

# **SHRI GURU RAM RAI UNIVERSITY**

**PATEL NAGAR DEHRADUN, UTTARAKHAND (INDIA)**

(Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017)

## **COURSE CURRICULA & SYLLABI**

*Effective from Academic Session 2021-22*

**For Academic Programme**

**Ph. D. Plant Pathology**



**Approved By:**

**BOARD OF STUDIES, Plant Pathology**

**DEPARTMENT OF Plant Pathology  
SCHOOL OF AGRICULTURAL SCIENCES  
SHRI GURU RAM RAI UNIVERSITY PATEL NAGAR DEHRADUN,  
UTTARAKHAND (INDIA) -248001**

## Curriculum and Syllabus for Ph.D. (Plant Pathology) 2021 onwards

Table: The course structure and Assessment scheme:

S.N	Course No.	Subject	Credits T:P	Total Credit	Total Marks	Maximum marks to be scored for successful completion
<b>Core Courses</b>						
1	PRMC-601	Paper I Research Methodology*	4(3+1)	4	100	50
2	PRPE-602	Paper II Research and publication ethics*	2(1+1)	2	100	50
3	PPPC-603	Epidemiology and disease forecasting	4(3+1)	4	100	50
4	PPPS-604	Doctoral Seminar	1(0+1)	1	100	50
<b>Elective courses</b>						
5	PPPE-605	Advanced Virology**	4(3+1)	4	100	50
6	PPPE-606	Advanced Bacteriology**	4(3+1)	4		
7	PPPE-607	Molecular basis of host pathogen interaction**	4(3+1)	4		
8	PPPE-608	Plant Bio-security and Plant Bio-safety**	4(4+0)	4		
<b>Ph.D Thesis Research</b>						
9	PPPT-609	Ph.D Thesis	15	15	500	

\*Core courses , \*\*Elective courses (Students have to select any one course from above elective courses)

## Pre- Ph. D. Courses

**Programme Outcome:** After completion of programme the students will be able to

P.O. 1: Develop deeper understanding of a subject for its application in addressing socio-economic issues pertaining to agriculture.

P.O. 2: To understand the critical aspects of conducting ethical research for sustainable development.

P.O. 3: To develop the capability of reasoning-based scientific solution for agricultural pest problems.

P.O.4: To understand the impact of research & development on environment safety and sustainability.

P.O.5: Inculcate the leadership skills required to identify the problem and finding the solution in coherence with the teamwork.

P.O.6: To develop the skill set of designing and executing experiments pertaining to a targeted scientific problem.

P.O.7: Develop the analytical skills prerequisite for analyzing data, explaining findings, justifying the findings to reach final conclusion.

P.O.8: To develop meticulous scientific writing skills for presenting the research outcomes.

### Course outcome

**After Successful completion of course scholars will be able to:**

S.N	Course no.	Subject	COURSE OUTCOME
1.	PPPC-603	Advanced virology	CO1. Acquaint with the latest advances in Mycology. CO2.Summarise Recent taxonomic criteria, morphological criteria for classification. CO3.Categorize reproduction in different groups of fungi. CO4.Explain Mechanism of nuclear inheritance and extra-nuclear inheritance.

2.	<b>PPPS-604</b>	Doctoral Seminar	<p>CO.1: Acquaint with scientific terms, concepts and content preparation, etc.</p> <p>CO.2: Outline and summarize presentation.</p> <p>CO.3: Present and implement photographs and sketches in power point to give valuable information.</p> <p>CO.4: correlate research proposal or synopsis, report, manuscripts/article and publications.</p>
3.	<b>PPPE-605</b>	Advanced Mycology**	<p>CO1.define advanced techniques and new developments in the field of Plant Virology.</p> <p>CO 2. Summarize Mechanism of virus transmission.</p> <p>CO3.categorize methods of immune-diagnosis, hybridoma technology.</p> <p>CO4.Explain Genetic engineering with plant viruses, viral suppressors, a RNAi dynamics, resistant genes.</p>
3.	<b>PPPE-606</b>	Advanced Bacteriology**	<p>CO 1.characterization and identification of phytopathogenic bacteria</p> <p>CO 2. Summarize Current trends in taxonomy of phytopathogenic procarya</p> <p>CO3.Determine Role of enzyme, toxin, expolysaccharide, polypeptide signals in disease development</p> <p>CO4. Explain Host-bacterial pathogen interaction.</p>

