

FACULTY OF AGRICULTURAL SCIENCES

Syllabus

M.Sc. Ag. (Plant Pathology)
(2020-21)



**SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY
GURUGRAM (DELHI-NCR)**

Contents

1. Executive Summary

1.1. Organization of Course Contents & Credit Requirements

1.1.1. General Information about Course Code Numbers

1.1.2. General Information about Course Contents

1.1.3. Minimum Credit Requirement

2. Major Subject Courses

2.1. Courses' Structure – at a Glance

2.1.1 Course Content

3. Minor Subject

3.1. Minor Subject Courses

3.1.1. Courses' Structure at a Glance

3.1.1.1. Course Content

4. Supporting Courses

4.1. Courses' Structure at a Glance

4.1.1. Course Content

5. Compulsory Non-Credit Courses

5.1 Courses' Structure at a Glance

6. Semester-wise Course Structure

6.1. Course Structure: 1st Semester

6.2. Course Structure: 2nd Semester

6.3. Course Structure: 3rd Semester

6.4. Course Structure: 4th Semester

7. E- Resources for Information on Plant Pathology

1. Executive Summary

The global population will grow from its current 7.8 billion in 2020 to 9.8 billion in 2050 and global food demand is estimated to increase by at least 50%, but demand for protein rich products may grow even faster. In India also population has been increasing with a compounded annual growth rate of 1.6%. An additional 5.0 to 6.0 mt of foodgrains are required to feed the annually increased population. This becomes a challenging task in the event of reducing factor productivity, depleting natural resources- particularly the water and the climate change. In addition to these factors it is estimated that of the 36.5 per cent average total losses, 14.1 per cent are caused by diseases. At the country level now in addition to the National Food Security, now great emphasis is being laid on Nutritional Security. Here the importance of horticultural and vegetable crops' come in play. The organic food segment including fruits and vegetables in India is also expected to grow at a CAGR of 10% during 2015-25. Therefore, the importance of disease control mechanisms is realized.

The science dealing with plant diseases is referred to as plant pathology or phytopathology. The science of plant pathology is also closely allied with other sciences such as botany, mycology, microbiology, genetics, nematology, bacteriology, horticulture, agronomy, and soil science. Therefore, the role of plant pathology is approaching the central stage as it needs diagnosis, management, forecasting and forewarning, quarantine host-pathogen interactions, pathogen resistance and management, all of which can help enhance yield and quality of field and horticultural crops. This is beneficial not just to farmers, but also to the society at large. Pathologists play a crucial role in management of diseases through chemicals, agronomic practices, and biological control or by means of integrated diseases management.

Keeping pace with the educational reforms, The SGTU has planned to introduce the new programmes in a phased manner and M.Sc. Ag. (Plant Pathology) will be the fourth addition to the list of Master's Degree Programmes planned by the Faculty of Agricultural Sciences at SGTU.

The newly proposed M.Sc. Ag. (Plant Pathology) programme will be on similar pattern as suggested by ICAR. Core and optional courses have been included in the syllabus.

1.1. Organization of Course Contents & Credit Requirements

1.1.1. General Information about Course Code Numbers

- i). All courses for M.Sc. Ag. (Plant Pathology) will be of 500-series.
- ii). Credit seminar has been designated by code no. 591, while code no. 599 pertains for Master's Research.

1.1.2. General Information about Course Contents

The contents of each course have been organized into:

- i). Objective (s) – to elucidate the basic purpose.
- ii). Theory units – to facilitate uniform coverage of syllabus for paper setting.
- iii). Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.
- iv). E-Resources - This may be useful as study material for research topics/ for quick update on specific topics/events pertaining to the subject.

1.1.3. Minimum Credit Requirement

Subject*	Master's Programme
Major	20
Minor	09
Supporting	05
Seminar	01
Research	20
Total Credits	55
Compulsory Non-Credit Courses	Section 5

*Major subject: The subject (department) in which the student takes admission

Minor subject: The subject closely related to student's major subject.

Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Compulsory Non-Credit Courses: Please see Section 5 for details. Six courses (PGS 501 to PGS 506) are of general nature and are compulsory for Master's programme.

