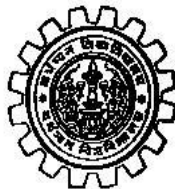


THE UNIVERSITY OF BURDWAN



Curriculum and syllabus for 3- yr. B.Sc. General

in

Plant Protection

Under Choice Based Credit System (CBCS)

(w.e.f. Academic Year 2017-2018)

DETAILS OF COURSES

Core Courses:- Plant Protection

- 1A. Pests and Vectors:
- 1B. Pest Management:
- 1C. Bionomics, plant diseases and their Management:
- 1D. Plant's Defence Mechanism:

Discipline specific Electives (Plant protection):

DSE-1A

- 1. Integrated Pest Management.
- or

- 2. Seed Pathology and Seed treatment.

DSE-1B

- 1. Biotechnology in plant Protection.
- or

- 2. Dissertation.

Ability Enhancement compulsory course:

- 1. Environmental studies.
- 2. communicative English/ MIL.

Skill Enhancement courses (Plant Protection):

SEC-1

- 1. Green Pesticides.
- or
- 2. Vermiculture

SEC-2

- 1. Formulation and application of pesticides and their precautions
- or
- 2. Pest survey and surveillance

SEC-3

- 1. Biological Control
- or
- 2. Remote sensing techniques in plant protection

SEC-4

- 1. Pesticide applications equipments
- or
- 2. Plant growth promoting microorganisms (PGPM)

Scheme for Choice Based Credit System in B.Sc. with Plant Protection:

Semester	Core Course (12)	Ability Enhancement compulsory course (AECC) (2)	Skill enhancement course (SEC) (2)	Discipline specific elective DSE (6)
SEM-I	Discipline 1 (Plant Protection) CC 1A: Pests and Vectors Discipline 2 (other) CC 2A: Discipline 3 (other) CC 3A:	Environmental Studies (ENVS)		
SEM-II	Discipline 1 (Plant Protection) CC 1B: Pests management Discipline 2 (other) CC 2B: Discipline 3 (other) CC 3B:	Communicative English /MIL		
SEM-III	Discipline 1 (Plant Protection) CC 1C: Bionomics, Plant Diseases and their Management Discipline 2 (other) CC 2C : Discipline 3 (other) CC 3C:		SEC-1	
SEM-IV	Discipline 1 (Plant Protection) CC 1D: Plant's defence Mechanism Discipline 2 (other) CC 2D: Discipline 3 (other) CC 3D:		SEC-2	
SEM-V			SEC-3	DSE- 1A: (Plant Protection) : Integrated Pest Management/ Seed Pathology and Seed Treatment DSE – 2A (other) DSE – 3A (other)
SEM-VI			SEC-4	DSE – 1B : (Plant Protection) : Biotechnology in Plant Protection/ Dissertation DSE - 2B (other) DSE- 3B (other)

CREDIT DISTRIBUTION:

SEMESTER	COURSE OPTED	COURSE NAME	CREDIT	
SEM-I CREDIT 22	AECC-I	ENVS	4	
	Discipline 1 : (Plant Protection) (CC-1A Th)	Pests and vectors-Theory	4	
	Discipline 1 : (Plant Protection) CC-1A (PR)	Pests and vectors-Practical	2	
	Discipline -2 (OTHER) CC-2A (TH)	TH	4	
	Discipline 2 : (OTHER) CC-2A PR	PR	2	
	Discipline -3 : (OTHER) CC-3A TH	TH	4	
	Discipline -3 : (OTHER) CC-3A PR	PR	2	
	AECC-II	Communicative English/MIL	2	
SEM-II CREDIT 20	Discipline 1 : (Plant Protection) CC-1B (TH)	Pest management- Theory	4	
	Discipline 1: (Plant Protection) CC-1B (PR)	Pest management – Practical	2	
	Discipline -2 : (OTHER) CC-2B (TH)	TH	4	
	Discipline 2 : (OTHER) CC-2B PR	PR	2	
	Discipline -3 : (OTHER) CC-3B TH	TH	4	
	Discipline -3 : (OTHER) CC-3B PR	PR	2	
	SEM-III CREDIT 20	Discipline 1 : (Plant Protection) CC-1C (TH)	Bionomics, Plant diseases and their Management -Theory	4
		Discipline 1: (Plant Protection) CC-1C (PR)	Bionomics, Plant diseases and their Management- Practical	2
Discipline -2 : (OTHER) CC-2C (TH)		TH	4	
Discipline 2 : (OTHER) CC-2C PR		PR	2	
Discipline -3 : (OTHER) CC-3C TH		TH	4	
Discipline -3 : (OTHER) CC-3C PR		PR	2	
Skill Enhancement Course-I		SEC-1	2	

