and chemotherapy	
	UNIT IV (5 hours) Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.	**CO4**
	Practical (15 hours) *In vitro* and *in vivo* evaluation of chemicals against plant pathogens; ED and MICvalues, study of structural details of sprayers and dusters.	

Reference Books:

1. Fry WE. 1982. Principles of Plant Disease Management. Academic Press, NewYork.
2. Hewitt HG. 1998. Fungicides in Crop Protection. CABI, Wallington. 3.Marsh RW. 1972. Systemic Fungicides. Longman, New York.
3. Nene YL & Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford &IBH, NDelhi. Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer-Verlag,New York

Course Code	**AGS661**						
Course Title	Plant Virology						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Learn about plant viruses, their transmission, architecture and historical events in development of field of Plant Virology **CO2:** Learn about viroids, phages and virus replication, classification, purification, serological and molecular diagnostics of plant viruses **CO3:** Learn about mycoviruses, Baculoviruses and working of electron microscope **CO4:** Learn about resistance and genetic engineering in management of plant viruses						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**UNIT I (10 hours)** History of plant virology, composition and structure of viruses. Symptomatology of important plant viral diseases, transmission, chemical and physical properties, virus-host interaction, virus-vector relationship.						**CO1**
	UNIT II (10 hours) Virus nomenclature and classification, genome organization, replication and movement of viruses. Virus isolation and purification, electron microscopy, protein and nucleic acid-based diagnosis						**CO2**

	Unit III (5 hours) Mycoviruses, phytoplasma, arbo and baculoviruses, satellite viruses, satellite RNAs, phages,viroids, prions. Principles of the working of electron-microscope and ultra-microtome.	**CO3**
	UNIT IV (5 hours) Virus origin and evolution, mechanism of resistance, genetic engineering, ecology, and management of plant viruses.	**CO4**
	Practical (15 hours) Study of symptoms caused by viruses, transmission, assay of viruses, physical properties, purification, method of raising antisera, serological tests, electron microscopy, PCR.	

Reference Books:

1) Bos L. 1964. Symptoms of Virus Diseases in Plants. Oxford &IBH., New Delhi.
2) Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ & Watson L. 1995 Virus ofPlants: Descriptions and Lists from VIDE Database. CABI, Wallington
3) Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold,London

Course Code	**AGS663**						
Course Title	**Seed health technology**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Learn about history and economic importance of seed pathology **CO2:** Learn about recent advances in seed transmission of plant diseases **CO3:** Learn about seed-borne diseases, seed certification and epidemiological factors influencing transmission of seed borne diseases **CO4:** Learn about production of toxic metabolites in seeds and its impact on human/plant health, seed health testing methods						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Syllabus	**UNIT I (8 hours)** History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.						**CO1**
	UNIT II (5 hours) Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens.						**CO2**
	Unit III (10 hours) Seed certification and tolerance limits, types of losses caused						**CO3**

	by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection.	
	UNIT IV (6 hours) Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.	**CO4**
	Practical (15 hours) Conventional and advanced techniques in the detection and identification of seed-borne fungi, bacteria and viruses. Relationship between seed-borne infection and expression of the disease in the field.	

Reference Books:

1. Agarwal VK & JB Sinclair. 1993. Principles of Seed Pathology. Vols. I & II, CBSPubl., New Delhi.
2. Hutchins JD & Reeves JE. (Eds.). 1997. Seed Health Testing: Progress Towards the21st Century. CABI, Wallington.
3. Paul Neergaard. 1988. Seed Pathology. MacMillan, London.
4. Suryanarayana D. 1978. Seed Pathology. Vikash Publ., New Delhi.