2. Major Subject Courses

2.1. Courses' Structure at a Glance

Course Code	Course Title	Credits
PL PATH 501*/11060115	Introductory Mycology	3(2+1)
PL PATH 502*/11060214	Introductory Plant Virology	3(2+1)
PL PATH 503*/11060116	Introductory Plant Bacteriology	3(2+1)
PL PATH 504*/11060118	Principles of Plant Pathology	3(3+0)
PL PATH 505*/11060119	Detection and Diagnosis of Plant Diseases	2(0+2)
PL PATH 506//11060117	Principles of Plant Disease Management	3(2+1)
PL PATH 510/11060312	Seed Pathology	2(1+1)

PL PATH 511/11060219	Chemicals in Plant Disease Management	3(2+1)
PL PATH 515/11060311	Biocontrol of Plant Diseases	3(2+1)
PL PATH 517/11060314	Mushroom Production	3(2+1)
PL PATH 518/11060215	Epidemiology and Forecasting of Plant Diseases	3(2+1)
NEMA 506/11060315	Nematode Diseases of Crops	3(2+1)
PL PATH 591/11060405	Master's Seminar	1(1+0)

* Compulsory Course

2.1.1. Course Content

PL PATH 501/11060115: Introductory Mycology 3(2+1)

Objective

To study the nomenclature, classification and characters of fungi.

Theory

UNIT-1

Historical introduction to Mycology, definition of different terms, basic concepts.

UNIT-2

Importance of Mycology in Agriculture, relation of fungi to human affairs, history of mycology. Morphology of reproductive structures and conidiogenous cells, Spore types, Saccardo's spore grid, groups and its taxonomic bearing, Concepts of nomenclature and classification, fungal biodiversity, reproduction in fungi.

UNIT-3

Classification of fungi. Economic mycology, edible fungi and entomogenous fungi. Mycorrhizal associations. Cell organelles, their morphology, functions and chemical composition.

UNIT-4

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. Lichens types and importance, fungal genetics and variability in fungi

Practical

Detailed comparative study of different groups of fungi; collection, identification and preservation of specimens. Isolation and identification of plant pathogenic fungi.

Suggested Readings

1. Agrios, G.N. 2004. Plant Pathology. Fifth Edition, Academic Press, USA.

2. Alexopoulos, J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology (Fourth Edition), J. Wiley & Sons, NewYork.
3. Mehrotra, R.S. and Aneja, K.R.1998. An Introduction to Mycology. New Age International, NewDelhi.
4. Nagamani, Kunwar and Manoharchary. 2006. Handbook of soil fungi. IK International Pvt. Ltd., NewDelhi.
5. Singh, R.S. 1984. Introduction to Principles of Plant Pathology, Oxford and IBH Publishing Co Pvt. Ltd., NewDelhi.

PL PATH 502/11060214: Introductory Plant Virology 3(2+1)

Objective

To acquaint with the structure, virus-vector relationship, biology and management of plant viruses.

Theory

Unit-1

History of plant viruses, composition and structure of viruses, Virus nomenclature and classification, Structure of plant virus, genome organization, replication and movement of viruses.

Unit-2

Symptomatology of important plant viral diseases, transmission, chemical and physical properties, host virus interaction, virus vector relationship.

Unit-3

Isolation and purification, estimation of virus titre and purity, electron microscopy, protein and nucleic acid-based diagnostics. Mycoviruses, phytoplasma arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions.

Unit-4

Assay of plant viruses including biological, physical, chemical, serological and molecular methods. Conventional and biotechnological techniques used in detection and diagnosis. Origin and evolution, mechanism of resistance, genetic engineering, ecology, and management of plant viruses.

Practical

Study of symptoms caused by viruses, transmission, assay of viruses, physical properties, purification, method of raising antisera, serological tests, electron microscopy, spectrophotometry and ultratomy, PCR, preservation of virus specimens, preparation of herbarium.

Suggested Readings

1. Agrios, G.N. 2004. Plant Pathology. Fifth Edition, Academic press,USA

2. Boss, L. 1999. Plant Viruses, Unique and Intriguing pathogens, a text book of plant virology. Backhuys Publishers, Leiden, The Netherlands
3. Roger, Hull. 2002. Matthews' Plant Virology. Fourth Edition, Academic press, USA
4. Walky, D.G.A. 1985. Applied Plant Virology. Longman, London, UK
5. Kolte, SJ and Tewari, AK. 2011. The Elements of Plant Virology - Basic Concepts and Practical Class Exercises, Kalyani Publishers, India, pp340

PL PATH 503/11060116: Introductory Plant Bacteriology 3(2+1)

Objective

To acquaint with plant pathogenic prokaryote (procarya) and their structure, nutritional requirements, survival and dissemination.

Theory

Unit-1

History of bacteriology, nomenclature and classification of bacteria, bacteriophages-morphology, types and uses, mycoplasma and bdellovibrios. Bacterial cell-morphology, organelles and their functions, cell wall structure and chemistry, endospore and its formation, composition and function, flagellar structure, arrangements.

Unit-2

Growth curve, nutrition and auxotrophic mutants, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya. Biology of extra chromosomal elements: plasmid borne genes and their expression: *avr*, *her*, *vie* and *pat* genes,

Unit-3

Elementary bacterial genetics and variability: conjugation, transduction and transformation, survival and dissemination of bacteria. Bacteriophages: lytic and lysogenic cycles. Prokaryotic inhibitors and their mode of action. Morphology, biochemical characteristics, reproduction and life cycle of phytoplasma and other fastidious prokaryotes.