SEM-IV CREDIT 20	Discipline 1 : (Plant Protection) CC-1D (TH)	Plants' Defence Mechanisms- Theory	4
	Discipline 1 : (Plant Protection) CC-1D (PR)	Plants' Defence Mechanisms- PRACT	2
	Discipline -2 : (OTHER) CC-2D (TH)	TH	4
	Discipline 2 : (OTHER) CC-2D PR	PR	2
	Discipline -3 : (OTHER) CC-3D TH	TH	4
	Discipline -3 : (OTHER) CC-3D PR	PR	2
	Skill Enhancement Course-2	SEC-2	2
SEM-V CREDIT 20	Skill Enhancement Course-3	SEC-3	2
	Discipline specific Elective (DSE) PLANT PROTECTION THEORY	DSE - 1A Plant Protection Theory	4
	Discipline specific Elective (DSE) PLANT PROTECTION PRACTICAL	DSE- 1A Plant Protection Practical	2
	Discipline specific Elective (DSE) OTHER	DSE (2A) OTHER Theory	4
	Discipline specific Elective (DSE) OTHER	DSE (2A) OTHER Practical	2
	Discipline specific Elective (DSE) OTHER	DSE (3A) OTHER Theory	4
	Discipline specific Elective (DSE) OTHER	DSE (3A) OTHER Practical	2
SEM-VI CREDIT 20	Skill Enhancement Course-4	SEC-4	2
	Discipline Specific Elective (DSE) PLANT PROTECTION THEORY	DSE (1B) Plant Protection Theory	4
	Discipline specific Elective (DSE) PLANT PROTECTION PRACTICAL	DSE (1B) Plant Protection Practical	2
	Discipline specific Elective (DSE) OTHER	DSE (2B) OTHER Theory	4
	Discipline specific Elective (DSE) OTHER	DSE (2B) OTHER Practical	2
	Discipline specific Elective (DSE) OTHER	DSE (3B) OTHER Theory	4
	Discipline specific Elective DSE(3)- OTHER	DSE (3B) OTHER Practical	2
TOTAL			122

Semester I

Core Course (CC – 1A) : Pests and Vectors

Credits: 6 (Theory- 4, Practical -2)

Lectures: 60

THEORY

Unit 1: Pest- Comprehensive definition.

Categories of pests: Pathogenic, Competitive, Regular, Sporadic with examples and their corresponding vectors. **(5 lectures)**

Unit 2: Characteristics of following pests.

Protozoans, Nematodes, Mites, Insects, Molluscs, Birds, Rodents. **(8 lectures)**

Unit 3: Locust

Migration of Locust, Phase Theory, Origin of New Locust Cycle, nature of damage and management. **(5 lectures)**

Unit 4: Classification of Plant Disease

Brief account of bacteria and like organism, fungi and like organism, algae and angiosperms, disease triangle, viroids and molecutes. **(10 lectures)**

Unit 5: Dissemination of plant pathogen, soil borne, seed borne, air borne and water borne

diseases: mode ,of transmission of viruses and their common vectors. **(12 lectures)**

Unit 6: Symptoms

Major types due to fungi, bacteria, viruses. **(10 lectures)**

Unit 7: Epidemiology

Endemic, Epidemic and Pandemic, Sporadic disease, monocyclic and poly cyclic, Disease pyramid, Strategy of management. **(10 lectures)**

PRACTICAL

1. Mounting, preserving and labelling of Insect Pests and Vectors.
2. Identification of Insect Pest and diseases.
3. Preparation of fungal slide.
4. Inoculation techniques.
5. Isolation of causal organism (fungus), pests and their culture; Submission of such specimens.
6. Collection of insects and other pests, diseased plant samples.
7. Practical study tour and field trips for collection of specimens and surveillance.

