

Ph. D. Syllabus: Department of Plant Pathology

Course No. as per University norms	Course code	Name of the course	Credits
Course - I	PPT 601	Research Methodology and Techniques in Plant Protection	4+0
Course - II	PPC 601	Fungal Plant Pathology	4+0
	PPC602	Post Harvest Pathology	4+0
	PPC-603	Seed Pathology	4+0
	PPC 604	Mushroom and Commercial Mushroom Production Technology	4+0
	PPC-605	Root pathology	4+0
	PPC 606	Advanced Virology	4+0
	PPC 607	Advanced Plant Bacteriology	4+0
Course - III	PPT 602	Research Prelims	4+0

PPT 601 : Research Methodology and Techniques in Plant Protection 4+0

*Module A: Compulsory and any one of Module B or Module C depending on problem to be allocated in the specialized area

Objective: To provide fundamental knowledge about the dimension of agricultural research, methodology, data analysis and interpretations, pathometry, maintenance of plants pathogens and their management.

Learning Outcome: Help the researcher to understand the basic techniques required for plant pathological research, help them to identify the niche areas of research and make them competent enough for individual research.

Module A

Research Concept and Classification; Categories of research and Societal needs; t', Agricultural Research systems in India as well as other developing countries; Plant Protection Societies and International Plant Protection, Methodologies for recording and collection of data, data sis and interpretation of data; graphical representation of data; Use of mathematical and statistical tools for analysis of data; .Maintenance of pathogen cultures and pests, vectors etc. ;Statistical methods relevant to plant protection experiments

Module B

Study of plant growth and crop growth parameters and modeling; Loss assessment in crops and cropping system; Pathometry; Study of growth of plant pathogens and some basic techniques essential for Plant Pathology; Basic knowledge on different groups of plant pathogens;

Management of Plant Pathogens for sustainable production of crops; Practicals relevant to collection of data, data analysis and interpretation of data; Use of mathematical tools and statistical package; Pathometry and loss assessment by different techniques; Selected exercise on plant pathogens; Basic laboratory techniques

PPC 601: Fungal Plant Pathology 4+0

Objective: To provide detail knowledge about the fungal pathogens their ecology and host pathogen interactions, development of diseases and their epidemics and management through various approaches.

Learning Outcome: Developed tangible idea about the fungi and their different dimensions in relation to ecology, disease and management among the researchers which help to initiate research in fungal plant pathology.

Advanced taxonomic principles and modern system of classification of fungi; Host — pathogen recognition and specificity including nature; Study of offence systems among fungal plant pathogens (details of each type); Defense systems known in plants against obligate, and facultative plant pathogens and parasites; Induction of defense systems in plants — biological and chemical pathway and methods; Changes in host physiology during and after infection; Ecology of fungal plant pathogens; Epidemiology — Pathosystems and advanced methodologies; Plant Pathology and WTO, Risk assessment; Integrated disease management against fungal plant pathogens and their associations with other agents (General and specific case study). Fungal diseases of the concerned crop or cropping systems. Study of the characteristics of important genera with taxonomic details for identification; Morphogenesis. Sporulation and spore germination of concerned fungus/fungi; Selected exercise on assay on toxin, characterization of toxin, Effect of growth regulators on healthy and diseased plants; Study of WTO rules and implementation of SPS; Analysis of epidemics- selected experiments as required for the thesis work; *In vitro* ecological experiments and analysis of an ecosystem; Identification of fungal diseases of concerned crops.

PPC 602: Post Harvest Pathology 4+0

Objective: To acquaint with post harvest diseases of crops, their identification, mechanism of pathogenicity, losses and their eco-friendly management

Learning Outcome: To develop overall idea about the post harvest diseases of agricultural produce and their management among the students.

Theory

Concept of post harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as pre-harvest and post-harvest, merits and demerits of biological/phyto-extracts in controlling post-harvest diseases. 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. 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 of plant pathogens by resident and introduced antagonists. Isolation, characterization and maintenance of pathogens, role of different storage. 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.

PPC-603

Seed Pathology

4+0

Objective To acquaint with seed-borne diseases, their nature, detection, transmission, epidemiology, impacts/loses and management.

Learning Outcome: To develop overall idea about the seed borne diseases of agricultural crops and their management among the students and researchers.

Theory

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. 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. Seed certification and tolerance limits, types of losses caused 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. 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.

PPC 604: Mushroom and Commercial Mushroom Production Technology 4+0

Objective: To provide detail knowledge about the macro-fungi (mushrooms), edible fungi and important cultivated mushrooms, their cultivation technology, and small and large scale production.

Learning Outcome: Generate knowledge about the mushrooms, their biology and cultivation techniques among the researchers for conducting individual research on mushroom and entrepreneur development.

Mushroom — History, Development of commercial cultivation , present status; Economic importance and medicinal value; Taxonomy and classification of mushroom fungi ; edible and poisonous mushrooms; Reproduction and Life cycle of cultivated mushrooms; Maintenance of pure culture and strain improvement; Spawn production and establishment of commercial spawn production laboratory; Preparation of substrate for mushroom cultivation; Composting of substrate — long, short and indoor methods, formulae of different composts and computation thereof; qualities and testing of compost; uses of spent mushroom compost and substrate; Mushroom Farm — Establishment; Seasonal and environmental control for commercial cultivation; Ventilation and CO₂ , Maintenance of Temperature and RH. Commercial cultivation technology of *Agaricus bisporus* , *Pleurotus* spp., *Volvariella* spp. *Calocybe indica*, *Lentinus edodes*, *Auricularia* sp. and *Ganoderma lucidum*; Insect pests , diseases and abnormalities of cultivated mushroom and their management; Economics and Extension in mushroom cultivation; Postharvest processing and value addition in mushrooms; Biotechnology and mushroom cultivation; Preparation of spawn and compost; Spawning, casing harvesting; Postharvest handling of edible mushrooms; Identification of various pathogens; Competitors of various mushrooms

PPC-605:

Root pathology

4+0

Objective: To provide detail knowledge about soil borne microbes and harmful pathogens, their relationship with plant rhizosphere eco-system and management of root borne diseases.