Unit-4

Important bacterial diseases: Bacterial leaf blight of rice, bacterial blight of pomegranate, cotton bacterial blight, bacterial wilt of solanaceous vegetables, soft rot of vegetables and black rot of crucifers and their management

Practical

Isolation, purification, identification and host inoculation of phytopathogenic bacteria, staining methods, biochemical and serological characterization, isolation of plasmid and use of antibacterial chemicals/antibiotics

Suggested Readings

1. Frobisher, M. 1944. Fundamentals of Bacteriology, W. B. Saunders Company.
2. Gerhardt, P., Murray, R.G.E., Wood, A.W. and Krieg, N.R. 1994. Methods for Molecular Bacteriology, American Society of Microbiology, Washington, DC
3. Jackson, R.W. 2009. Plant Pathogenic Bacteria: Genomics and Molecular Biology, Caister Academic Press, USA.
4. Salle, A.J. 1967. Fundamental Principles of Bacteriology, Mc Graw-Hill, Inc., New York.
5. Schaad, N.W., Jones, J.B. and Chun, W. 2001. Laboratory Guide for Identification of Plant Pathogenic bacteria, APS Press, St. Paul, Minnesota.

PL PATH 504/11060118: Principles of Plant Pathology 3(3+0)

Objective

To introduce the subject of Plant Pathology, its concepts and principles.

Theory

Unit-1

Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases, disease caused by phanerogamic parasites

Unit-2

Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development, modern detection methods. Physiologic specialization, Factors influencing infection, colonization and development of symptoms.

Unit-3

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, induced resistance, altered plant metabolism as affected by plant pathogens.

Unit-4

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

Suggested Readings

1. Robert, D.A. and Boothroyd, C.W. 1984. Fundamentals of Plant Pathology (2nd edn), 432pp.
2. Schumann Gail, L. 1991. Plant Diseases: Their Biology and Social Impact. APS Press, USA. 397pp.
3. Singh, R.S. 1984. Introduction to Principles of Plant Pathology, 3rd edition, pp. 534. Oxford & IBH Publishing Co. (P) Ltd., New Delhi, Bombay, Calcutta.

4. Stakman, E.C. and Harrar, J.G. 1957. Principles of Plant Pathology, pp. 581. The Ronald Press Co., New York.
5. Strange, R.N. 1993. Plant Disease Control-Towards environmentally accepted methods. Chapman and Hall 2-6, London.
6. Vidhyasekharan, P. 1993. Principles of Plant Pathology, CBS Publishers & Distributors, Delhi. 166pp.

PL PATH 505/11060119: Detection and Diagnosis of Plant Diseases 2(0+2)

Objective

To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.

Practical

Laboratory Equipment and their use -Autoclave, hot air oven, laminar air flow, pH meter, spectrophotometer micro tomes and B.O.D. Incubator, Determination. of pH. Field experiments, and collection of data and references. Preparation and sterilization of common media. cleaning and sterilization of glassware and culture media (natural, semi synthetic and synthetic). Inoculation and isolation of pathogens, purification of fungal culture, Koch's postulates. Methods of spore germination, Microscopy: Calibration and measurement of spore, camera lucida drawing, microtomes and microtomy procedures (paraffin embedding and freeze microtome), Preparation of mount, preservation of fungi, Demonstration of appressoria and houstoniain plant pathogenic fungi. Stains and staining, detection of plant pathogens. In vitro evaluation of fungicides and bactericides. Molecular detection of pathogens in seeds and other planting materials.

Suggested Readings

1. Vishunawat, K and Kolte, SJ. 2001. Essentials of Phytopathological Techniques. Kalyani Publishers., New Delhi, India, 260pp.
2. Kolte, SJ and Tewari, AK. 2011. The Elements of Plant Virology - Basic Concepts and Practical Class Exercises. Kalyani Publishers., New Delhi, India, 313pp.

Agrios, G.N. 2004. *Plant Pathology*. Fifth Edition, Academic pr

PL PATH 506/11060117: Principles of Plant Disease Management 3(2+1)

Objective

To acquaint with different strategies for management of plant diseases.

Theory

Unit-1

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

Unit-2

Disease resistance and molecular approach for disease management. 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.

Unit-3

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

Unit-4

General principles of plant quarantine. Exotic pathogens and pathogens introduced into India. Sanitary and phytosanitary issues under WTO, TRIPS and PRA. Genetic basis of disease resistance and pathogenicity: gene for gene hypothesis; Seed certification

Practical

In vitro and *in vivo* evaluation of chemicals against plant pathogens; ED and MIC values, study of structural details of sprayers and dusters.