4.	<b>PPPE-607</b>	Molecular basis of host pathogen interaction**	CO1. Define concepts of molecular biology and biotechnology in relation to host-pathogen interactions. CO2. categorize Molecular basis of host-pathogen interaction CO3. Examine Induction of defense responses CO4. Correlate Biotechnology and disease management
5.	<b>PPPE-608</b>	Plant Bio-security and Plant Bio-safety**	CO1. facilitate deeper understanding on plant biosecurity and biosafety issues in agriculture CO2. outline and summarize National Regulatory Mechanism and International Agreements CO3. Determine Biosafety, policies and regulatory mechanism,. CO4. Explain release of genetically modified crops.
7.	<b>PPPT-609</b>	<b>Ph.D Thesis</b>	CO.1: Remember scientific terms of research designing, citation and bibliography. CO.2: summarize ethical dimensions of research work and knowledge to obtain appropriate approval. CO.3: correlate scientific measurements, statistical calculations and analysis of data. CO.4: Explain research works, collection, classification, presentation and analysis of data.

## **PROGRAMME (ONE SEMESTER COURSE)**

### **Core Courses**

There will be three core courses and one seminar which carry 100 marks. Elective Course which carry 4 credits. Theory Paper will be of 60 marks and the sessional tests shall be of 40 marks (60+40=100). The candidate will have to take any one elective course.

## **CORE COURSE-I**

### **PRMC-601: Paper-I Research Methodology 4(3+1)**

#### **Unit I- Concept & Types of Research**

Meaning and importance of Research – Types of Research – Selection and formulation of Research Problem – Research Design, Classification of Research, Pure and Applied Research, Exploring or formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation research/Studies, Action Research, Experimental Research, Analytical Study of Statistical Method, Historical Research,

#### **Unit II –Methods Research**

Surveys, Case Study, Field Studies General Survey of various Methods including Survey Method, Interdisciplinary Method, Case Study Method, Sampling Method, Statistical Method, Observation Method, Interview Method, Schedule Method, Questionnaire Method, Documentary Method, Library Method, Historical Method and Scientific Method. Characteristic Features of Scientific Method; Empirical Verifiable, Cumulative, Self - Correcting, Deterministic, Ethical & Ideological neutrality (Value Free).

#### **Unit III- Data Collection and Data Analysis**

Collection, Objectives and Classification of Data, Aims, Methods and Objects of Tabulation of Data, Forms and Processes of Interpretation and Presentation of Data.

Primary, Secondary and Tertiary Data. Construction and adaptation of instruments, administration of questions and tests, Tabulation of data. Data organization in SPSS & Excel, Graphical representation of data.

Definition and Aims of Content Analysis, Problems of Content Analysis, Computer and Content Analysis Discussion and Interpretation of results, Testing of Hypothesis: Logical and Statistical Techniques.

#### **Unit IV- Report Writing**

Locating Information on a Topic of Interest, Acquiring Copies of Articles of Interest, The Nature of Scientific Variables, Conceptual Versus Operational Definitions of Variables, Levels of Measurement, Various Paradigms including Formism, Mechanism, Organicism, Pragmatism, The Basic Format for a Research Report, Identification of the Parts of a Research Report, Citation and Referencing Styles, Essentials of Report Writing, Aids for Writing Good Research Report.

#### **References**

Bagchi, Kanak Kanti (2007). Research Methodology in Social Sciences: A Practical Guide, Delhi, Abijeet Publications.

Sharma, B.A.V. et al., (2000). Research Methods in Social Sciences, New Delhi, Sterling Publishers.

