UG PROGRAMME

NEP

B.Sc. (Hons.) Agriculture

as per 6th Dean's Committee Recommendation of ICAR

(w.e.f. 2024-25)

Revised & Restructured Courses and Syllabus of Plant Pathology

Palli Siksha Bhavana

(Institute of Agriculture)

Visva-Bharati, Sriniketan

Semester-wise course and credits allocation

Course Code	Name of the Course	Course Structure (Credits)		
		Theory	**Practical**	**Total**
1st Year – I Semester				
Induction cum Foundation course				
IFC-111	Deeksharambh	2 weeks- Non-gradial (NG)		
1st Year – II Semester				
PPC-121	Fundamentals of Plant Pathology	2	1	3
2nd Year – III Semester				
PPC-211	Fundamentals of Nematology	1	1	2
2nd Year – IV Semester				
Skill Enhancement Courses (SEC)				
SEC-2209	Mushroom Production Technology	0	2	2
3rd Year – V Semester				
PPC-311	Diseases of Field & Horticultural Crops & their Management	2	1	3
3rd Year – VI Semester				
PPC-321	Agricultural Microbiology and Phyto -remediation	1	1	2
4th Year – VII Semester				
Elective Courses				
EC-4134	Bio-pesticides and Bio-control	3	1	4
4th Year – VIII Semester				
Student READY				
READY-421	For B.Sc. (Hons.) Agriculture Degree Student READY: RAWE/Industrial Attachment/Experiential Learning/ Hands-on Training/ Project Work/Internship	20		
Total Credit Hours		36 + 2 (Non gradial course)**		

DETAILED SYLLABI

Semester II

PPC-121	Fundamentals of Plant Pathology	2+1

Objectives

1. To get acquainted with the role of different microorganisms in the development of plant disease
2. To get general concepts and classification of plant diseases
3. To get knowledge of general characteristics of fungi, bacteria, virus, and other microorganisms causing plant diseases
4. To acquaint the students with reproduction in fungi, and bacteria, causing plant diseases
5. To get acquainted with various plant disease management principles and practices

Theory

Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, Indigenous knowledge regarding plant diseases and their management in different ancient Indian literature, History of Plant Pathology with special references to India; Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis; Development of disease in plants: Disease Triangle, Disease cycle; Fungi and their morphology, reproduction and classification of fungi; Bacteria: Morphology, reproduction classification of phytopathogenic bacteria; Other plant pathogens: Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus transmission; Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).

Practical

Study of the microscope; Acquaintance with laboratory material and equipment; Study of different plant disease symptoms; Microscopic examination of general structure of fungi; Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria; Microscopic examination of fungal diseased specimen; Microscopic examination of bacterial diseased specimen; Preparation of culture media; Isolation of plant pathogens: Fungi, bacteria and viruses; Purification of plant pathogens; Study on plant disease diagnosis: Koch's Postulates, Characteristics, formulation, methods of application and calculation on fungicides.

Suggested readings

1. Agrios, G.N. 2010. Plant Pathology. Acad. Press.
2. Alexopoulos, Mims and Blackwel. Introductory Mycology.
3. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
4. Gibbs, A. and Harrison, B. 1976. Plant Virology - The Principles. Edward Arnold, London
5. Goto, M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
6. Hull R. 2002. Mathew's Plant Virology. 4th edn. Academic Press, New York.
7. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur.
8. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th edn. Tata Mc Graw Hill Publ. Co. Ltd.
9. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, New Delhi.
10. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur
11. Rajeev, K. and Mukherjee, R.C. 1996. Role of Plant Quarantine in IPM. Aditya Books.
12. Rhower, G.G. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd edn. Vol. II. (Ed. David Pimental). CRC Press.
13. Singh R.S. 2008. Plant Diseases. 8th Ed. Oxford & IBH. Pub. Co.
14. Singh R.S. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
15. Verma, J.P. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
16. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

Semester III

PPC-211	Fundamentals of Nematology	1+1

Objectives

1. To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.
2. To impart knowledge on nematode pests of different crops of national and local importance and their management.

Theory

Introduction: Ancient Indian knowledge on nematodes. History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode: definition, general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut. Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM. IKS - Management of Nematode diseases through available indigenous knowledge system and locally adopted cultural methods.

Practical

Sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique, Picking and counting of plant parasitic nematode. Identification of economically important plant nematodes up to generic level with the help of keys and description: Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, and Helicotylenchus etc. Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc. Methods of application of nematicides and organic amendments.