Course Code	**AGS662**						
Course Title	**Detection and Diagnosis of Plant Pathogens**						
Hours	35 L:0, T:0, P:2						
Credits	2						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Learn about different pure culture techniques and use of different media for isolation of pathogens and proving pathogenicity by Koch Postulates **CO2:** Learn about preservation techniques of diseased specimens, use of different laboratory equipment's for disease management **CO3:** Learn about techniques of microscopic characterization of pathogens, types of microscopes and serological and molecular diagnostics for detection of pathogen **CO4:** Learn about techniques for checking efficacy of plant protectants, laying out of filed experiments, data collection and preparation of references etc.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Syllabus	**UNIT I (15 hours)** Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.						**CO1**
	UNIT II (5 hours) Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.						**CO2**
	UNIT III (10 hours) Microscopic techniques and staining methods, phase contrast						**CO3**

	system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge, DNA isolation, electrophoresis, disease diagnostics, serological and molecular techniques for detection of plant pathogens, Basic local alignment search tool.	
	UNIT IV (5 hours) Evaluation of fungicides, bactericides etc., field experiments, data collection and preparationof references.	**CO4**

Reference Books:

1. Baudoin ABAM, Hooper G R, Mathre D E & Carroll R B. 1990. LaboratoryExercises in Plant Pathology: An Instructional Kit. Scientific Publ., Jodhpur.
2. Dhingra O D & Sinclair J B. 1986. Basic Plant Pathology Methods. CRC Press,London, Tokyo.
3. Fox R T V. 1993. Principles of Diagnostic Techniques in Plant Pathology. CABI Wallington.

Course Code	**AGS664**						
Course Title	**Phytonematology**						
Hours	30 L:1, T:0, P:1						
Credits	2						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the general morphology and anatomy of plant parasitic nematodes **CO2:** Understand the classification of plant parasitic nematodes **CO3:** Understand the various types of diseases caused by plant parasitic nematodes **CO4:** Understand various methods used for management of plant parasitic nematodes						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Syllabus	**UNIT I (6 hours)** History, morphology and anatomy of body wall, digestive, reproductive, excretory andnervous system; body cavity						**CO1**
	UNIT II (5 hours) Taxonomic concepts, classification with emphasis on Phyto nematodes, nematological techniques						**CO2**
	UNIT III (4 hours) Nematodes as pests of crops, nematode ecology and disease compels; nematode biology andphysiology;						**CO3**
	UNIT IV (3 hours) Different methods of nematode management.						**CO4**

	Practical (12 hours) Sampling and extraction techniques for endo and ecto-parasitic nematodes; counting estimation of soil populations; killing; fixing and preserving, preparing mounts; staining nematode in plant tissues; pathogenicity techniques; morphology studies of different body systems, drawing measurement of nematodes; identification of phyto- parasitic nematodes upto genetic level; familiarity with important nematode diseases and their control.	

Reference Books:

1. Barrington EJW. 1967. Invertebrate Structure and Function. Nelson, Nairobi.
2. Blackwelder RE. 1967. Taxonomy - A Text and Reference Book. John Wiley & Sons, New York.
3. Chen ZX, Chen SY & Dickson DW. 2004. Nematology: Advances and Perspectives.Vol. I. Nematode Morphology, Physiology and Ecology. CABI, Wallingford.

Course Code	**AGS665**						
Course Title	**Insect vectors of plant viruses and other pathogens**						
Hours	30 L:1, T:0, P:1						
Credits	2						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the role of insect vectors, their mouth parts and ecology in relation to disease transmission **CO2:** Understand the transmission of plant viruses and fungal growth **CO3:** Understand the transmission of mycoplasma and bacterial pathogens **CO4:** Understand the epidemiology and management of plant diseases through vector management						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Syllabus	**UNIT I (5 hours)** History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission						**CO1**
	UNIT II (5 hours) Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors. Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.						**CO2**
	UNIT III (4 hours) Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers. Transmission of plant viruses by psyllids, beetles and mites						**CO3**

	UNIT IV (4 hours) Epidemiology and management of insect transmitted diseases through vector management.	**CO4**
	Practical (12 hours) Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; culturing and handling of vectors; demonstration of virus transmission through vectors- aphids, leafhoppers and whiteflies	