Suggested Readings

1. Agrios, G.N. 2004. Plant Pathology. Fifth Edition, Academic Press, USA.
2. Chaube, H.S. and Pundhir, V.S. 2005. Crop Disease and Their Management. Prentice Hall of India Private Limited.
3. Das Gupta, M.K. 1994. Principles of Plant Pathology. Published by Allied Publishers
4. John, A.L. and Dickinson, C.H. 1998. Plant Pathology and Plant Pathogens. Wiley-Blackwell.
5. Manners, J.G. 1993. Principles of Plant Pathology. Cambridge University Press, UK.
6. Singh, R.S. 1984. Introduction to Principles of Plant Pathology, Oxford and IBH Publishing Co Pvt. Ltd., New Delhi.

PL PATH 510/11060312: Seed Pathology 2(1+1)

Objective

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

Theory

Unit-1

History and importance of seed pathology. International seed testing association its role and functions. Morphology and anatomy of seed; Entry points of seed infection. Plant- seed and seed-plant transmission.

Unit-2

Establishment of infection and Course of disease. Environment affecting establishment, seed crop management. Seed treatment, quarantine for seed certification.

Unit-3

Detection of seed borne pathogen. Seed health testing methods. Important seed transmitted disease, their symptoms and disease cycles.

Unit-4

Storage fungi. Impact of storage fungi on stored grains seeds. Factors influencing invasion of stored grain seed by fungi. Management of seed borne pathogens. Production of disease-free seeds and planting materials. Seed certification.

Practical

Seed treatment, Detection of seed borne pathogen. Seed health testing methods. Important seed transmitted disease, their symptoms and disease cycles. Storage fungi. Impact of storage fungi on stored grains seeds. Factors influencing invasion of stored grain seed by fungi. Management of seed borne pathogens.

Suggested Readings

1. Vishunawat K. 2016 Fundamentals of Seed Pathology. Kalyani Publisher, India. Pp26
2. Neergaard. P. 2011. Seed Pathology, SCIENTIFIC Publishers, pp1187
3. Cooke, B.M., Jones, D.G. and Kaye, B. 2006. (eds). A text book 'The Epidemiology of Plant Diseases, Springer, pp 456.
4. Davis, P.M. 1986. Statistics for describing populations. In : Handbook of Sampling methods for Arthropods in Agriculture (eds L. P. Pedigo and Buntin, G. D.) CRC Press, pp.34-53

PL PATH 511/11060219. Chemicals in Plant Disease Management 3(2+1)

Objective

To impart knowledge on the concepts, principles and judicious use of chemicals in plant disease management.

Theory

Unit-1

History and development of chemicals; definition of pesticides and related terms; advantages and disadvantages of chemicals. Classification of chemicals used in plant disease control and their characteristics.

Unit-2

Chemicals in plant disease control, viz., fungicides, bactericides, nematicides, antiviral chemicals and botanicals Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides

Unit-3

Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides

Unit-4

General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.

Practical

Acquaintance with formulation of different fungicides and plant protection appliances. Formulation of fungicides, bactericides and nematicides; *in vitro* evaluation techniques, preparation of different concentrations of chemicals including botanical pesticides based on active ingredients against pathogens; persistence, compatibility with other agro-chemicals; detection of naturally occurring fungicide resistant mutants of pathogen; methods of application of chemicals

Suggested Readings

1. Farm Chemicals Handbook. (A global guide to crop protection produced yearly with information on all pesticides plus fer tilizers, sources and regulatory information. Available at www.meisterpro.com)
2. Fry, W.E. 1982. Principles of Plant Disease Management. Academic Press, New York, NY
3. Green, M.B. and Spilker, D.A. 1986. Fungicide Chemistry: Advances and Practical Applications (ACS Symposium Series, 304). American Chemical Society, Oxford University Press
4. Hewitt, H.G. 1998. Fungicides in Crop Protection CABI Publishing, CAB International, Oxon, United Kingdom.
5. Hutson, D. and Miyamoto, J. 1999. Fungicidal Activity: Chemical and Biological Approaches to Plant Protection, John Wiley & Sons. New York,

PL PATH 515/11060311: Biocontrol of Plant Diseases 3(2+1)

Objective

To study principles and application of ecofriendly and sustainable management strategies of plant diseases.

Theory

Unit-1

Concept of biocontrol definitions, importance, principles of plant disease management with bioagents, history of biocontrol, merits and demerits of biocontrol, Microorganisms antagonistic to plant pathogens in soil, rhizosphere and phyllosphere and their use in the control of plant diseases; soil fungistasis. Plant growth promoting Rhizobacteria.