Suggested reading

1. Atwal, A. S. 1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers, Ludhiana
2. Dasgupta, M K 1988: Principles of Plant Pathology. Allied Publishers Pvt. Ltd., Calcutta
3. Mandahar, C L, 1987: Introduction of Plant Virus. S Chandan Co. (Pvt.) Ltd., New Delhi
4. Basu, A N and Giri, B K 1993:The Essentials of Viruses, Vectors and Plant Diseases. Wiley Eastern Ltd., New Delhi
5. Agarios,GN 1988:Plant Pathology Academic Press Inc, New York
6. TK Prasad. Hand book of Entemology. New Vishal Publications, New Delhi

Semester II

Core course (CC- 1B) : Pest Management

Credits: 6 (Theory- 4 ,Practical -2)

Lectures:60

THEORY

- Unit 1.** Forecasting : Definition and need. (2 lectures)
- Unit 2.** Forecasting and monitoring of some insects. (5 lectures)
- Unit3.** Major signs and damage due to animal pests. (3 lectures)
- Unit4.** Forecasting of plant disease (2 lectures)
Importance of disease Forecasting service. (2 lectures)
Methods of Forecasting. (6 lectures)
- Unit5.** Methods of Managements
- Legislation (3 lectures)
- Eradication (2 lectures)
- Physical control (2lectures)
- Cultural control (3 lectures)
- Biological control (5 lectures)
- Chemical control (5 lectures)
- Genetic resistance (5 lectures)
- Unit6.** Integrated Pest Management (IPM) (5 lectures)
Definition; genesis; phases (5 lectures)
Appropriate IPM, methods with examples from Rice and other field crops with special reference rice, wheat, potato, mustard, sugarcane and pulse. (10 lectures)

PRACTICAL

1. Study of Symptoms of attack by type pests and disease of plants.
2. Identification of common Insects, fungi other pests and diseases of major crops.
3. Preservation, permanent slides preparation, labelled specimens and field records to be submitted during final examinations.
4. Study tour and field trips for collection of specimens and surveillance.

Suggested reading

1. Chiang, HC 1977. Pest management in the people's Republic of China monitoring and forecasting insect population in Rice, Wheat, Cotton, Maize, FAO Plant Protection Bulletin 25(1-8)
2. Agarwal, RA, Gupta, GP, Kishore, P and Chandra, D (Eds) 1983: Principles and concepts of Integrated Pest Management, Entomology Division, IARI, New Delhi

3. Atwal, A. S 1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers, Ludhiana
4. Flint, ML and Bosch, R Vanden 1981: Introduction of Integrated Pest Management Plenum Press, London.

Semester III

Core Course (CC – 1C) : Bionomics, Plant disease and their management

Credits Theory -4, Practical -2, Lectures : 60

Group A

(Bionomics and Management of Insect Pests)

Unit 1: Bionomics and Management of major insect pests of following crops: **(20 Lectures)**

Rice (Stem borer and Gundhybug)	Brinjal (Borer)
Sugarcane (Top borer and Shoot borer)	Jute (Jute stem borer)
Mustard (Aphid and Sawfly)	Gram (Pod borer)
Potato (Cutworms)	Mango (Hopper)
Cauliflower (Diamond-back moth)	Tea (Mosquito bug)

Unit 2: Termites- Examples, Biology and management **(2 Lectures)**

Unit 3: Rodents (*Bandicota bengalensis*, *Rattus rattus*) and their management **(2 Lectures)**

Unit 4: Common bird pest (*Psittacula* sp., *Colombia* sp.) in West Bengal and their management **(2 Lectures)**

Unit 5: Stored grain pest- Cereals (Rice weevil) and Pulses (Gram dhora) and their management **(4 Lectures)**

Group B

(Plant disease and their management)

Unit 1: Predisposition and epidemiological factors. **(4 Lectures)**

Unit 2: Symptoms, Etiology, disease cycle and management of major disease of following crops. **(16 Lectures)**

Rice [Brown spots of rice (*Helminthosporium oryzae*); Bacterial leaf blight (*Xanthomonas oryzae*)]

Wheat [Black rust of wheat (*Puccinia graminis tritici*)]

Sugarcane [Red rot of sugarcane]

Rape and Mustard [Club root of crucifer]

Potato [Late and Early blight of Potato]

Tea [Blister blight]

Tomato [Wilt of tomato]

Groundnut [Tikka Disease]

Jute [Stem rot]

Banana [Panama disease]

Unit 3: Seed Pathology- seed deterioration, seed transmission, strategy and methods of management **(3 Lectures)**

Unit 4: Post-harvest diseases and perishables loss, types of disease of one fruit and one vegetable (Mango and Potato) **(3 Lectures)**