Reference Books:

1. Basu AN. 1995. *Bemisia tabaci* (Gennadius) - Crop Pest and Principal WhiteflyViruses. Oxford & IBH, New Delhi.
2. HarrisKF and Maramarosh K. (Eds.). 1980. Vectors of Plant Pathogens. Academic Press, London.
3. Maramorosch K & Harris KF. (Eds.). 1979. Leafhopper Vectors and Plant DiseaseAgents. Academic Press, London.
4. Youdeovei A & Service MW. 1983. Pest and Vector Management in the Tropics.English Language Books Series, Longman, London.

Course Code	**AGS666**						
Course Title	**Chemicals in Plant Disease Management**						
Hours	45 L:2, T:0, P:1						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the history of pesticide development and to understand their classification **CO2:** Understand the role of various chemicals, botanicals and their different formulations in plant disease management **CO3:** Understand the handling, storage and precautions while using fungicides **CO4:** Understand various plant protection appliances and the environmental concern related to use of chemical plant protectants						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**25%**	**35%**	**0**	**5%**
Syllabus	**UNIT I (10 hours)** History and development of chemicals; definition of pesticides and related terms; advantages and disadvantages of chemicals. Classification of chemicals used in plant disease control and their characteristics.						**CO1**
	UNIT II (5 hours) Chemicals in plant disease control, viz., fungicides, bactericides, nematicides, antiviralchemicals and botanicals. Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides.						**CO2**

	UNIT III (10 hours) Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides.	**CO3**
	UNIT IV (5 hours) General account of plant protection appliances; environmental pollution, residues and healthhazards, fungicidal resistance in plant pathogens and its management.	**CO4**
	Practical (15 hours) Acquaintance with formulation of different fungicides and plant protection appliances. Formulation of fungicides, bactericides and nematicides; *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.	

Reference Books

1. Bindra OS & Singh H. 1977. Pesticides - An Application Equipment. Oxford & IBH, NewDelhi.
2. Nene YL &Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd Ed.Oxford &IBH, New Delhi.
3. Torgeson DC (Ed.). 1969. Fungicides. Vol. II. An Advanced Treatise. AcademicPress, New York.
4. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGrawHill, New Delhi.

<table>
<tr><td>Course Code</td><td colspan="7">AGS667</td></tr>
<tr><td>Course Title</td><td colspan="7">Ecology of soil-borne pathogens</td></tr>
<tr><td>Hours</td><td colspan="7">45 L:2, T:0, P:1</td></tr>
<tr><td>Credits</td><td colspan="7">3</td></tr>
<tr><td>Type</td><td colspan="7">Elective Course</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On the completion of the course, the student will gain the following knowledge and skills:
CO1: Understand the importance of soil inhabiting plant pathogens and the importance of rhizosphere
CO2: Understand the role of various biocontrol agents and their types
CO3: Understand the role of inoculum density of the pathogen and various biocontrol mechanisms
CO4: Understand the role of suppressive soils for the management of soil borne pathogens</td></tr>
<tr><td>Examination Type</td><td colspan="7">Theory+ Practical</td></tr>
<tr><td>Assessment Tools</td><td>Written Quiz</td><td>Assignment/Project Work</td><td>MSE</td><td>MSP</td><td>ESE</td><td>ESP</td><td>ABL/PBL</td></tr>
<tr><td>Weightage</td><td>10%</td><td>0</td><td>25%</td><td>25%</td><td>35%</td><td>0</td><td>5%</td></tr>
<tr><td>Syllabus</td><td colspan="6">UNIT I (10 hours)
Soil as an environment for plant pathogens, nature and importance of rhizosphere andrhizoplane, host exudates, soil and root inhabiting fungi.</td><td>CO1</td></tr>
<tr><td></td><td colspan="6">UNIT II (6 hours)
Bio-control agents and their types.</td><td>CO2</td></tr>
<tr><td></td><td colspan="6">UNIT III (10 hours)
Inoculum potential and density in relation to host and soil variables, competition, predation,antibiosis and fungistasis.</td><td>CO3</td></tr>
<tr><td></td><td colspan="6">UNIT IV (4 hours)
Suppressive soils, biological control- concepts and potentialities for managing soil bornepathogens.</td><td>CO4</td></tr>
</table>