Unit-2

Types of interactions, competition, mycoparasitism, exploitation for hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis, induced resistance, mycorrhizal associations, operational mechanisms and its relevance in biological control.

Unit-3

Characterization and evaluation of bioagents, case example of successful bioagents (bacterial and fungal bioformulation), variability and characterization of bioagents important characteristics like competitive saprophytic ability, pesticideresistance.

Unit-4

Commercial production of antagonists, Improvisation, genetic engineering, delivery systems, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market. Quality control system of biocontrolagents.

Practical

Isolation, characterization and maintenance of antagonists, methods of study of antagonism and antibiosis, application of antagonists against pathogen *in vitro* and *in vivo* conditions. Study of cfu/g.

Suggested Readings

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society.
2. Gnanamanickam, S.S. 2002. Biological control of crop Disease. Kuykendall Marel Dekker, INC.
3. Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services Bangalore.
4. Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodes and Weeds. Precision Fototype Services Bangalore

PL PATH 517/11060314: Mushroom Production 3(2+1)

Objective

i). To acquaint the students with historical development of mushroom cultivation and present status of mushroom industry in India.

ii). To develop mushroom cultivation skills for entrepreneurial activity.

Theory

Unit-1

Introduction, history and economic importance of mushrooms. Morphology and taxonomy.

Unit 2

Edible and poisonous mushrooms. Cultivation system and farm design, compost and composting, spawn & spawning, Casing materials and case running.

Unit 3

Cultivation of mushrooms- *Agaricus*, *Pleurotus*, *Lentinula*, *Volverella*

Unit 4

Diseases of mushrooms, postharvest handling and processing.

Practical

Cultivation techniques of *Agaricus*, *Oyster*, *Pleurotus* and *Volverellamushrooms*.

Suggested readings

1. Miles P.G and Chang S. 2004. Cultivation, Nutritional Value, Medicinal Effect, and Environmental ImpactCRC Press,480PP
2. Ritti and Singh U. C.2005. Modern Mushroom Cultivation.Agrobios(India).pp244.
3. Parvatha Reddy, P. 2010. Fungal Diseases and Their Management in Horticultural Crops. ScientificPublication.
4. Saharan, G.S. and Metha, N. 2008. Sclerotinia Disease of Crop Plants; Biology, Ecology and Disease Management, Springer.

PL PATH 518/11060215: Epidemiology and Forecasting ofPlantDiseases3(2+1)

Objective

To acquaint students with the principles of epidemiology and its application in disease forecasting.

Theory

Unit-1

Epidemic concept and historical development, pathometry and crop growth stages, epidemic growth and analysis. Common and natural logarithms, function fitting area under disease progress curve and correctionfactors

Unit-2

Inoculum dynamics, population biology of pathogens, temporal spatial variability in plant pathogens. Epidemic analysis and prediction models. Crop loss assessment: critical and multiple point models.

Unit-3

Survey, surveillance and vigilance, crop loss assessment and models. Monocyclic and polycyclic pathogens. Role of environment and meteorological factors in the development of plant disease epidemics.

Unit-4

Principles and pre-requisites of forecasting, systems and factors affecting various components of forecasting, 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, multiplication of inoculum, computerized data analysis, function fitting, model preparation and validation.

Suggested Readings

1. Campbell, C.L. and Madden, L.V. 1990. Introduction to Plant Disease Epidemiology. John Willey & Sons, New York.
2. Cooke, B.M., Jones, D.G. and Kaye, B. 2006. (eds). A textbook 'The Epidemiology of Plant Diseases, Springer, pp 456.
3. Davis, P.M. 1986. Statistics for describing populations. In : Handbook of Sampling methods for Arthropods in Agriculture (eds L. P. Pedigo and Buntin, G. D.) CRC Press, pp.34-53.
4. Gilligan, C.A. and Kleczkowski, A. 1997. Population dynamics of botanical epidemics involving primary and secondary infection. Phil Trans R Soc London B 352:591-608.

NEMA 506/11060315: Nematode Diseases of Crops 3 (2+1)

Objective

To impart basic knowledge about the causal organism, nature of damage, symptoms and control of nematode diseases of agricultural and horticultural crops.

Theory

Causal organism, distribution, host range, biology, nature of damage, symptoms, interaction with other organisms and management of major diseases caused by important nematodes in different crops:

Unit-1

Cereal crops (Rice, wheat, barley, oat, maize, sorghum): Ear-cockle and tundu disease of wheat, molya disease of wheat and barley; rice-root nematode, root-knot and cyst nematodes, ufra and white tip disease of rice; lesion and cyst nematodes of maize and sorghum.

Pulses, oilseeds, Cash, and fibre crops (Pigeon pea, mungbean, cowpea, chickpea, groundnut, castor, soybean, sunflower, sesame, Sugarcane, sugar beet, Cotton, jute): Pigeonpea cyst nematode, root-knot, reniform nematodes, lesion, lance nematodes, sugar beet cyst and soybean cyst nematode problems.

