

Course Code	Course Name	Credits
26BY607	PLANT DISEASES AND MANAGEMENT	04

Course Objectives

- Analyze plant-pathogen interactions and disease cycle dynamics.
- Evaluate pathogen virulence mechanisms and host colonization strategies.
- Design structural defense engineering approaches for disease resistance.
- Optimize molecular immunity pathways (PTI/ETI) with novel delivery systems.
- Develop precision IDM strategies for major Indian/Northeast crop diseases.

Learning Outcomes

Upon successful completion of this course, it is intended that a student will be able to:

- Model disease cycles incorporating quorum sensing and effector biology.
- Quantify ROS burst, callose deposition, and hypersensitive responses.
- Predict NLR receptor interactions with pathogen effectors.
- Design nanopesticide + RNAi spray protocols for disease control.
- Implement R-gene + microbiome strategies for regional crop protection.

Unit 1 - History and Disease Cycle (12 Hrs.)

History of plant pathology, potato blight, Koch's postulates. Disease cycle: inoculation, appressoria formation, penetration, colonization, dissemination. Effector biology and quorum sensing in infection dynamics. Modern disease forecasting models.

Unit 2 – Pathogenesis and Virulence (12 Hrs.)

Pathogen effects on plant physiology. Mechanical forces, enzymes, toxins (Tabtoxin, Phaseolotoxin, Victorin). Polysaccharides, detoxification mechanisms. CRISPR-screened virulence factors. Plant growth regulators in disease development.

Unit 3 - Structural Plant Defenses Factors (12 Hrs.)

Non-host, horizontal, vertical resistance. Pre-existing structural defenses, chemical inhibitors. Induced defenses: cytoplasmic reactions, cell wall reinforcement, callose deposition dynamics, hypersensitive response, lignin engineering.

Unit 4 – Molecular Plant Immunity (12 Hrs.)

Pathogen elicitors, plant receptors, signal transduction. PTI/ETI immune systems, NLR receptors. Secondary metabolites, PR proteins, RNAi defense. Nanoparticle-mediated gene silencing. Environmental factors influencing immunity.

Unit 5 - Precision Disease Management (12 Hrs.)

Physical, chemical, biological, and nanopesticides. Fungicide/bactericide classification (red/blue/yellow/green labels).

Regional Disease Portfolio (symptoms/etiology/management):

Cereals: Rice blast, Rice sheath blight

Vegetables: Chilli leaf spot, Potato late blight, Okra yellow vein mosaic, Brinjal little leaf, Leaf Blight of Cabbage/Mustard

Fruits: Mango anthracnose, Citrus bacterial canker, Papaya mosaic, Pineapple fruit rot, Anthracnose & Fruit Rot of King Chilli

Plantation/NE Crops: Sugarcane red rot, Tea blister blight, Coffee rust, Rubber powdery mildew, Large cardamom wilt.

Tuber Crop: *Colocasia* Leaf Blight

Fiber Crop: Powdery Mildew of Mulberry.

Microbiome biocontrol for Northeast crops.

Reference Books:

1. Agrios, G. N. (2024). *Agrios' Plant Pathology* (6th ed.). Academic Press.
2. Lucas, J. A. (2023). *Plant Pathology and Plant Pathogens* (5th ed.). Wiley-Blackwell.
3. Mehrotra, R. S., & Aggarwal, A. (2022). *Plant Pathology* (4th ed.). McGraw-Hill.
4. Rangaswami, G. (2021). *Diseases of Crop Plants in India* (6th ed.). PHI Learning.
5. Dangl, J. L. (2025). *Plant Immunity: Molecular Mechanisms*. Wiley.
6. Walters, D. R. (2024). *Molecular Plant Pathology*. CABI.