Suggested readings

1. Economic Nematology-Edited by J.M. Webster
2. Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde
3. Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta,
   P. K. Koshy.
4. Text book on Introductory Plant Nematology -R.K. Walia and H.K. Bajaj.

Semester IV

SEC-2209	Mushroom Production Technology	0+2

Objective

To generate knowledge about edible and cultivated mushroom, their cultivation and entrepreneurship development.

Practical

Mushroom- Definition, history and importance of mushroom cultivation; present scenario of mushroom cultivation in India. Indian knowledge system in mushroom identification, cultivation and their use in human health in ancient time. Types of mushrooms- edible, poisonous, medicinal mushroom; puff balls, truffles and false truffles. food value of mushroom. General morphological features, life cycle pattern of cultivated mushroom. Pure culture of mushroom fungi and their nutritional requirements Spawn - types, characteristic of a good quality spawn, methods of spawn production, storage of spawn

Cultivation of mushroom - Cultivation different *Agaricus* species (button mushroom)- composting and its formulation, casing, sterilization of casing materials. Cultivation methods, cropping and maintenance, harvesting etc. Different species of oyster mushroom (*Pleurotus* species), substrate selection and cultivation technique. Paddy straw mushroom, its species and their cultivation techniques. Other cultivated mushrooms i.e. *Lentinus*, *Calocybe*, *Auricularia* and *Ganoderma* Identification and management of different pests and diseases of mushrooms. Post-harvest preservation and value addition of mushroom through indigenous knowledge system. Canning, pickling, dehydration and value addition of mushrooms. Preparation of different recipes of mushrooms. Economics of mushroom cultivation

Learning Outcome

Student can start their own entrepreneurship by acquiring the knowledge and **s**kills about mushroom cultivation

Semester V

PPC-311	Diseases of Field & Horticultural Crops & their management	2+1

Objectives

1. To study the symptoms produced on the host
2. To study the etiology of the diseases
3. To know about the disease cycle of the pathogens during pathogenesis
4. To study the epidemiological factors responsible for disease development
5. To study the management techniques for curbing the major diseases of field and horticultural crops

Theory

Symptoms, etiology, disease cycle, epidemiology and management of plant diseases through available indigenous knowledge of plant protection. of the following field and horticultural crops: Field crops- Rice (blast, brown spot, sheath blight, false smut, bacterial leaf blight, bacterial leaf streak, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt); Maize (banded leaf and sheath blight, southern and northern blight, downy mildew); Sorghum (smuts, grain mold, anthracnose); Bajra (downy mildew, ergot) and Finger millet (blast, leaf spot); Groundnut (early and late leaf spots, rust, wilt); Soybean (rhizoctonia blight, bacterial spot, seed and seedling rot, mosaic); Grams (Ascochyta blight, wilt, grey mold); Pea (downy mildew, powdery mildew, rust); Black gram and Green gram (web blight, Cercospora leaf spot, anthracnose, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, PokahBoeng); Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight); Cotton (anthracnose, vascular wilts, black arm). Horticultural crops: Citrus (canker, gummosis) and Guava (wilt, anthracnose); Banana (sigatoka, Panama wilt, bacterial wilt, bunchy top); Papaya (foot rot, leaf curl, mosaic) and Pomegranate (bacterial blight); Apple (scab, powdery mildew, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose) and Strawberry (leaf spot); Coconut (bud rot, Ganoderma wilt), Tea (blister blight) and Coffee (rust); Mango (anthracnose, malformation, bacterial blight, powdery mildew); Potato (early and late blight, black scurf, leaf roll, mosaic) and Tomato (damping off, wilt, early and late blight, leaf curl, mosaic); Brinjal (phomopsis blight and fruit rot, sclerotinia blight) and Chilli (anthracnose and fruit rot, wilt, leaf curl); Cucurbits (powdery and downy mildew, wilts) and Cruciferous vegetables (Alternaria leaf spot, black rot, cauliflower mosaic); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Turmeric (leaf Spot) and Coriander (stem gall); Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots).

Practical

To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, downy mildew and powdery of cucurbits, rhizoctonia and Cercospora leaf spot of green gram/black gram, Alternaria blight and downy mildew of mustard, early blight of late blight of potato and tomato, Phomopsis blight of brinjal, powdery mildew and rust of pea, stem gall of coriander, anthracnose and fruit rot of chilli, taphrina leaf spot of turmeric, red rot of sugarcane, acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.
Field visit for the diagnosis of field problems, Collection and preservation of plant diseased specimens for herbarium.

