DEPARTMENT OF HIGHER EDUCATION

RAJA MAHENDRA PRATAP SINGH UNIVERSITY, ALIGARH

AS PER THE ICAR-Sixth Deans' Committee

Course Curriculum of M.Sc. (Ag.) Plant Pathology

Course Curriculum of M.Sc. (Ag.) Plant Pathology
(Based on Restructured and Revised Syllabi of PG Programme by ICAR)

1st Semester			Evaluation Marks			
Code No.	**Course Title**	**Credit Hours**	**Mid Term (Internal)**	**Practical (External)/ Assignment (Internal 2)**	**End term/Final (External)**	**Total**
PPA-501	Principles of Plant Pathology	3(2+1)	20	30	50	100
PPA-502	Mycology	3(2+1)	20	30	50	100
PPA-503	Plant Pathogenic Prokaryotes	3(2+1)	20	30	50	100
	Elective	3(2+1)	20	30	50	100
AST 501	Experimental Design	3(2+1)	20	30	50	100
PGS 501	Basic Concepts in Laboratory Technique	1(0+1)	40	10	-	50
PGS 502	Intellectual Property and Its Management in Agriculture	1(1+0)	-	-	50	50
	Total Credit	**17**				**600**
2nd Semester			**Evaluation Marks**			
PPA-504	Disease Resistance in Plants	3(3+0)	40	10	50	100
PPA-505	Plant Virology	3(2+1)	20	30	50	100
PPA-506	Plant Nematology	2(1+1)	20	30	50	100
	Elective	3(2+1)	20	30	50	100
AST 502	Date Analysis Using Statistical Packages	3(2+1)	20	30	50	100
PGS 503	Agriculture Research, Research Ethic and Rural Development Programmes	1(1+0)	-	-	50	50
PGS 504	Library and Information Services	1(0+1)	40	10	-	50
	Total Credit	**16**				**600**
3rd Semester			**Evaluation Marks**			
PPA-507	Principles of Plant Disease Management	2(1+1)	20	30	50	100
PPA-508	Diseases of Field and Horticultural Crops	4(3+1)	20	30	50	100
PPA-509	Techniques in Detection and Diagnosis of Plant Diseases	2(0+2)	20	30	50	100
	Elective	2(1+1)	-	100	-	100
PGS-505	Technical Writing and - Communications Skills	1(0+1)	-	100	-	100
	Total Credit	**11**				**500**

4th Semester			Evaluation Marks			
PPA-510	Master Seminar	1(0+1)	-	100	-	100
PPA- 511 A	Master Research (Thesis)	30	Satisfactory/Unsatisfactory			
OR						
PPA- 511 B	IDEA (Internship for Development of Entrepreneurship In Agriculture)	30	Satisfactory/Unsatisfactory			
	Total Credit	**31**				**100**
	Grand total credit hours	**45 +30 = 75**				**1800**

M.Sc. (Ag.) Plant Pathology

The following nomenclature and Credit Hrs. are following while structuring Syllabus:

A. Course Work	Course Code	Allotted Credit Hours
1. Major Course	PPA- 501 To PPA- 509	25
2. Minor Course	Elective	08
3. Supporting Course	AST-501 & AST-502	06
4. Common Course	PGS-501 To PGS-505	05
5. Seminar	PPA- 510	01
B. 1.Thesis Research/ IDEA	Master Research or IDEA	30
Total		**75**

List of Minor Papers for Other Departments

Sr. No.	Course Code	Course Name	Allotted Credit Hours	Semester
1	PPA -501	Principles of Plant Pathology	3(2+1)	Ist Sem.
2	PPA -504	Disease Resistance in Plants	3(3+0)	IInd Sem.
3	PPA -507	Principles of Plant Disease Management	2(1+1)	IIIrd Sem.

Note: -

1. The student has to opt. Minor Courses of Minimum 8 credit hours offer by other department.
2. The first course of every semester from the respective department is treated as a Minor for other department.

Detailed syllabus
M.SC. (Ag) PLANT PATHOLOGY
1st SEMSTER

(PPA 501) - Principles of Plant Pathology 3 (2+1)

Theory:

Unit I

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases.

Unit II

Classification of plant diseases, Disease triangle, disease tetra-hedden, Kotches postulates, stages in disease development.