Learning Outcome: Generate knowledge about the interaction of microbial consortiums and plant rhizosphere for getting benefits from beneficial microbes and also minimizing the damage caused by soil borne pathogens.

Theory

General – Plant root growth, rhizospheric zone and root growth modeling, soil-root interaction and interface, root-shoot interrelationship, host root exudates and its impact on microbial consortium . Soil-microorganism in relation to plant root diseases and brief account of soilborne plant pathogens and their interaction. Mycorrhiza – Types and role in agriculture. Classification of root diseases – systems, chronic and acute, organism involved. Pathogenic root infecting fungi – types and their ecology; factors and measurements of tropism in fungi and other pathogens in host recognition. Ecological concepts – inoculum potential, CSA, EGH, rhizosphere and soil mycostasis. Structure and physiology of resting structure. Molecular detection of soil borne plant pathogens. Polyetic epidemiology and modeling in soil microorganism with special reference to pathogens

PPC 606:

Advanced Virology

4+0

Objective: To provide detail knowledge about the plant viruses, their ecology, host-vector-environmental interactions, assay techniques, viral diseases and their epidemics and management through various approaches.

Learning Outcome: To develop overall idea about the plant viruses and different techniques associated with plant virus research among the students.

Virus architecture and genome organization among different groups of plant viruses, Detail study of concerned family, group or species; Virus replication and assembly of plant viruses; Host virus interaction. ultrastructural changes due to Virus infection, molecular mechanism of host virus interactions; Variation, mutation and virus strains; Use of monoclonal antibodies in identification of viruses and their strains; Polymerase Chain Reaction. Immunology - Immunoglobulin structure and functions of various domains, methods of immunodiagnosis; hybridoma technology and monoclonal antibodies production. Gene expression and regulation, viral promoters, virus induced gene; Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Relation between viruses and their vectors; Efficiency of transmission; molecular mechanism of vector transmission, symptom expression. Transmission of plant viruses by plant pathogenic fungi, nematode and mites; Transmission of mycoplasma by different vectors; Subviral particles - viroids, virusoids, satellite viruses and RNAs and prions. Biotechnology of plant viruses - Genetic engineering, potential and exploitation as of viruses as vectors, genetically engineered host resistance, transgenic plants. ; Techniques and application of tissue culture; Epidemiology and management of virus diseases; Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; demonstration of virus transmission through vectors-aphids, leafhoppers; Detection of plant viruses; Selected exercise on management of plant virus diseases.

PPC 607:

Advanced Plant Bacteriology

4+0

Objective: To provide detail knowledge about the plant pathogenic bacteria, their taxonomy, growth, ecology, mode of dissemination and survival, reproduction, epidemiology and management.

Learning Outcome: Generate knowledge about the plant pathogenic bacteria and their different aspect which will help the researcher for conducting individual research on phytopathogenic bacteria.

Prokariotes – History and introduction to phytopathogenic prokariotes viz., bacteria, MLOs, spiroplasma and other fastidious prokariota; Economic uses of prokariotes. **Prokariotic cell-** Morphology , ultra structure and chemical composition of prokaryotic cell in relation to function. **Bacterial growth** – Growth curve and factors of growth. Nutrition and auxotrophic mutants. **Bacterial taxonomy** - Classification and identification of bacteria with special reference to plant

pathogenic bacteria; advanced taxonomic tools and techniques. **Ecology** – Interrelationship with microbes; Mode of dissemination and survival of phytopathogenic prokaryotes; Vector transmission and pathogen vector relationships. **Bacterial genetics and variability** – Mutation, transformation, transduction and conjugation; Biology of extra chromosomal elements, Plasmids borne genes and their expression : avr, hrp and pat genes. **Bacteriophages** – Morphology, structure, lytic and lysogenic cycles. Phytoplasmas and other fastidious prokaryotes – morphology, biochemical characteristics, reproduction and life cycle. Study of type of diseases caused by bacteria, phytoplasmas and other fastidious prokaryotes and details study of concerned disease. Epidemiology – concepts and pathosystems; detail study of epidemiology of any one best known disease. **Management**–Methods and prokaryotic inhibitors and their mode of action.

PPT 602 :

Research Prelims

4+0

Objective: To provide fundamental knowledge about the collection of literature and reviews, arrangements of data, analysis and their interpretation, preparation of dissertation and research articles.

Learning Outcome: Help the researcher to understand the basic principles for writing experimental findings, dissertation, research articles etc.

Collection of literature and preparation of two review articles: Collection of thesis related review articles (2 objectives) from various sources, system of collection, processing of reviews, compilation, arrangement of reviews arrangement of references in bibliography.

Preparation of synopsis of research topic: Collection of background history, selection of methodology, setting and arrangement of experiments. Making of time frame of research, probable outcome of research and compilation of whole experiments with proper objectives.

Final Registration Seminar (including methodology of trial and experiments): Preparation of Power Point(ppt) slides, content compilation, methods of presentation, question answering etc.

Data analysis and preparation of MS for Thesis: Analysis of data, tabulation, preparation of manuscript by experimental findings and discussions. Preparation of short abstract.