B.A.V. Busha, C. H and Harter, S. D. (1980). Research Methods in Librarianship, New Academic Press.

Cooper, R. Donald and Pamela S. Schindler (2003). Business Research Methods, Delhi, Tata McGraw-Hill.

Flyvbjerg, Bent (2001). Making Social Science Matter: Why Social Inquiry Fails and How it can succeed Again, United Kingdom, Cambridge University Press.

Goodde and Hatte (1952). Methods in Social Research, New York, Mc Graw – Hill.

Gopal, M.H (1970) An Introduction to Research Procedures in Social Sciences, Bombay, Asia Publishing House.

Hunt, Morton (1989) Profiles of Social Research: The Scientific Study of Human Interactions, Bombay, Popular Prakashan.

Kothari, C.R (2004) Research Methodology: An Introduction, Delhi, New Age.

## **PRPE-602: Paper-II Research & Publication Ethics 2(1+1)**

### **Philosophy and Ethics**

- Introduction to Philosophy: definition, nature and scope, concept, branches
- Ethics: definition, moral philosophy, nature of moral judgements and reactions

### **Scientific Conduct**

- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
- Redundant publications: duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

### **Publication Ethics**

- Publication ethics: definition, introduction and importance
- Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
- Conflicts of interest
- Publication misconduct: definition, concept, problems that lead to unethical behaviour

- and vice -versa, types
- Violation of publication ethics, authorship and contributorship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals

## **Practicals**

### **Open Access Publishing**

- Open access publications and initiatives
- SHERPA/ RoMEO online resource to check publisher copyright & self- archiving policies
- Software tool to identify predatory publications developed by SPPU
- Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

### **Publication Misconduct**

#### **Group Discussions**

- Subject specific ethical issues, FFP, authorship
- Conflicts of interest
- Complaints and appeals: examples and fraud from India and abroad

#### **Software tools**

- Use of plagiarism software like Turnitin, Urkund and other open source software tools
- Databases and Research Metrics

#### **Databases**

- Indexing databases
- Citation databases: Web of Science, Scopus, etc.

#### **Research Metrics**

- Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
- Metrics: h- index, g index, i10 index, altmetricsPre- Ph. D. Courses

## **PPPC-603 : Epidemiology and forecasting of Plant Diseases**

**3+1**

**Objective:** To acquaint with the principles of epidemiology and its application in disease forecasting.



## **Theory**

### **UNIT I**

Epidemic concept and historical development, pathometry and crop growth stages, epidemic growth and analysis.

### **UNIT II**

Common and natural logarithms, function fitting area under disease progress curve and correction factors, inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens.

### **UNIT III**

Survey, surveillance and vigilance, crop loss assessment and models.

### **UNIT IV**

Principles and pre-requisites of forecasting, systems and factors affecting various components of forecastings, some early forecasting, procedures based on weather and inoculum potential, modeling disease growth and disease prediction.

**Practical:** Measuring diseases, spore dispersal and trapping, weather recording, survey, computerized data analysis, function fitting, model preparation and validation.

### **Suggested Readings**

Campbell CL & Madden LV. 1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons. New York Cowling EB & Horsefall JG. 1978.

Plant Disease. Vol. II. Academic Press, New York. Laurence VM, Gareth H & Frame Van den Bosch (Eds.). The Study of Plant Disease Epidemics. APS, St. Paul, Minnesota.

Nagarajan S & Murlidharan K. 1995. Dynamics of Plant Diseases. Allied Publ., New Delhi.

Thresh JM. 2006. Plant Virus Epidemiology. Advances in Virus Research 67, Academic Press, New York.