Unit 5: Weed-classification, examples and management **(4 Lectures)**

Practical

1. Study of symptoms of attack by type pests and diseases of plants-as per theoretical syllabus
2. Isolation of causal organism, pests and their culture. Submission of such specimens during final examination
3. Preparation of desired strength of Pesticides
4. Plant protection equipments; handling of rotary duster, Knapsack sprayer and seed dresser
5. Collection of insect pests, diseased plant samples, common weeds, their identification, preservation, permanent preparation, labelled specimens and field records to be submitted during final examination.
6. Practical study tour and field trips for collection of specimens and surveillance

Suggested Reading

1. Atwal, AS.1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers, Ludhiana
2. Dasgupta, MK.1988: Principles of plant pathology, Allied Publishers Pvt. Ltd., Calcutta
3. Basu, AN and Giri, BK 1993: The Essentials of Viruses, Vectors and Plant Diseases, Wiley Eastern Ltd., New Delhi
4. Agraio, GN.1988: Plant Pathology Academic Press Inc. New York
5. Narayanasamy, P. 2008: Post-harvest pathogens and disease management. Wiley India Pvt.Ltd.
6. Chattopadhyay, SB and Mustafee, T. 2008: Plant diseases and their management. Aditya books Pvt. Ltd. New Delhi.

Skill Enhancement Course

SEC 1 (any one) :

(1) Green Pesticides (Theory) Credits -2 Lectures : 30

Unit 1: Definitions of green pesticides/Botanical Pesticide **(6 Lectures)**

Unit 2: Preparation of pesticides from Neem, Chrysanthemum, Tobacco. Advantage of use of botanical pesticides or Green pesticides / Insecticide from plant origin. **(12 Lectures)**

Unit 3: Green Pesticide: Method of utilization, mode of action **(4 Lectures)**

Unit 4: Green pesticides *vis-à-vis* chemical pesticides **(8 Lectures)**

Suggested Reading:

1. Atwal, A.S. (1986) Agricultural Pests of India and South- East Asia. Kalyani Publishers, Ludhiana.
2. Chatterjee, P.B. (1997). Plant Protection Technique . Bharati Bhawan (Publishers & Distributors)
3. Anonymous (1967) Pesticides in Indian Agriculture. National Council of Applied Economic Research New Delhi.
4. Huffaker, C.B (1980). New Technology Of Pest Control. John Wiley and Sons , Toronto.
5. Sill, W.H (Jr.) (1985). Plant Protection: An Integrated Interdisciplinary Approach (Indian ed.) Kalyani Publishers, Ludhiana.

(2) Vermiculture (Theory) Credits -2 Lectures : 30

Unit 1: Definition of vermicompost, difference between compost and vermicompost. *Eisenia foetida* **(6 Lectures)**

Unit 2: Factor affecting Earthworm activity and propagation **(8 Lectures)**

Unit 3: Vermicompost preparation, Vermicompost preparation-types of substrates and quality improvement; problem in vermicompost preparations **(10 Lectures)**

Unit 4: Uses of vermicompost, vermicompost in Organic farming **(6 Lectures)**

Suggested Reading:

1. Dropkin, V.H. (1980). Introduction to Plant Nematology. John Wiley & Sons, New York.
2. Sasser, J.N and Jenkins, W.R. (1960) Nematology. The University Of North Carolina Pests, North Carolina.
3. Chatterjee, P.B. (1997). Plant Protection Techniques. Bharati Bhawan (Publishers & Distributors).
4. Dasgupta, M.K. (1988). Principles of Plant Pathology. Allied Publishers. Pvt. Ltd. Calcutta.
5. Maggenti, A. (1981). General Nematology. Springer- Verlag, New York.

SEMESTER IV

Core course (CC- 1D): Plant's Defence Mechanisms

Credits: 6 (Theory -4; Practical-2)

Lectures:60

Group –A

Lectures:30

Unit-1: Resistance of Host Plant to insects Physical defences Antigenotic chemical factors Attractants and repellents Antibiotic factors	10 Lectures
Unit-2: Physiological inhibitors and feeding deterrents	(2 Lectures)
Unit-3: Ovipositional stimulants and deterrents	(2 Lectures)
Unit-4: Allelochemicals decreasing nutrients bioavailability	(2 Lectures)
Unit-5: Feeding stimulants	(2 Lectures)
Unit-6: Host Plant Nutrients and Insects Resistance Role of amino acids, sugar, vitamins, minerals, fats	(10 Lectures)
Unit-7: Plant Breeding for insect resistance	(2 Lectures)