Unit-2

Vegetable crops (Tomato, brinjal, chillies, carrot, onion, garlic, okra, cucurbits, potato): root-knot disease, reniform nematode, potato cyst nematode; stem and bulb nematode; nematode problems in protected cultivation.

Unit-3

Horticultural and Ornamental crops (Citrus, grapes, peach, strawberry, papaya, mushroom, rose, chrysanthemum, zinnia, gladiolus, tuberose, crossandra, jasmine): root-knot disease, reniform nematode; slow decline of citrus, Nematode problems in mushroom.

Unit-4

Plantation crops & Medicinal and Aromatic plants (Banana, pepper, betelvine, coconut, arecanut, palm, cocoa, tea, coffee, rubber, condiments): burrowing nematode infestation in banana, spices and condiments, root-knot and lesion nematodes of coffee and tea, red ring disease of coconut. pine wilt disease.

Practical

Study of symptoms of cyst, root-knot, lesion, earcockle, citrus, burrowing, reniform, stem and bulb, white tip, mushroom, leaf and bud, golden nematode damage in different crop plants. Visual field diagnosis of nematode problems through study tours.

Suggested Readings

1. Bridge, J. and Starr, J. 2007. Plant Nematodes of Agricultural Importance, Manson Publishing, 128pp. Bridge, John S., and Starr, J. 2007. Plant Nematodes of Agricultural Importance: A Colour Handbook, Wiley February 2007.
2. Kenneth, R.H. and Nelson P.E. 1997. Compendium of Chrysanthemum Diseases, APS
3. Parvatha, Reddy. P. 2008. Diseases of Horticultural Crops: Nematode Problems and their Management, Scientific Publishers, 380pp.
4. Perry, R N and Moens, M 2006. Plant Nematology, CABI May 2006

3. Minor Subject(s)

The student admitted for M.Sc. Ag. (Plant Pathology) will study Entomology as the minor subject.

3.1. Courses' Structure at a Glance

Course Code	Course Title	Credits
ENT 507/11060217	Biological Control of Crop Pests and Weeds	2(1+1)

ENT 510/11060218	Principles of Integrated Pest Management	2(1+1)
ENT 511/11060216	Major Pests of Crops and Their Management	3(1+2)
ENT 519/11060313	Commercial Entomology	2(1+1)

3.1.1 Course Content

ENT 507/11060217: Biological Control of Crop Pests and Weeds 2(1+1)

Objective

To train the students in theory and practice of biological control, mass production techniques and field evaluation of various biological control agents like parasitoids, predators and various entomopathogenic microorganisms.

Theory

Unit-1

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation.

Unit-2

Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects. Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa etc., their mode of action. Biological control of weeds using insects.

Unit-3

Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation.

Unit-4

Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies- Quarantine regulations, biotechnology in biological control.

Semiochemicals in biological control.

Practical

Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers; Visits (only where logistically feasible) to bio-control laboratories to learn rearing and mass production of egg, egg-larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds. Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

Suggested Readings

1. De Bach P. 1964. Biological Control of Insect Pests and Weeds. Chapman & Hall, New York.
2. Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publ., New Delhi.
3. Huffaker CB & Messenger PS. 1976. Theory and Practices of Biological Control. Academic Press, London.
4. Ignacimuthu SS & Jayaraj S. 2003. Biological Control of Insect Pests. Phoenix Publ., New Delhi.
5. Saxena AB. 2003. Biological Control of Insect Pests. Anmol Publ., New Delhi.
6. Driesche & Bellows TS. Jr. 1996. Biological Control. Chapman & Hall, New York.

ENT 510/11060218: Principles of Integrated Pest Management 2(1+1)

Objective

To familiarize the students with principles of insect pest management, including concept and philosophy of IPM. Train students in computation of ETL, implementing IPM programmes.

Theory

Unit-1

History and origin, definition and evolution of various related terminologies.

Unit-2

Concept and philosophy, ecological principles, economic threshold concept, and economic consideration.

Unit-3

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.

Unit-4

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.

Practical

Characterization of agro-ecosystems. Sampling methods and factors affecting sampling. Population estimation methods. Crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses. Computation of EIL and ETL; crop modeling; designing and implementing IPM system.

Suggested Readings

1. Dhaliwal GS & Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publ., New Delhi.

2. Dhaliwal GS, Singh R & Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi.
3. Flint MC & Bosch RV. 1981. Introduction to Integrated Pest Management. 1st Ed., Springer, New York.
4. Horowitz AR & Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.
5. Ignacimuthu SS & Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.
6. Metcalf RL & Luckman WH. 1982. Introduction of Insect Pest Management. John Wiley & Sons, New York.
7. Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.
8. Norris RF, Caswell-Chen EP & Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.
9. Subramanyam B & Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

ENT 511/11060216: Major Pests of Crops and Their Management 3(1+2)

Objective

To familiarize the students about nature of damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods.