Suggested Readings

1. Integrated Plant Disease Management By R.C. Sharma
2. Plant Diseases By R.S. Singh
3. Plant Disease Management: Principles and Practices By Hriday Chaube
4. Plant Pathology By G.N. Agrios

Semester VI

PPC-321	Agricultural Microbiology and Phyto-remediation	1+1

Objectives

1. To get an introduction to microbiology with specific focus on its significance in agriculture science
2. To get acquainted with the bacterial structure and the function of the different bacterial components
3. To get highlights on different fields of microbiology
4. To get highlights on the bioremediation of polluted soils using microbial mediators and phytoremediation
5. To get a concept of biological control and the role of biopesticides in plant disease management.

Theory

Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. Ancient Indian Practices for Phytoremediation. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering. Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Food Microbiology: Microbial spoilage and principles of food preservations, Food poisoning. Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water. Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc. Biological control: Microbial biopesticides for plant disease management Concepts of rhizosphere microbiology- Rhizodeposits - biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiomeresidents and their roles. Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils**.**

Practical

Study of the microscope; Acquaintance with laboratory material and equipment; Microscopic observation of different groups of microorganisms: moulds (Fungi); Direct staining of bacteria by crystal violet; Negative or indirect staining of bacteria by nigrosin; Gram staining of bacteria; Study of phyllosphere and rhizosphere microflora; Measurement of microorganisms; Preparation of culture media; Isolation and purification of rhizospheric microbes; Isolation and purification of N-fixers; Isolation and purification of Nutrient solubilizers; Isolation and purification of Endophytes.

Suggested readings

1. `Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. `Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. ` Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta
4. `Dubey, H.C. 2007. A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi – 10014
5. `Salyers, A. A. and Whitt, D. D. 2001. Microbiology: diversity, disease, and the environment. Fitzgerald Science Press, Inc. 6. Prescott, L. M. 2002. Microbiology 5th Edition. McGraw-Hill Inc, US

Semester VII

EC-4134	Bio-pesticides and Bio-control	3+1

Objective

To generate knowledge about biological control agents, their production and application in crop disease management.

Theory

Definition, history, importance, scope, potential and concepts of bio-pesticides and biological control of crop pests and diseases. Understanding of ecological equilibrium in relation to biological control. Attributes of an ideal bio-pesticides. Different biocontrol agents and their characteristics.

Mechanisms of biological control- Interactions of harmful and beneficial microbes in different habitats. Role of VAM and PGPR in bio-control of plant diseases. Growth promotion – *Pseudomonas* spp., *Bacillus* spp., *Trichoderma* spp. and Actinomycetes.

Classification of biopesticides - Microbes, botanicals and other bio-rationales and their uses. Management of Plant diseases through antagonistic locally available microorganism.

Mass production technology of bio-pesticides- Isolation, purification, identification and maintenance of pure culture of recognized biocontrol agents. Virulence and pathogenicity of entomopathogenic micro- organisms and nematodes.

Methods of application of biopesticides. Methods of quality control of bio-pesticides. Impediments and limitation in production and use of biopesticides

Formulation of different types of bio-control agents and their efficacy. Legislature acts in the production and marketing of biocontrol agents and bio-pesticides. Organic amendments, culture filtrates and botanicals etc. for plant disease management. Entrepreneurship development in the field of bio-control.

Practical

1. Visit to biological control laboratory.
2. Identification of important botanicals.
3. Isolation of bio-control agents from different sources.
4. Pure culturing and evaluation of bio-control potential of isolates.
5. Testing of antibiotic production in culture and in culture filtrate.
6. Identification of entomopathogenic entities in field condition. Quality control of biopesticides
7. In-vitro screening of different bio-agents.
8. Mechanisms of biological control-antibiosis, lysis, parasitism, competition
9. Mass multiplication of biocontrol agents.
10. Assessment of commercial potential of bioagent for crop disease management

Learning Outcome

Eco-friendly management of diseases through Bio-control agents and botanicals and entrepreneurship development among the students.

Semester VIII

READY-421 For B.Sc. (Hons.) Agriculture Degree Student READY:

RAWE/Industrial Attachment/Experiential Learning/ Hands- on Training/ Project Work/Internship