Group-B

Lectures:30

Unit-1: Preinfectious defence mechanism	(4 Lectures)
Unit-2: Postinfectious defence mechanism	(4 Lectures)
Unit-3: Structural Defense: Development of Cicatrice layers Formation of abscission layers Deposition of gums Formation of Tyloses Cellular defence structures	(8 Lectures)
Unit-4: General Biochemical defence mechanism. Defence through hypersensitivity Role of phytoalexins in defence mechanism.	(12 Lectures)
Unit-5: Basic idea about toxins of pathogen	(2 Lectures)

Practical:

1. Subculturing of plant pathogen
2. Demonstration of comparative estimation of total phenol from infected and non-infected plant tissue
3. Study of structural defences in plants- Trichome, Tyloses, Cork layer
4. Plant protection equipment; parts and handling of Rotary Duster, knapsack sprayer, hand compression sprayer and seed dresser.
5. Practical study tour and field trips for collection of specimens and surveillance.

Suggested reading:

1.Chatterjee,P.B. 1997. Plant Protection Techniques. Bharati Bhawan(Publishers and Distributors), Patna.

2.Painter, RH 1951. Insect resistance in crop plants. University of Kansas press Lawrence, USA

3.Vander Plank, JE 1975. Principals of Plant Infection. Academic Press, Inc, New York.

4. Dasgupta , MK 1988. Principles of Plant Pathology. Allied Publishers PVt. Ltd., Calcutta.

Skill Enhancement Course

SEC -2 (any one)

(1) Formulation and application of pesticides and their precautions

Credits -2 Lectures : 30

Unit 1. Formulation of Pesticides: (Prepare desired strength of pesticides showing method of Calculation) **(15 Lectures)**

A. Solid formulation : a) dust (b) wettable powder (WP) or water dispersible powder (WDP) and water soluble powder (c) granules (d) capsules (e) baits and pellets

B. Liquid formulation:

(a) Solution (b) Emulsifiable concentrate (EC) (c) Stock emulsion (d) Ultra low volume (ULV) (e) Suspension

C. Gaseous formulation:

(a) Fumigant (b) Aerosol and foams (c) Smokes (d) Mists and fog

Unit 2: Application of pesticides: (Set the equipments for its implementation and its handling technique) **(15 Lectures)**

1. Sprayer

2. Duster

3. Sprayer-Cum-Duster

4. Aerosol generator

5. Soil injector

6. Granule applicator

7. Seed-dressing machine

Precautions: Precautions during formulation and application of pesticides by the equipments.

Suggested reading:

1.Chatterjee,P.B. 1997. Plant Protection Techniques. Bharati Bhawan(Publishers and Distributors), Patna.

2. Bindra ,O.S and Singh,H. 1977.Pesticide Application Equipment Oxford and IBH Publishing Co.;New Delhi .
- 3.Brent,K.J and Atkin,R.K.(Eds),1987. Rational Pesticide Use. Cambridge University Press, Cambridge
4. Matthews,G.A. 1979, Pesticide Application Method.Longman,London.
5. Hassal,K.A. 1990. The Biochemistry and uses of Pesticides. ELBs /Macmillan Press Ltd.Hampshire,England.

(2) Pest Survey and Surveillance	Credits -2	Lectures : 30
1.Definition		(1 lecture)
2.Ecological characterization of an area		(2 lectures)
3.Importance of surveillance		(1 lecture)
4.Kinds of surveys		(6 lectures)
i) Qualitative survey		
ii)Quantitative survey		
5.Method of survey		(8 lectures)
I. Selection of field		
II. Recording data on survey form		
III. Analysis of data		
IV. Preparation of survey reports		
6. Sampling : Sampling procedure		(8 lectures)
i)Random Sampling		
ii)Multistage Random Sampling		
7. Assesment of pest populations and injury.		(4 lectures)

Suggested Reading:

- 1.Chatterjee,P.B. (1997). Plant Protection Techniques. Bharati Bhawan(Publishers and Distrbutors), Patna.
- 2.Atwal, AS.1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers, Ludhiana.
3. Metcalf, R.L and Luckman, W.H (1975) . Introduction to Insect Pest Management .John Wiley and sons, Toronto.
- 4.Sill, W.H(Jr.), (1985). Plant Protection: An Integrated interdisciplinary Approach (India ed.) Kalyani Publishers, Ludhiana.
5. Pedigo,L.P(1991). Entomology and Pest Management. Macmillan Publishing Company, New York.