Unit III

Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.

Unit IV

Host parasite interaction, 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.

Unit V

Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.

Practical

- Basic plant pathological techniques;
- Isolation, in osculation and purification of plant pathogens and proving Koch's postulates;
- Techniques to study variability in different plant pathogens;
- Purification of enzymes, toxins and their bio assay;
- Estimation of growth regulators, phenols, phytoalexins in resistant and susceptible plants.

Suggested Reading

- AgriosGN. 2005.Plant Pathology. 5thEd. Academic Press, New York.
- Heitefuss R and Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York.
- Mehrotra RS and Aggarwal A. 2003.Plant Pathology. 2nd Ed. Oxford &IBH,New Delhi.
- Singh RP. 2012. Plant Pathology 2nd edn. Kalyani Publishers, New Delhi.
- Singh RS. 2017. Introduction to Principles of Plant Pathology. 5th edn.Med Tech,New Delhi.
- Singh D Pand Singh A .2007.Disease and Insect Resistance in Plants .Oxford &IBH, New Delhi.Upadhyay RK. and Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.

(PPA 502) Mycology 3 (2+1)

Theory

Unit I

Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs. History of mycology. Importance of culture collection and herbarium of fungi. Somatic characters and reproduction in fungi. Modern concept of nomenclature and classification, Classification of kingdom fungi: Stramenopila and Protists.

Unit II

The general characteristics of protists and life cycle in the Phyla Plasmodiophoromycota, Dictyosteliomycota, Acrasiomycota and Myxomycota.Kingdom Stramenopila: characters and life cycles of respective genera under Hypochytriomycota, Oomycota and Labyrinthulomycota.

Unit III

Kingdom fungi: General characters, ultrastructure and life cycle patterns in representative genera under Chytridiomycota, Zygomycota, Ascomycota; Archiascomycetes, Ascomycetous yeasts, Pyrenomycetes, Plectomycetes, Discomycetes, Loculoascomycetes, Erysiphales and anamorphs of ascomycetous fungi.

Unit IV

Basidiomycota; general characters, mode of reproduction, types of basidiocarpsand economic importance of Hymenomycetes. Uridinales and Ustilaginales; variability.

Unit V

Host specificity and life cycle pattern in rust sand smuts. Mito aporic fungi; status; status of asexual fungi, their teliomorphic relationships, Molecular characterization of plant pathogenic fungi.

Practical

- Detailed comparative study of different groups of fungi;
- Collection of cultures and live specimens;
- Saccardoan classification and classification based on conidiogenesis;
- Vegetative structures and different types of fruiting bodies produced by slime molds, Stramenopila and true fungi;
- Myxomycotina Fructification, plasmodiocarp, sporangia, plasmodium andaethalia. Oomycota;
- Somatic and reproductory structures of Pythium, Phytophthora,
- Downy mildews and Albu go, Zygomycetes: Sexual and asexual structures of Mucor,
- Rhizopus, General characters of VAM fungi. Ascomycetes; fruiting
- structures, Erysiphales, and Eurotiales;
- General identification characters of Pyrenomycetes, Discomycetes, Loculoascomycetes and Laboulbenio-mycetes, Basidiomycetes; characters,
- ultrastructures and life cycle patterns in Ustilaginomycetes and Teliomycetes, Deuteromycetes;
- Characters of Hyphomycetes and Coelomycetes and their teliomorphic and
- anamorphic states, Collection, preservation, culturing and identification of plant parasitic fungi;
- Application of molecular approaches and techniques for identification of fungal pathogens.

Suggested Reading

- Ainsworth GC, Sparrow FK and Susman HS. 1973. The Fungi – An Advanced Treatise. Vol. IV (A & B). Academic Press, New York.
- Alexopoulos CJ, Mims CW and Blackwell M.2000. Introductory Mycology.5th Ed. John Wiley & Sons, New York.
- Maheshwari R. 2016. Fungi: Experimental Methods in Biology 2nd end.CRC Press, US. Mehrotra RS and Arneja KR. 1990. An Introductory
- Mycology. Wiley Eastern, New Delhi. Sarbhoy AK. 2000. Text book of
- Mycology. ICAR, New Delhi.
- Singh RS. 1982. Plant Pathogens – The Fungi. Oxford & IBH, New Delhi.
- Webster J. 1980. Introduction to Fungi. 2nd Ed. Cambridge Univ. Press,
- Cambridge, New York.