Van der Plank JE. 1963. Plant Diseases Epidemics and Control. Academic Press, New York. Zadoks JC &

Schein RD. 1979. Epidemiology and Plant Disease Management. Oxford Univ. Press, London. PPA 518

**Objective** To educate about the advanced techniques and new developments in the field of Plant Virology.

## **Theory**

### **UNIT I**

Mechanism of virus transmission by vectors, virus-vector relationship, bimodal transmission and taxonomy of vectors and viruses, vector specificity for classes of viruses, virus replication, assembly and architecture, ultra structural changes due to virus infection, variation, mutation and virus strains.

### **UNIT II**

Immunoglobulin structure and functions of various domains, methods of immunodiagnosis, hybridoma technology and use of monoclonal antibodies in identification of viruses and their strains, Polymerase Chain Reaction.

### **UNIT III**

Genome organization, replication, transcription and translational strategies of pararetroviruses and gemini viruses, satellite viruses and satellite RNA genome organization in tobamo-, poty-, bromo, cucummo, ilar and tospoviruses.

### **UNIT IV**

Gene expression and regulation, viral promoters, molecular mechanism of host virus interactions, virus induced gene, molecular mechanism of vector transmission, symptom expression, viroids and prions.

### **UNIT V**

Genetic engineering with plant viruses, viral suppressors, a RNAi dynamics, resistant genes. Viruses potential as vectors, genetically engineered resistance, transgenic plants.

### **UNIT VI**

Techniques and application of tissue culture. Origin, evolution and inter relationship with animal viruses.

## **Practical**

Purification of virus(es), SDS-PAGE for molecular weight determination, production of polyclonal antiserum, purification of IgG and conjugate preparation, serological techniques (i) DAC-ELISA (ii) DAS -ELISA (iii) DIBA (iv) Western blots (v) (ab) 2-ELISA, vector transmission (one

each with aphid, leaf hopper and whitefly), methods for collecting vectors and their maintenance, nucleic acid isolation, DOT-blot, southern hybridization, probe preparation and autoradiography, PCR application and viral genome cloning, sequencing annotation of genes.

### **Suggested Readings**

Davies 1997. Molecular Plant Virology: Replication and Gene Expression. CRC Press, Florida.  
Fauquet et al. 2005.

Virus Taxonomy. VIII Report of ICTV. Academic Press, New York.

Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London.

Jones P, Jones PG & Sutton JM. 1997. Plant Molecular Biology: Essential Techniques.

John Wiley & Sons, New York.83 Khan JA & Dijkstra. 2002. Plant Viruses as Molecular Pathogens. Howarth Press, New York.

Maramorosch K, Murphy FA & Shatkin AJ. 1996. Advances in Virus Research. Vol. 46. Academic Press, New York.

Pirone TP & Shaw JG. 1990. Viral Genes and Plant Pathogenesis. Springer Verlag,

New York. Roger Hull 2002. Mathew's Plant Virology (4th Ed.). Academic Press,

New York. Thresh JM. 2006. Plant Virus Epidemiology. Advances in Virus Research 67. Academic Press, New York.

### **PPPC-606: Advanced Bacteriology**

**3+1**

**Objective** To provide knowledge about the latest advances in phytobacteriology.

#### **Theory**

##### **UNIT I**

Current approaches for the characterization and identification of phytopathogenic bacteria. Ultrastructures and biology of bacteria.

##### **UNIT II**

Current trends in taxonomy of phytopathogenic procarya.

##### **UNIT III**

Role of enzyme, toxin, exopolysaccharide, polypeptide signals in disease development. Mechanism of wilt (*Ralstonia solanacearum*) development, mechanism of soft rot (*Erwinia* spp.) development, mechanism of Crown gall formation (*Agrobacterium tumefaciens*).

#### **UNIT IV**

Host-bacterial pathogen interaction, quorum-sensing phenomenon, Type III secretion system, HR/SR reactions, R-genes, Avr-genes, hrp genes, Effector protein.

#### **UNIT V**

Molecular variability among phytopathogenic prokaryotes and possible host defense mechanism(s). Genetic engineering for management of bacterial plant pathogens-gene silencing, RNAi technology.

#### **UNIT VI**

Epidemiology in relation to bacterial plant pathogens. Development of diagnostic kit.