Semester –V

SEC 3 (any one)

(1) Biological Control (Theory) Credits -2 Lectures : 30

Unit 1. History,Types of biological control and biological pest management and importance. (6 lectures)

Unit 2. Biocontrol Agents – Antagonists (8 lectures)

- a) Bacterial antagonists.
- b) Fungal antagonists.
- c) Viral antagonists.
- d) Antagonistic nematodes and insects.

Unit 3. Predators and Parasitoids; Plant Parasitic nematodes. (5 lectures)

Unit 4. Principle and Methods of Biological Control- (6 lectures)

Types of Interactions (microbial interactions) contributing to biological control.

Mechanism of biological control :

- a) Hyperparasitism and Predation.
- b) Antibiosis and antibiotic like substances mediated suppression of plant pathogens.

Unit 5. Biopesticides –Types ,Examples, applications,advantages and disadvantages.

(5 lectures)

Suggested Reading:

1. Atwal, A.S.1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers.
2. De Bach, P.;Rosen ,D.(1991):Biological Control By Natural Enemies.Cambridge University Press, Cambridge
3. Hoy ,M.A.;Herzog,D.C.(Eds)(1985): Biological Control in Agricultural IPM Systems,Academic Press, London.
4. De Bach, P. (eds)(1975):Biological Control of Insect pests and weeds Chapman and Hall, London.
5. Burges,H.D. and Hussey,N.W. .(eds)(1971): Microbial Control of Insects and mites. Academic press, London.

(2) Remote Sensing Technique in Plant Protection Credits -2 Lectures : 30

Unit 1: Basic Principle of Geographical Information Science (GIS) and Remote Sensing (RS) *vis a vis* Plant Protection. (7 lectures)

Unit 2: Application of GIS and RS in forestry and agriculture. (7 lectures)

Unit 3: Methods of collection data using mobile phones and GPS/GNSS in forestry context.

(8 lectures)

Unit 4: Some case studies and Remote Sensing Institutes/Forest Research Institutes in India and their activities. (8 lectures)

Suggested Reading:

1. Prithvish Nag: Digital Remote Sensing
2. Prithvish Nag: Indias Geospatial Infrastructure
3. Thomas Lillesand: Remote Sensing and Image Interpretation
4. R H Robinson: Elements of Cartography

Discipline specific Electives

DSE – 1A (any one) :

(1) Integrated pest management Credits: 6
Theory -4; Practical-2 Lectures:60

Unit 1: Definition and genesis (2 lectures)

Unit 2: Tools and strategies of IPM

- a) Cultural control (2 lectures)
- b) Physical control (2 lectures)
- c) Mechanical control (2 lectures)
- d) Biological control (9 lectures)
- e) Chemical control (10 lectures)
- f) Genetic control (5 lectures)
- g) Legislative control (4 lectures)

Unit 3: Appropriate IPM-

- Methods with example from
- Rice field (4 lectures)
 - Wheat field (4 lectures)
 - Potato field (4 lectures)
 - Mustard field (4 lectures)
 - Sugarcane field (4 lectures)
 - Pulse field (4 lectures)

Practical

1. Study of sign and symptoms caused by pest.
2. Field survey and collection of pest and disease.
3. Application of pesticides in crop field.
4. Study tour and field trips for collection of specimens and surveillance.

Suggested reading:

1. Atwal, AS.1986: Agricultural Pests of India and South-East Asia. Kalyani Publishers,

Ludhiana

2. Flint ML and Bosch ,R Vanden 1981 : Introduction of Integrated Pest Management,Plenum Press,London.
3. Chadwick,D.J. .(ed)(1993):Crop Protection and Sustainable Agriculture,John Wiley & Sons, Newyork
4. Dent,D .(ed)(1995): Integrated Pest Management. Chapman and Hall, London.
5. Dhaliwal,G.S.;Arora,R.(2005): Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi

(2)Seed Pathology and Seed Treatment
Theory -4; Practical-2

Credits: 6

Lectures:60

Unit 1. Seed Pathology- Definition, objectives of study, factors responsible for infection of seeds and grains under storage and during transit. **(10 lectures)**

Unit 2. Seed borne pathogens –Seed borne fungi, Seed borne bacteria, Seed borne viruses. Optimum conditions of seeds for the growth of seed borne pathogens in the seeds and grains. **(10 lectures)**