Theory

Unit-1

Introduction to Entomology: Position of insects in animal kingdom and brief history of Entomology in India; non-insect pests and pollinators.

Unit-2

Insect Pests of important crops and their management: Cereals: Paddy, barley, wheat, sorghum, and maize. Pulses: Pigeon pea, chickpea, mung bean, cowpea, and lentil. Oil seeds: Mustard, groundnut, castor, and jatropha. Vegetables: Cole crops, okra, cucurbits, potato, garden peas, and spinach. Fruits: Mango, guava, banana, citrus, ber, and aonla. Cotton. Sugarcane.

Unit-3

Pests of storage and their management: Beetle insects, moth insects, mites, fungi, birds, and rodents.

Unit-4

Pesticide application appliances and their safe handling: Sprayers, dusters and miscellaneous equipments.

Practical

Study of grasshoppers, study of garden slug and its stages, study of Termitarium, termite soldier and workers, distinguishing characters between insect and mite, study of damage symptoms caused by common grasshoppers and birds, study of rodent burrows and identification of live burrows, preparation of rat baits and its application in the live burrows. Study of pesticide labels for toxicity and safe handling, pesticide application equipments - sprayer, duster etc. Study of soil inhabiting pests (cutworms, white grubs, black ants, and nematodes). Study of insect trap, light trap, sticky trap, pheromone trap, and rat trap. Collection and study of insects from pulses, paddy, cotton, vegetables, cereals, oil seeds, fruits, and storage. Calculation of pesticide doses and preparation of stock solution. Study of useful insects (parasites, predators, and pollinators).

Suggested Readings

1. Saxena RC & Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy, Jodhpur.
2. Atwal AS & Dhaliwal GS. 2002. Agricultural Pests of South Asia and their Management. Kalyani Publ., New Delhi.
3. Nair, M.R.G.K.1986. Insect and Mites of Crops in India. ICAR, New Delhi. Pradhan, S. 1969. Insect Pests of Crops. National Book Trust, India, 208p.
4. Regupathy, A.N., Chandramohan, S., Palanisamy and Gunathilagaraj, K. 2003. A Guide on Crop Pests. TNAU, Coimbatore, 276.

ENT 519/11060313: Commercial Entomology 2(1+1)

Objective

To familiarize the students with entrepreneurial opportunities in entomology, provide information on productive insects and their products, as well as insect pests of public health and veterinary importance and their management.

Theory

Unit-1

Bee keeping- General colony management during different seasons. Seasonal management. Managing colonies for honey production and pollination. Artificial queen rearing. Pests and diseases of honey bees. Bee poisoning. Production and marketing of quality honey and value added honey products. Establishment and maintenance of apiaries.

Unit-2

Study of different species of silkworms, characteristic features, moriculture, silk and its uses, pests and diseases of silkworms, rearing and management of silkworms. Lac insect- natural enemies and their management.

Unit-3

Economic and public health importance of insect pests in human habitation and habitats, biology, damage and control of mosquitoes, houseflies, bed bugs, ants, termites, cockroaches, flies, silverfish, head and body lice, carpet beetles, cloth moths, crickets, wasps, house dust

mites, insect pests of cattle, poultry, pet animals and their management.

Unit-4

Principles and methods of pest management in residential places and public buildings, insecticides for domestic use and their safety, pre- and postconstruction termite proofing of buildings, appliances for domestic pest control. Rodent control methods. Organic methods of domestic pest management.

Practical

Assessing pest status in dwellings (labs, canteen or hostel), implementation of pest control against flies, mosquitoes, bed bugs, cockroaches and rodents. Pre- and post-construction termite proofing methods, control of silverfishes in the library. Visit to poultry units and assessing pest status in poultries. Evaluation of commercially available domestic insect pestcontrol products through bioassays. Identification of honey bee species, bee castes and special adaptations, identification and handling of bee-keeping equipments. Handling of honey bees-hive and frame inspection. Honey extraction and processing methods of hive products extraction. Preparation of bee-keeping projects for funding. Visit to bee nursery andcommercial apiaries. Silkworm rearing and management. Lac host and crop management technology and processing of lac. Products and bye-products of lac.

Suggested Readings

1. Aruga H. 1994. Principles of Sericulture. Oxford & IBH, New Delhi. Atwal AS. 2006. The World of the Honey Bee. Kalyani Publ., New Delhi. Ganga G. 2003. Comprehensive Sericulture. Vol. II. Silkworm Rearing and Silk Reeling. Oxford & IBH, New Delhi.
2. Partiban S & David BV. 2007. Management of Household Pests and Public Health Pests. Namratha Publ., Chennai.
3. Singh S. 1975. Beekeeping in India. ICAR, New Delhi.