#### **UNIT VII**

Beneficial prokaryotes- Endophytes, PGPR, phylloplane bacteria and their role in disease management. Endosymbionts for host defence.

#### **Practical**

Pathogenic studies and race identification; plasmid profiling of bacteria; fatty acid profiling of bacteria; RAPD profiling of bacteria and variability status; Endospore, Flagellar staining; test for secondary metabolite production, cyanides, EPS, siderophore; specific detection of phytopathogenic bacteria using species/pathovar specific primers. Basic techniques in diagnostic kit development, molecular tools to identify phytoendosymbionts.

#### **Suggested Readings**

Dale JW & Simon P. 2004. Molecular Genetics of Bacteria. John Wiley & Sons, New York. 84

Garrity GM, Krieg NR & Brenner DJ. 2006. Bergey's Manual of Systematic Bacteriology: The Proteobacteria. Vol. II. Springer Verlag, New York.

Gnanamanickam SS. 2006. Plant-Associated Bacteria. Springer Verlag, New York.

Mount MS & Lacy GH. 1982. Plant Pathogenic Prokaryotes. Vols. I, II. Academic Press, New York.  
Sigeo DC. 1993.

Bacterial Plant Pathology: Cell and Molecular Aspects. Cambridge Univ. Press,

Cambridge. Starr MP. 1992. The Prokaryotes. Vols. I–IV. Springer Verlag, NewYork.

**PPPE-607: Molecular Basis of Host-Pathogen Interaction                    3+1**

**Objective**

To understand the concepts of molecular biology and biotechnology in relation to host-pathogen interactions.

**Theory**

**UNIT I**

Importance and role of biotechnological tools in Plant Pathology- Basic concepts and principles to study host pathogen relationship.

**UNIT II**

Molecular basis of host-pathogen interaction- fungi, bacteria and viruses; recognition system, signal transduction.

**UNIT III**

Induction of defense responses- pathogenesis related proteins, HR, reactive oxygen species, phytoalexins and systemic acquired resistance, Programmed Cell Death, Viral induced gene silencing.

**UNIT IV**

Molecular basis of gene-for-gene hypothesis; R-gene expression and transcription profiling, mapping and cloning of resistance genes and marker-aided selection, pyramiding of R genes.

**UNIT V**

Biotechnology and disease management; development of disease resistance plants using genetic engineering approaches, different methods of gene transfer, biosafety issues related to GM crops.

**Practical**

Protein, DNA and RNA isolation, Plasmids extraction, PCR analysis, DNA and Protein electrophoresis, bacterial transformation.

### **Suggested Readings**

Chet I. 1993. Biotechnology in Plant Disease Control. John Wiley & Sons, New York.

Gurr SJ, McPohersen MJ & Bowlos DJ. (Eds.). 1992. Molecular Plant Pathology - A Practical Approach. Vols. I & II, Oxford Univ. Press, Oxford. Mathew JD. 2003. Molecular Plant Pathology. Bios Scientific Publ., UK.

Ronald PC. 2007. Plant-Pathogen Interactions: Methods in Molecular Biology.

Humana Press, New Jersey. 85 263 Stacey G & Keen TN. (Eds.). 1996. Plant Microbe Interactions. Vols. III. Chapman & Hall, New York; Vol. IV. APS Press, St. Paul, Minnesota.

### **PPPE-608: Principles and Procedures of Certification 1+0**

**Objective** To acquaint with certification procedures of seed and planting material.

#### **Theory**

##### **UNIT I**

Introduction to certification. International scenario of certification and role of ISTA, EPPO, OECD etc. in certification and quality control.

##### **UNIT II**

Case studies of certification systems of USA and Europe. National Regulatory mechanism and certification system including seed certification, minimum seed certification standards. National status of seed health in seed certification. Methods for testing genetic identity, physical purity, germination percentage, seed health etc.