(PPA 503) Plant Pathogenic Prokaryotes 3 (2+1)

Theory:

Unit I

Prokaryotic cell: History and development of Plant bacteriology, history of plant bacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and gram positive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccaride structure; Membrane transport; fimbrae and pili (Type IV pili); Mechanism of flagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (Slayer;

capsule); the bacterial chromosomes and plasmids; Operon and other structures in cytoplasm; Morphological feature of fastidious bacteria, spiroplasmas and Phytoplasmas.

Unit II

Growth and nutritional requirements. Infection mechanism, role of virulence factors in expression of symptoms. Survival and dispersal of phytopathogenic prokaryotes.

Unit III

Taxonomy of phytopathogenic prokarya: Taxonomic ranks hierarchy; Identification, Classification and nomenclature of bacteria, phytoplasma and spiroplasma. The codes of Nomenclature and characteristics. Biochemical and molecular characterization of phytopathogenic prokaryotes.

Unit IV

Variability among phytopathogenic prokarya: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteriaconjugation; transformation; transduction); and horizontal gene transfer.

Unit V

Bacteriophages, L form of bacteria, plasmids and bdellovibrios: Structure; Infection of host cells; phage multiplication cycle; Classification of phages, Use of phages in plant pathology/ bacteriology, Lysogenic conversion; H Plasmids and their types, plasmid borne phenotypes.Introduction to bacteriocins. Strategies for management of diseases caused by phytopathogenic prokaryotes.

Practical

- Study of symptoms produced by phytopathogenic prokaryotes;
- Isolation, enumeration, purification, identification and host inoculation of phytopathogenic bacteria;
- Stains and staining methods;
- Biochemical and serological characterization;
- Isolation of genomic DNA plasmid;
- Use of antibacterial chemicals/ antibiotics;
- Isolation of fluorescent Pseudomonas;
- Preservation of bacterial cultures;
- Identification of prokaryotic organisms by using 16S rDNA, and other gene sequences;
- Diagnosis and management of important diseases caused by bacteria and mollicutes.

Suggested Reading

- Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
- Jayaraman J and Verma JP. 2002. Fundamentals of Plant Bacteriology. Kalyani Publishers, Ludhiana.
- Mount MS and Lacy GH. 1982. Phytopathogenic Prokaryotes. Vols. I, II Academic Press, New York.
- Salle AJ. 1979. Fundamental Principles of Bacteriology 7th end.
- Verma JP, Varma A and Kumar D. (Eds). 1995. Detection of Plant Pathogens

(AST 501) Experimental Designs 3(2+1)

Theory

Unit I

Need for designing of experiments, characteristics of a good design. Basic principles of designs-randomization, replication and local control.

Unit II

Uniformity trials, size and shape of plots and blocks, Analysis of variance, completely randomized design, randomized block design and Latin square design.

Unit III

Factorial experiments, (symmetrical as well as asymmetrical). Orthogonality and partitioning of degrees of freedom. Concept of confounding.

Unit IV

Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications.

Unit V

Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined analysis.

Practical

- Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law,
- Analysis of data obtained from CRD, RBD, LSD, Analysis of factorial experiments,
- Analysis with missing data,
- Split plot and strip plot designs.

Suggested Reading

- Cochran WG and Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
- Dean AM and Voss D. 1999. Design and Analysis of Experiments. Springer.
- Montgomery DC. 2012. Design and Analysis of Experiments, 8th Ed. John Wiley.
- Federer WT. 1985. Experimental Designs. MacMillan.
- Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments.IASRIPubl.
- Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley.
- www.drs.icar.gov.in.

(PGS 501) BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Practical

- 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 agro-chemical doses in field and pot applications;
- Preparation of solutions of acids;
- Neutralization of acid and bases;
- Preparation of buffers of different strengths and pH values;
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer,
- magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath
- Electric wiring and earthing;
- Preparation of media and methods of sterilization;
- Seed viability testing, testing of pollen viability;
- Tissue culture of crop plants;
- Description of flowering plants in botanical terms in relation to taxonomy.

Suggested Readings

- Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press
- Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ.Co.