	Practical (15 hours) Quantification of rhizosphere and rhizoplane microflora with special emphasis onpathogens; pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in natural soils; suppression of test soil-borne pathogens by antagonistic microorganisms. Isolation and identification of different biocontrol agents.	

Reference Books:

1. Baker KF & Snyder WC. 1965. Ecology of Soil-borne Plant Pathogens. John Wiley,New York.

2. Cook RJ & Baker KF. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.

3. Garret SD. 1970. Pathogenic Root-infecting Fungi. Cambridge Univ. Press,Cambridge, New York.

4. Hillocks RJ & Waller JM. 1997. Soil-borne Diseases of Tropical Crops. CABI, Wallington.

5. Parker CA, Rovira AD, Moore KJ & Wong PTN. (Eds). 1983. Ecology andManagement of Soil-borne Plant Pathogens. APS, St. Paul, Minnesota.

Course Code	**AGS668**						
Course Title	**Disease resistance in plants**						
Hours	30 L:2, T:0, P:0						
Credits	2						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the process of infection and sources of resistance in germplasm **CO2:** Understand the type of resistance, physiological races of pathogens and selection pressure **CO3:** Understand the various types of structural and biochemical defense mechanisms in plants **CO4:** Understand the gene for gene concept and deployment of resistance genes for plant disease management						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Syllabus	**UNIT I (10 hours)** Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centers as sources of resistance, disease resistance terminology.						**CO1**
	UNIT II (5 hours) Disease escapes, disease tolerance, disease resistance, types of resistance, identification of physiological races of pathogens, disease progression in relation to resistance, stabilizing selection pressure in plant pathogens						**CO2**
	UNIT III (5 hours) Host defense system, morphological and anatomical resistance, preformed chemicals in host defense, post infection chemicals						**CO3**

	in host defense, phytoalexins, hypersensitivity and its mechanisms.	
	UNIT IV (10 hours) Gene-for-gene concept, protein-for-protein and immunization basis, management ofresistance genes. Strategies for gene deployment.	**CO4**

Reference Books:

1. Deverall BJ. 1977. Defence Mechanisms in Plants. Cambridge Univ. Press, Cambridge, New York.
2. Mills Dallice et al. 1996. Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction. APS, St Paul, Minnesota.
3. Parker J. 2008. Molecular Aspects of Plant Diseases Resistance. Blackwell Publ. 4. Robinson RA. 1976. Plant Pathosystems. Springer Verlag, New York.
5. Singh BD. 2005. Plant Breeding – Principles and Methods. 7th Ed. Kalyani Publ., Ludhiana
6. Van der Plank JE. 1975. Principles of Plant Infection. Academic Press, New York.
7. Van der Plank JE. 1978. Genetic and Molecular Basis of Plant Pathogenesis.Springer Verlag. New York.

Course Code	**AGS669**						
Course Title	**Epidemiology and forecasting of plant diseases**						
Hours	45 L:2, T:0, P:2						
Credits	3						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the development of epidemics and their importance from historic perspective **CO2:** Understand the mathematical models in plant disease epidemiology **CO3:** To asses crop losses and understand the role of surveillance in minimizing the probability of epidemics **CO4:** Understand the importance of plant disease forecasting for minimizing epidemic spread						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**25%**	**35%**	**0**	**5%**
Syllabus	**UNIT I (10 hours)** Epidemic concept and historical development, pathometry and crop growth stages, epidemic and analysis.						**CO1**
	UNIT II (5 hours) 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.						**CO2**
	UNIT III (5 hours) Survey, surveillance and vigilance, crop loss assessment and models for prediction of crop losses.						**CO3**
	UNIT IV (10 hours)						**CO4**

	Principles and pre-requisites of forecasting, systems and factors affecting various components of forecastings, some early forecasting, and procedures based on weather and inoculum potential, modeling disease growth and disease prediction.	
	Practical (10 hours) Measuring diseases, spore dispersal and trapping, weather recording, survey, multiplication of inoculum, computerized data analysis, function fitting, model preparation and validation.	