##### **UNIT III**

Fixing tolerance limits for diseases and insect pests in certification and quality control programmes. Methods used in certification of seeds, vegetative propagules and in vitro cultures. Accreditation of seed testing laboratories. Role of seed/ planting material health certification in national and international trade.

### **Suggested Readings**

Association of Official Seed Certifying Agencies. <http://www.aosca.org/index.htm>. Hutchins D & Reeves JE. (Eds.). 1997. Seed Health Testing: Progress Towards the 21st Century. CABI, UK. ISHI-

veg Manual of Seed Health Testing Methods.  
http://www.worldseed.org/enus/international\_seed/ishi\_vegetable.html ISHI-F Manual of  
Seed Health Testing Methods. 264 http://www.worldseed.org/en-  
us/international\_seed/ishi\_f.html ISTA Seed Health Testing Methods.  
http://www.seedtest.org/en/content---1--1132--241.html Tunwar NS & Singh SV. 1988. Indian  
Minimum Seed Certification Standards. Central Seed Certification Board, Department of  
Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.US  
National Seed Health System. <http://www.seedhealth.org/>

### **PPPE-609: Plant Biosecurity and Biosafety 2+0**

**Objective** To facilitate deeper understanding on plant biosecurity and biosafety issues in agriculture.

#### **Theory**

##### **UNIT I**

History of biosecurity, Concept of biosecurity, Components of biosecurity, Quarantine, Invasive Alien Species, Biowarfare, Emerging/resurgence of pests and diseases.

##### **UNIT II**

National Regulatory Mechanism and International Agreements/Conventions viz., Agreement on Application of Sanitary and Phytosanitary (SPS) Measures/World Trade Organization (WTO), Convention on Biological Diversity (CBD), International Standards for Phytosanitary Measures, pest risk analysis, risk assessment models, pest information system, early warning and forecasting system, use of Global Positioning System (GPS) and Geographic Information System (GIS) for plant biosecurity, pest/disease and epidemic management, strategies for combating risks and costs associated with agroterrorism event, mitigation planning, integrated approach for biosecurity.

##### **UNIT III**

Biosafety, policies and regulatory mechanism, Cartagena Protocol on Biosafety and its implications, Issues related to release of genetically modified crops.

#### **Suggested Readings**

FAO Biosecurity Toolkit 2008. [www.fao.org/docrep/010/a1140e/a1140e00.htm](http://www.fao.org/docrep/010/a1140e/a1140e00.htm) Laboratory Biosecurity Guidance. [http://www.who.int/csr/resources/publications/biosafety/WHO\\_CDS\\_EPR\\_2006.pdf](http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006.pdf) Grotto Andrew J & Jonathan B Tucker. 2006. Biosecurity: A Comprehensive Action Plan. [http://www.americanprogress.org/kf/biosecurity\\_a\\_comprehensive\\_action\\_plan.pdf](http://www.americanprogress.org/kf/biosecurity_a_comprehensive_action_plan.pdf) Biosecurity Australia. [www.daff.gov.au/ba](http://www.daff.gov.au/ba); [www.affa.gov.au/biosecurityaustralia](http://www.affa.gov.au/biosecurityaustralia) Biosecurity New Zealand. [www.biosecurity.govt.nz](http://www.biosecurity.govt.nz) DEFRA. [www.defra.gov.uk/animalh/diseases/control/biosecurity/index.htm](http://www.defra.gov.uk/animalh/diseases/control/biosecurity/index.htm) Randhawa GJ, Khetarpal RK, Tyagi RK & Dhillon. BS (Eds.). 2001. Transgenic Crops and Biosafety Concerns. NBPGR, New Delhi. Khetarpal RK & Kavita Gupta 2006. Plant Biosecurity in India - Status and Strategy. Asian Biotechnology and Development Review 9(2): 39-63. Biosecurity for Agriculture and Food Production. <http://www.fao.org/biosecurity/> CFIA. <http://www.inspection.gc.ca/english/anima/heasan/fad/biosecure.shtml#7> Note: For minor courses please refer the concerned department's