(PGS 502) Intellectual Property and Its Management In Agriculture 1(1+0)

Theory

Historical perspectives and need for the introduction of Intellectual Property Rightregime;TRIPs and various provisions in TRIPS Agreement; Intellectual Propertyand Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislationsfor the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement**.**

Suggested Readings

- Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural
- Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy.
- McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and
- Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol.
- V.Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal
- Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing
- Countries: A Compendium on Law and Policies. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks
- Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000;
- PPV and FR Act 2001, and Rules 2003; The Biological Diversity Act, 2002.

2nd SEMESTER

(PPA 504) Disease Resistance in Plants 3(3+0)

Theory

Unit I

Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centers as sources of resistance.

Unit II

Disease resistance terminologies. Disease escape, non-host resistance and disease tolerance.

Unit III

Genetic basis of disease resistance, types of resistance, identification of physiological races of pathogen, disease progression in relation to resistance, stabilizing selection pressure in plant pathogens.

Unit IV

Host defense system, morphological and anatomical resistance, pre-formed chemicals in host defense, post inflectional chemicals in host defense, phytoalexins, hypersensitivity and its mechanisms.

Unit V

Genetic basis of relationships between pathogen and host, Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment

(PPA 505) Plant Virology 3(2+1)

Theory

Unit I

History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, Arbo and Baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions. Origin and evolution of viruses and their nomenclature and classification.

Unit II

Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatically changes.

Unit III

Transmission of viruses and virus-vector relationship. Isolation and purification of viruses.

Unit IV

Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques. Natural (R-genes) and engineering resistance to plant viruses.

Unit V

Virus epidemiology and ecology (spread of plant viruses in fields, host range and survival). Management of diseases caused by plant viruses.

Practical

- Study of symptoms caused by plant viruses (followed by field visit);
- Isolation and biological purification of plant virus cultures;
- Bioassay of virus cultures on indicator plants and host differentials;
- Transmission of plant viruses (Mechanical, graft and vector and study of disease development);
- Plant virus purification (clarification, concentration, centrifugation, high resolution separation and analysis of virions), Electron microscopy for studying viral particle morphology;
- Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid (Non-PCR–LAMP, Later flow micro array and PCR based techniques);
- Exposure to basic bio-informatic tools for viral genome analysis and their utilization in developing detection protocols and population studies (Blast tool, Primer designing software, Bloedite tool, Claustal X/W, MEGA Software).

Suggested Reading

- Bos L. 1964. Symptoms of Virus Diseases in Plants. Oxford & IBH., New Delhi.
- Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ and Watson L. 1995. Virus of Plants: Descriptions and Lists from VIDE Database. CABI, Wallington.
- Gibbs A and Harrison B. 1976. Plant Virology – The Principles. Edward Arnold, London. Hull
- R. 2002. Mathew's Plant Virology. 4th Ed. Academic Press, New York.
- Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments.Oxford & IBH, New Delhi.
- Wilson C. 2014. Applied Plant Virology. CABI Publishing England.

(PPA 506) Plant Nematology 2 (1+1)

Unit I

Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.

Unit II

Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.

Unit III

Types of parasitism; nature of damage and general symptomatology; interaction of plant-parasitic nematodes with other organisms.

Unit IV

Plant nematode relationships, cellular responses to infection by important Phyto-nematodes; physiological specialization among Phyto nematodes.

Unit V

Principles and practices of nematode management; integrated nematode management. Emerging nematode problems, Importance of nematodes in international trade and quarantine.

Practical

- Studies on kinds of nematodes- free-living, animal, insect and plant parasites;
- Nematode extraction from soil;
- Extraction of migratory endoparasites, staining for sedentary endoparasites;
- Examination of different life stages of important plant parasitic nematodes,
- their symptoms and histopathology.

Suggested Reading

- Dropkin VH. 1980. An Introduction to Plant Nematology. John Wiley & Sons, New York. Maggenti AR. 1981. General Nematology. Springer-Verlag, New York.
- Perry RN and Moens M. 2013. Plant Nematology. 2nd Ed. CABI Publishing: Wallingford, UK. Perry RN, Moens M, and Starr JL. 2009. Root-knot nematodes, CABI Publishing: Wallingford.
- Sikora RA, Coyne D, Hallman J and Timper P. 2018. Plant Parasitic Nematodes in Subtropical and Tropical Agriculture.3rd end. CABI Publishing, England.
- Thorne G. 1961. Principles of Nematology. McGraw Hill, New Delhi.
- Walia RK and Bajaj HK. 2003. Text Book on Introductory Plant Nematology.
- ICAR, New Delhi. Walia RK and Khan MR. 2018. A Compendium of Nematode Diseases of Crop Plants.