Unit 3. Deterioration of seeds and grains by microbial invasion and their effects on seeds quality. **(10 lectures)**

Unit 4. Toxins:Definition, history of discovery of mycotoxins, Chemical nature, Types with special references to aflatoxins, mycotoxin contaminations in seeds and their deleterious effects. **(8 lectures)**

Unit 5. Seed dressing, seed treatment- Mechanical method, chemical method and physical method. **(15 lectures)**

Unit 6. Production of pathogen free seeds; seed viability,seed vigor, certified seeds and authentic seeds. **(7 lectures)**

PRACTICAL

1. Seed treatment and Seed dressing- basic method of Seed dressing (demonstration).
2. Test of seed viability (TTC test) and assay of seed germination (T₅₀).
3. Determination of seed vigor index
4. Isolation of fungal pathogens from infected seeds and their culture.

Suggested Reading:

1. Agrios, G.N. (1988). Plant Pathology. Academic Press. Inc. New york.
2. Dasgupta, M.K.(1988). Principles of Plant Pathology. Allied Publishers Pvt. Ltd, Calcutta.
3. Singh, R.S.(1988). Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Vanderplank, J.E .(1963). Plant Disease: Epidemic and Control. Academic Press New York.
5. Sharville , E.G.(1979). Plant Disease Control. AVI Publ. Co., West Port.

Semester –VI

Skill Enhancement Course

SEC 4 (any one) :

(1) Pesticide Applications Equipments (Theory) Credits -2 Lectures : 30

Unit 1: Set the equipments for its implementation and its handling technique

- | | |
|-----------------------|--------------------------|
| 1. Sprayer | 5. Seed-Dressing machine |
| 2. Duster | 6. Granule applicator |
| 3. Sprayer-Cum-Duster | 7. Aerosol generator |
| 4. Soil injector | |

Precautions: Precautions during formulation and application of pesticides by the equipments.

Suggested reading:

1. Matthews,G.A. 1979, Pesticide Application Method. Longman, London.
2. Bindra ,O.S and Singh,H. 1977.Pesticide Application Equipment Oxford and IBH Publishing Co.;New Delhi
3. Chatterjee,P.B. 1997. Plant Protection Techniques. Bharati Bhawan(Publishers and Distributors), Patna.
4. Brent,K.J and Atkin,R.K.(Eds),1987. Rational Pesticide Use. Cambridge University Press, Cambridge.

(2) Plant Growth Promoting Microorganisms (PGPR) (Theory)
Credits -2 Lectures : 30

Unit1. Plant Growth Promoting microorganism:- Bacteria, BGA, PGPF (4 lectures)

Unit 2. Plant Growth Promoting Traits. (14 lectures)

- a) IAA production.
- b) N₂ fixation.
- c) NH₃ production.
- d) HCN production.
- e) Siderophore production.
- f) ACC Deaminase production.
- g) Phosphate Solubilization
- h) Induced systemic resistance .
- i) Induced systemic tolerance .

Unit 3. Application of PGPM (6 lectures)

- a) As Phytostimulation

- b) As Biofertilizer
- c) As Biocontrolling agent

Unit 4. Monitoring of Plant Growth by Application of PGPM

(6 lectures)

- a) Root growth
- b) Shoot growth
- c) Seed Vigour Index

Suggested Reading:

1. Egamberdieva, Dilfuza, Shrivastava, Smriti, Varma, Ajit (Eds.) (2015) Plant-Growth-Promoting Rhizobacteria (PGPR) and Medicinal Plants. Springer. ISBN 978-3-319-13401-7.
2. P. Lemanceau, P. Bakker, J.M. Raaijmakers, G. Bloemberg, M. Höfte, B.M. Cooke (Eds.) (2010) New Perspectives and Approaches in Plant Growth-Promoting Rhizobacteria Research, Science, Springer Science & Business Media. ISBN 978-1-4020-6775-4.
3. Akira Ogoshi (1997) Plant growth-promoting Rhizobacteria : present status and future prospects : proceedings of the Fourth International Workshop on Plant Growth-Promoting Rhizobacteria ; Japan-OECD Joint Workshop ; Sapporo, Japan, October 5-10, 1997
4. Ahemad Munees (2013) Plant Growth Promoting Rhizobacteria LAP Lambert Academic Publishing (12 January 2013) ISBN-13: 978-3659323126.
5. Bashan Y, Holguin G, Lifshitz R (1993) Isolation and characterization of plant growth-promoting rhizobacteria. In: Glick BR, Thompson JE (eds) Methods in plant molecular biology and biotechnology. CRC Press, BocaRaton, FL, pp 331–345.
6. Bashan Y, Puente ME, de-Bashan LE, Hernandez JP (2008) Environmental uses of plant growth-promoting bacteria. In: Barka EA, Clement C (eds) Plant-microbe interactions. Trivandrum, Kerala, India, pp 69–93.
7. Beattie GA (2006) Plant-associated bacteria: survey, molecular phylogeny, genomics and recent advances. In: Gnanamanickam SS (ed) Plant-associated bacteria. Springer, The Netherlands, pp 1–56. doi: 10.1007/978-1-4020-4538-7_1
8. Kloepper JW, Tuzun S, Liu L, Wei G (1993) Plant growth-promoting rhizobacteria as inducers of systemic disease resistance. In: Lumsden RD, Waughn JL (eds) Pest management: biologically based technologies. American Chemical Society Books, Washington, DC, pp 156–165