Reference Books:

1. Campbell CL & Madden LV. 1990. Introduction to Plant Disease Epidemiology.John Wiley & Sons. New York
2. Cowling EB & Horsefall JG. 1978. Plant Disease. Vol. II. Academic Press, NewYork.
3. Laurence VM, Gareth H & Frame Van den Bosch (Eds.). The Study of PlantDisease Epidemics. APS, St. Paul, Minnesota.
4. Nagarajan S & Murlidharan K. 1995. Dynamics of Plant Diseases. Allied Publ., NewDelhi.
5. Thresh JM. 2006. Plant Virus Epidemiology. Advances in Virus Research 67, Academic Press, New York.
6. Van der Plank JE. 1963. Plant Diseases Epidemics and Control. Academic Press,New York.
7. Zadoks JC & Schein RD. 1979. Epidemiology and Plant Disease Management.Oxford Univ. Press, London.

<table>
<tr><td>Course Code</td><td colspan="7">AGS670</td></tr>
<tr><td>Course Title</td><td colspan="7">Integrated disease management</td></tr>
<tr><td>Hours</td><td colspan="7">45 L:2, T:0, P:2</td></tr>
<tr><td>Credits</td><td colspan="7">3</td></tr>
<tr><td>Type</td><td colspan="7">Interdepartmental elective Course</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">On the completion of the course, the student will gain the following knowledge and skills:
CO1: Understand the concepts and tools of plant disease management
CO2: Understand the various components of integrated plant disease management
CO3: Understand the development of IDM modules
CO4: Understand the importance of IDM in management of diseases in different crops</td></tr>
<tr><td>Examination Type</td><td colspan="7">Theory+ Practical</td></tr>
<tr><td>Assessment Tools</td><td>Written Quiz</td><td>Assignment/Project Work</td><td>MSE</td><td>MSP</td><td>ESE</td><td>ESP</td><td>ABL/PBL</td></tr>
<tr><td>Weightage</td><td>10%</td><td>0</td><td>25%</td><td>25%</td><td>35%</td><td>0</td><td>5%</td></tr>
<tr><td>Syllabus</td><td colspan="6">UNIT I (10 hours)
Introduction, definition, concept and tools of disease management</td><td>CO1</td></tr>
<tr><td></td><td colspan="6">UNIT II (10 hours)
Components of integrated disease management- their limitations and implications.</td><td>CO2</td></tr>
<tr><td></td><td colspan="6">UNIT III (6 hours)
Development of IDM- basic principles, biological, chemical and cultural diseasemanagement.</td><td>CO3</td></tr>
<tr><td></td><td colspan="6">UNIT IV (4 hours)
IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard,pearl millet, kharif pulses, vegetable crops and fruit crops.</td><td>CO4</td></tr>
</table>

	Practical (15 hours) Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM; demonstration of IDM in certain crops as project work.	

Reference Books:

1. Gupta VK& Sharma RC. (Eds). 1995. Integrated Disease Management and PlantHealth. Scientific Publ., Jodhpur.

2. Mayee CD, Manoharachary C, Tilak KVBR, Mukadam DS & Deshpande Jayashree (Eds.). 2004. Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publ. House, New Delhi.

3. Sharma RC & Sharma JN. (Eds). 1995. Integrated Plant Disease Management. Scientific Publ., Jodhpur.

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