(AST 502) Data Analysis Using Statistical Packages 3(2+1)

Theory

Unit I

Introduction to various statistical packages: Excel, R, SAS, SPSS. Data Preparation; Descriptive statistics; Graphical representation of data, Exploratory data analysis.

Unit II

Test for normality; Testing of hypothesis using chi-square, t and F statistics and-Ztest.

Unit III

Data preparation for ANOVA and ANCOVA, Factorial Experiments, contrast analysis, multiple comparisons, Analyzing crossed and nested classified designs.

Unit IV

Analysis of mixed models; Estimation of variance components; Correlation and regression analysis, Probit, Logit and Tobit Models.

Unit V

Discriminant function; Factor analysis; Principal component analysis; Analysis of time series data, Fitting of non-linear models; Neural networks.

Practical

- Use of software packages for summarization and tabulation of data, obtaining descriptive statistics, graphical representation of data
- Testing the hypothesis for one sample t-test, two sample t-test, paired t-test, test for
- large samples - Chi-squares test, F test, one-way analysis of variance;
- Designs for Factorial Experiments, fixed effect models, random effect models, mixed
- effect models, estimation of variance components;
- Linear regression, Multiple regression, Regression plots
- Discriminant analysis - fitting of discriminant functions, identification of important
- variables
- Factor analysis. Principal component analysis - obtaining principal component.

Suggested Reading

- Anderson C.W. and Loynes R.M. 1987. The Teaching of Practical Statistics. John Wiley.
- Atkinson A.C. 1985. Plots Transformations and Regression. Oxford University Press.
- Chambers J.M., Cleveland W.S., Kleiner B and Tukey P.A. 1983. Graphical Methods for Data Analysis. Wadsworth, Belmont, California.
- Chatfield C. 1983. Statistics for Technology. 3rd Ed. Chapman & Hall. Chatfield C. 1995. Problem Solving: A Statistician's Guide. Chapman & Hall.
- Cleveland W.S. 1985. The Elements of Graphing Data. Wadsworth, Belmont, California.
- Ehrenberg ASC. 1982. A Primer in Data Reduction. John Wiley.
- Erickson B.H. and Nosan Chuk T.A. 1992. Understanding Data. 2nd Ed. Open University Press, Milton Keynes.
- Snell E.J. and Simpson HR. 1991. Applied Statistics: A Handbook of GENSTAT Analyses. Chapman and Hall.
- Sprent P. 1993. Applied Non-parametric Statistical Methods. 2nd Ed. Chapman & Hall.
- Tufte ER. 1983. The Visual Display of Quantitative Information. Graphics Press, Cheshire, Conn.
- Velleman PF and Hoaglin DC. 1981. Application, Basics and Computing of Exploratory Data Analysis. Duxbury Press.
- Weisberg S. 1985. Applied Linear Regression. John Wiley.
- Wetherill GB. 1982. Elementary Statistical Methods. Chapman & Hall.

(PGS 503)- Agricultural Research, Research Ethics and Rural Development Programmes 1 (1+0)

Theory:

UNIT I

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;

UNIT II

Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (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.

UNIT III

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT IV

Concept and connotations of rural development, rural development policies and strategies. Rural development Programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati-Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organizations.

UNIT V

Critical evaluation of rural development policies and Programmes. Constraints in implementation of rural policies and Programmes.

Suggested Readings

- Bhalla GS and Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
- Punia MS. Manual on International Research and Research Ethics. CCS Haryana Agricultural University, Hisar.
- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
- Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

(PGS 504)-Library and Information Services 1(0+1)

Practical

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; e-resources access methods.

3rd SEMESTER

(PPA 507) Principles of Plant Disease Management 2(1+1)

Theory

Unit I

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. Disease resistance and molecular approach for disease management.

Unit II

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. Label claim of fungicides.