Discipline specific Electives

DSE - 1B (any one) :

(1) Biotechnology in Plant Protection
Theory -4; Practical-2

Credits: 6
Lectures:60

Unit 1: Introduction to plant biotechnology and plant protection: Crop protection and food security, Applications of plant biotechnology in plant protection **(8 Lectures)**

Unit 2: Plant genetic engineering for resistance to plant pathogens: General concepts of genetic engineering and tissue culture for the management of disease and disease resistant crops **(8 Lectures)**

Unit 3: Biocontrol of plant pathogens Plant transformation process, and transgenic plants/ GM crops, Use of Beneficial Arthropods and Sterile Insect Release, Insect Pathogenic Microorganisms, Pheromones **(8 Lectures)**

Unit 4: Detection tools for plant infection: Application of Biotechnological tools for detecting plant infection (nucleic acid isolation and PCR based techniques, *in-situ* hybridization, ELISA, Flow cytometry) **(8 Lectures)**

Unit 5: Role of biotechnology in plant resistance to insects. successful examples of resistant crop varieties in India and world. **(8 Lectures)**

Unit 6 : Cell lines, genetic engineering in *Baculoviruses*, *Bt* and entomopathogenic fungi. Transgenic plants for pest resistance **(8 Lectures)**

Unit 7: Quarantine law, Biosafety, Use of tissue culture techniques in plant protection for resistance- genetic manipulation. **(8 Lectures)**

Practical

- 1: Microbial flora in plant crown galls and hairy roots-protocol and photographs
- 2: Demonstration of stomatal change during leaf infection
- 3: Demonstration of change in transpiration rate during phytopathogen infection
- 4: DNA extraction from plant infected tissue and detection of DNA through agarose gel electrophoresis
5. Protein isolation from the Bacteria, Fungus and pest and host plant and its quantification using spectrophotometer and molecular weight determination using SDS/PAGE.

Suggested Readings

- Alford DV. 1999. *A Textbook of Agricultural Entomology*. Blackwell Science, London. Crampton JM & Eggleston P. 1992. *Insect Molecular Science*. Academic Press, London.

- Sadasivam S & Thayumanavan B. 2003. *Molecular Host Plant Resistance to Pests*. Marcel Dekker, New York. Smith CM, Khan ZR & Pathak MD. 1994. *Techniques for Evaluating Insect Resistance in Crop Plants*. CRC Press, Boca Raton, Florida
- Bhattacharya TK, Kumar P & Sharma A. 2007. *Animal Biotechnology*. 1st Ed., Kalyani Publ., New Delhi. 39
- Hagedon HH, Hilderbrand JG, Kidwell MG & Law JH. 1990. *Molecular Insect Science*. Plenum Press, New York.
- Oakeshott J & Whitten MA.. 1994. *Molecular Approaches to Fundamental and Applied Entomology*. Springer Verlag.
- Rechcigl JE & Rechcigl NA. 1998. *Biological and Biotechnological Control of Insect Pests*. Lewis Publ., North Carolina. Roy U & Saxena V. 2007. *A Hand Book of Genetic Engineering*. 1st Ed., Kalyani Publ., New Delhi.
- Singh BD. 2008. *Biotechnology (Expanding Horizons)*. Kalyani Publ., New Delhi. Singh P. 2007. *Introductory to Biotechnology*. 2nd Ed. Kalyani Publ., New Delhi

(2) Dissertation (Curriculum based local area survey of pest and crop) Credit: 6

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