

PROGRAM OUTCOMES, PROGRAM SPECIFIC OUTCOMES, COURSE OUTCOMES

M.Sc. Ag. Plant Pathology

Program outcome	Plant Pathologist commonly work with plant breeders, farmers, entomologists, and botanists in the farms and gardens where plants grow. Additionally, plant pathologists engage with biological scientists and engineers to create safer living arrangements to allow plants to reach their maximum growth, yield and having potential to boost the Indian agriculture economy.
Program specific outcomes	Students of Plant Pathology comprises with the basic knowledge and technologies of Botany, Plant Anatomy, Plant Physiology, Mycology, Bacteriology, Virology, Nematology, Genetics, Molecular Biology, Genetic Engineering, Biochemistry, Horticulture, Tissue Culture, Soil Science, Forestry, Physics, Chemistry, Meteorology, Statistics and many other branches of applied science.
COURSE OUTCOMES	M.SC. (PLANT PATHOLOGY) PROGRAM
COURSE: MYCOLOGY (PL PATH-501)	
CO1.	Describe the introduction, definition of different terms and basic concepts of mycology
CO2.	Elaborate the importance of mycology in agriculture, relation of fungi to human affairs and historical landmarks of mycology.
CO3.	Elaborate the concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.
CO4.	Explain the comparative morphology, ultrastructure, characters of different groups of fungi up to generic level: (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina, v) Deuteromycotina.
CO5.	Define the Lichens, its types and importance, fungal genetics and variability in fungi.
COURSE: PLANT VIROLOGY (PL PATH-502)	
CO1.	Scientific knowledge: Apply the knowledge of plant viruses in terms of composition, structure and nature of plant viruses
CO2.	To study physical and chemical properties, symptomatology, transmission nature, how plant viruses spread from place to another places
CO3.	Detail classification, nomenclature, replication of plant viruses in plant system
CO4.	Understand the basic concept of isolation and purification of plant viruses with help of SEM and TEM microscope
CO5.	Perform procedures and working of electron microscope and ultra-microtome and understand the basic concept of different organisms

	related to viruses such as baculoviruses, RNA phages, Satellite viruses, prions etc.
CO6.	To understand the basic concept of genetic engineering, mechanism of resistance and management of plant viruses
COURSE: PLANT BACTERIOLOGY (PL PATH-503)	
CO1.	Develop a understanding of importance of phytopathogenic bacteria and to study in detail about different phytopathogenic bacteria such as MLOs, spiroplasmas, fastidious bacteria
CO2.	Develop an procedure for understanding of evolution, classification and nomenclature of plantpathogenic bacteria
CO3.	Describe a procedure for understanding of growth nutrients, reproduction and preservation of bacterial cultures
CO4.	Understand the general biology of bacteriophages, L form bacteria and plasmids
CO5.	Describe mode of action of prokaryotic inhibitors
CO6.	Develop an understanding of survival and dissemination of plant pathogenic bacteria
COURSE: PRINCIPLES OF PLANT PATHOLOGY (PL PATH-504)	
CO1.	Describe in detail definations, concept, history of plant disease. Provide basic understanding about biotic and abiotic factors and causes of plant disease
CO2.	Develop an understanding about growth, reproduction and role of environment in plant diseases
CO3.	Enumerate and explain recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens
CO4.	Develop an understanding about genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.
CO5.	Explain in detail different plant management strategies
COURSE: DETECTION AND DIAGNOSIS OF PLANT DISEASES (PL PATH 505)	
CO1.	Describe the methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.
CO2.	Explain the preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, cameralucida.

CO3.	Describe the microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens.
CO4.	Understanding of evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of references.
COURSE: PRINCIPLES OF PLANT DISEASE MANAGEMENT (PL PATH 506)	
CO1.	Explain the principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases.
CO2.	Describe the disease resistance and molecular approach for disease management.
CO3.	Describe the 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
CO4.	Understanding of history of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals
COURSE: INTEGRATED DISEASE MANAGEMENT (PL PATH 516)	
CO1.	Describe the introduction, definition, concept and tools of disease management, components of integrated disease management- their limitations and implications.
CO2.	Understanding the development of IDM- basic principles, biological, chemical and cultural disease management.
CO3.	Understanding the IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed- mustard, pearl millet, <i>kharif</i> pulses, vegetable crops and fruit crops.
COURSE: LIBRARY AND INFORMATION SERVICES (PGS-501)	

CO 1.	To understand Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; eresourcesaccess methods.
COURSE: TECHNICAL WRITING AND COMMUNICATIONS SKILLS (PGS-502)	
CO1.	Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion). Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.
COURSE: EXPERIMENTAL DESIGNS (SPG-502)	
CO1.	To understand various uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design. Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications ~ Lattice design, alpha design - concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.
COURSE: INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (PGS-503)	
CO1.	To understand historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.
COURSE: BASIC CONCEPTS IN LABORATORY TECHNIQUES (PGS-504)	
CO1.	Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and

	preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agrochemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer.
COURSE: REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM (SPG 503)	
CO1.	The use of arial photography, satellite imagery and geographic information syatem for the collection, storage and spatial analysis for ge-reference.Future prospects of remote sensing in India, software used in remote sensing, GIS versus remote sensing, Introduction to GIS software.
COURSE: AGRICULTURAL DEVELOPMENT PROGRAMMES (PGS-505)	
CO1.	To understand history of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility
COURSE: DISASTER MANAGEMENT (PGS-506)	
CO1.	Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.
COURSE: CASSIFICATION OF INSECTS (ENT-504)	
CO1.	Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda–Classes – Ellipura (Collembola, Protura), Diplura and Insecta- Orders contained.Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Subclass: Pterygota, Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.Distinguishing characters, general biology, habits and habitats of Insect orders and economically

	important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.
COURSE: PRINCIPLES OF INTEGRATED PEST MANAGEMENT (ENT-510)	
CO1.	Concept and philosophy, ecological principles, economic threshold concept, and economic consideration. Political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost-benefit ratios and partial budgeting; case studies of successful IPM programmes. Tools of pest management and their integration- legislative, cultural, physical and mechanical methods; pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys.
COURSE: TECHNIQUES IN PLANT PROTECTION (ENT-518)	
CO1.	Pest control equipments, principles, operation, maintenance, selection, application of pesticides and biocontrol agents, seed dressing, soaking, root-dip treatment, dusting, spraying, application through irrigation water. Protein isolation from the pest and host plant and its quantification using spectrophotometer and molecular weight determination using SDS/PAGE. Computer application for predicting/forecasting pest attack and identification.