Unit III

Application of chemicals on foliage, seed and soil, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects and safety measures

Unit IV

Introduction, definition, concept and tools of integrated disease management, components of integrated disease management- their limitations and implications. Development of IDM-basic principles, biological, chemical and cultural disease management.

Unit V

IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed and mustard, pearl millet, pulses, vegetable crops, fruit, plantation and spice crops.

Practical

- Phytopathometry.
- Methods of in-vitro evaluation of chemicals, antibiotics, bio agents against plant pathogens;
- Field evaluation of chemicals, antibiotics, bio agents against plant pathogens;
- Soil solarisation, methods of soil fumigation under protected cultivation;
- Methods of application of chemicals and bio control agents;
- ED and MIC values, study of structural details of sprayers and dusters;
- Artificial epiphytotic and screening of resistance.
- Application of physical, biological and cultural methods;
- Use of chemical and bio-control agents, their compatibility and integration in IDM. Demonstration of IDM and multiple disease management in crops of regional importance as project work.

Suggested Reading

Fry WE. 1982. Principles of Plant Disease Management. Academic Press, New York.Hewitt HG. 1998. Fungicides in Crop Protection. CABI, Wallington. Marsh RW. 1972.
Systemic Fungicides. Longman, New York.
Nene YL and Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford & IBH, New Delhi.
Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer Verlag, New York.
Vyas SC. 1993 Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.
Gupta VK and Sharma RC. (Eds). 1995. Integrated Disease Management and Plant Health. Scientific Publ., Jodhpur.
Mayee CD, Manohara chary C, Tilak KVBR, Mukadam DS and Deshpande Jayashree (Eds.). 2004. Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publ. House, New Delhi.
Sharma RC and Sharma JN. (Eds). 1995. Integrated Plant Disease Management. Scientific Publ., Jodhpur.

(PPA 508) Diseases of Field and Horticultural Crops 4(3+1)

Theory

Unit I

Nature, prevalence, factors affecting disease development and management of Diseases of Cereal crops- Rice, wheat, barley, pearl millet, sorghum and maize. Diseases of Pulse crops- Gram, Urdbean, mungbean, lentil, pigeon pea, soybean and cowpea. Diseases of Oilseed crops- Rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor, Diseases of Cash crops- Cotton, sugarcane, Diseases of Fodder legume crops- Berseem, oats, guar, Lucerne.

Unit II

Introduction, symptoms and etiology of different fruit diseases. Factors affecting disease development in fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus, mango, grapes, guava, ber, banana, pineapple, papaya, fig, pomegranate, date palm, custard apple and their management.

Unit III

Symptoms, mode of perpetuation of diseases of plantation crops such as tea, coffee, rubber and coconut and their management.

Unit IV

Symptoms and life cycle of pathogens. Factors affecting disease development of ornamental plants such as roses, gladiolus, tulip carnation, gerbera orchids, marigold, chrysanthemum and their management.

Unit V

Nature, prevalence, factors affecting disease development of tuber, bulb, leafy vegetable, crucifers, cucurbits and solanaceous vegetables. Diseases of crops under protected cultivation. Symptoms and management of diseases of different root, tuber, bulb, leafy vegetables, crucifers, cucurbits and solanaceous vegetable crops. Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, nutmeg, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger. Biotechnological approaches in developing disease resistant transgenic.

Practical

- Detailed study of symptoms and host parasite relationship of representative diseases of above mentioned crops;
- Collection and dry preservation of diseased specimens of important crops.
- Histopathological study of crops which covered in theory.
- Field visit for identification of various plant diseases in your curriculum

Suggested Reading

- Joshi LM, Singh DV and Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.
- Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, New Delhi.
- Ricanel C, Egan BT, Gillaspie Jr AG and Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
- Singh RS. 2017. Plant Diseases. 10th Ed. Medtech, New Delhi.
- Singh US, Mukhopadhyay AN, Kumar J and Chaube HS. 1992. Plant Diseases of Internatiobnal Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.
- Gupta VK and Sharma SK. 2000. Diseases of Fruit Crops. Kalyani Publishers, New Delhi.
- Pathak VN. 1980. Diseases of Fruit Crops. Oxford & IBH, New Delhi.
- Singh RS. 2000. Diseases of Fruit Crops. Oxford & IBH, New Delhi.

- Walker JC. 2004. Diseases of Vegetable Crops. TTPP, India.
- Chaube HS, Singh US, Mukhopadhyay AN N and Kumar J. 1992. Plant Diseases of International Importance. Vol. II. Diseases of Vegetable and Oilseed Crops. Prentice Hall, Englewood Cliffs, New Jersey.
- Gupta VK and Paul YS. 2001. Diseases of Vegetable Crops. Kalyani Publishers, New Delhi
- Gupta SK and Thind TS. 2006. Disease Problem in Vegetable Production. Scientific Publ., Jodhpur.
- Sherf AF and McNab AA. 1986. Vegetable Diseases and their Control. Wiley Inter Science, Columbia.
- Singh RS. 1999. Diseases of Vegetable Crops. Oxford & IBH, New Delhi.
- Walker JC. 1952. Diseases of Vegetable Crops. McGraw-Hill, New York

(PPA 509) Techniques in Detection and Diagnosis of Plant Diseases 2(0+2)

Practical

Detection of plant pathogens
1. Based on visual symptoms,
2. Biochemical test
3. Using microscopic techniques,
4. Cultural studies; (use of selective media to isolate pathogens).
5. Biological assays (indicator hosts, differential hosts)
6. Serological assays
7. Nucleic acid based techniques (Non-PCR–LAMP, Later flow microarray and PCR based- multiplex, nested, qPCR, immune capture PCR, etc.);

- Phenotypic and genotypic tests for identification of plant pathogens;
- Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer region sequences-prokaryotic organisms; and eukaryotic organism by ITS region) and whole genome sequencing;
- Volatile compounds profiling by using GC-MS and LC-MS;
- FAME analysis, Fluorescence in-situ Hybridization (FISH), Flow Cytometry, Phage display technique, biosensors for detection of plant pathogens;
- Genotypic tools such as genome/ specific gene sequence homology comparison by BLAST (NCBI and EMBL) and electron microscopy techniques of plant virus detection and diagnosis.

Suggested Reading

- Baudoin ABAM, Hooper GR, Mathre DE and Carroll RB. 1990. Laboratory Exercises in Plant Pathology: An Instructional Kit. Scientific Publ., Jodhpur.
- Dhingra OD and Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo. Fox RTV. 1993. Principles of Diagnostic Techniques in Plant Pathology, CABI Wallington. Forster D and Taylor SC. 1998. Plant Virology Protocols: From Virus Isolation to Transgenic
- Resistance. Methods in Molecular Biology. Humana Press, Totowa, New Jersey.
- Mathews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Boca Raton,
- Tokyo. Matthews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Florida.
- Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Cent. Agic. Pub.
- Doc. Wageningen.
- Pathak VN. 1984. Laboratory Manual of Plant Pathology. Oxford & IBH, New
- Delhi. Troiano RN, Windham MT and Windham AS. 2004. Plant Pathology Concepts and Laboratory

- Exercises. CRC Press, Florida. Chakravarti BP. 2005. Methods of Bacterial Plant Pathology. Aggrotech, Udaipur.

PGS 505) Technical Writing and Communications Skills 1(0+1)

Practical (Technical Writing)

- 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);
- Writing of abstracts, summaries, précis, citations, etc.; Commonly used abbreviations
- in the theses and research communications;
- Illustrations, photographs and drawings with suitable captions; pagination, numbering
- of tables and illustrations;
- Writing of numbers and dates in scientific write-ups;
- Editing and proof-reading;
- Writing of a review article;
- Communication Skills - 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.
- Suggested Readings

- Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.
- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
- Collins' Cobuild English Dictionary. 1995.
- Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed.
- Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced
- Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
- James HS. 1994. Handbook for Technical Writing. NTC Business Books.
- Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed.
- Affiliated East-West Press.
- Mohan K. 2005. Speaking English Effectively. MacMillan India.
- Richard WS. 1969. Technical Writing.
- Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd
- Ed. Prentice Hall of India.
- Wren PC and Martin H. 2006. High School English Grammar and Composition. S.
- Chand & Co.

4th Semester

(PPA 510)	**Master Seminar**	**1(0+1)**
(PPA -511A)	**Master Research (Thesis)**	**30**

OR

(PPA-511 B)	**IDEA (Internship for Development of Entrepreneurship in Agriculture)**	**30**