4. Supporting Courses

4.1. Courses' Structure at a Glance

Course Code	Course Title	Credits
FST 455/11060203	Experimental Designs	3(2+1)
PP 509/11060220	Physiology of Crop Plants-I	2(2+0)
PP 506/11060316	Physiology of Crop Plants-II	2(2+0)

4.1.1. Course Content

FST 455/11060203: EXPERIMENTAL DESIGNS 3(2+1)

Objective

This course is meant for students of agricultural and other related sciences. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Theory

UNIT-1

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

UNIT-2

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

UNIT-3

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment.

UNIT-4

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, Lattice design, Response surfaces.

UNIT-5

Bioassays- direct and indirect, potency estimation.

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 without and with confounding; Analysis with missing data; Split plot and strip plot designs; Transformation of data; Fitting of response surfaces and Bioassays.

Suggested Readings

1. Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley.
2. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
3. Federer WT. 1985. Experimental Designs. MacMillan.
4. Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
5. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publication
6. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley.
7. Design Resources Server: [www.iasri.res.in / design](http://www.iasri.res.in/design).

PP 509/11060220: Physiology of Crop Plants-I 2(2+0)

Objective

To impart knowledge of physiological aspects of different crop plants.

Theory

UNIT-1

Origin, evolution and distribution of crop, adaptability of crop to different agro climatic conditions (specific case studies of important cereal crops like wheat, rice, barley, maize, sorghum and minor millets).

UNIT-2

Crop characteristics-growth and development (both vegetative and reproductive), physiological processes governing productivity

UNIT-3

Influence of climatological factors (water, temperature, photoperiod and light) on crop growth attributes and physiological processes.

UNIT-4

Special problems of each crop, crop ideotype concept and source sink relationship.

Suggested Readings

1. Gardner, F.P., Pearce, R.B. and Mitchell, R.L. 1988. Physiology of Crop Plants. Scientific Publ.
2. Pessarakli, M. 2002. Handbook of Plant and Crop Physiology. Marcel and Dekker Inc. New York.
3. Satorre, E.H. and Slafer, G.A. (Eds) 1999. Wheat: Ecology and Physiology of yield determination. Food Product Press, New York.

PP 506/11060316: Physiology of Crop Plants-II 2(2+0)

Objective

To impart knowledge of physiological aspects of different crop plants.

Theory

UNIT-1

Origin, evolution and distribution of crop, adaptability of crop to different agro climatic conditions. Specific case studies: Oilseeds: rapeseed mustard, groundnut and sunflower. Pulses: mungbean, pigeonpea, soybean cowpea and chickpea)

UNIT-2

Crop characteristics-growth and development (both vegetative and reproductive), physiological processes governing productivity

UNIT-3

Influence of climatological factors (water, temperature, photoperiod and light) on crop growth attributes and physiological processes.

UNIT-4

Special problems of each crop, crop ideotype concept and source sink relationship.

Suggested Readings

1. Gardner, F.P., Pearce, R.B. and Mitchell, R.L. 1988. Physiology of Crop Plants. Scientific Publishers, Jodhpur.
2. Pessaraki, M. 2002. Handbook of Plant and Crop Physiology. Marcel and Dekker Inc. New York

5. Compulsory Non-Credit Courses

5.1.Courses' Structure at a Glance

Course Code	Course Title	Credits
PGS 501/11060111	Library and Information Services	1(0+1)
PGS 502/11060204	Technical Writing and Communications Skills	1(0+1)
PGS 503/11060205	Intellectual Property and Its Management in Agriculture (e-Course)	1(1+0)
PGS 504/11060206	Basic Concepts in Laboratory Techniques	1(0+1)
PGS 505/11060306	Agricultural Research, Research Ethics and Rural Development Programmes(e-Course)	1(1+0)
PGS 506/11060106	Disaster Management (e-Course)	(1+0)

5.1.1 Course Content

11060111: LIBRARY AND INFORMATION SERVICES 1(0+1)

Objective

To equip the library users with skills: to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

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.

11060204: TECHNICAL WRITING AND COMMUNICATIONS SKILLS 1(0+1)

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

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

- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh. Chicago Manual of Style. 14th Ed. 1996. Prentice-Hall of India, New Delhi.
- Collins' Cobuild English Dictionary. 1995. Harper Collins, New York.
- Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press, New Delhi.
- Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford UP, Oxford.
- Krishna Mohan 2005. Speaking English Effectively. Macmillan India, New Delhi.
- Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.
- Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice-Hallof India, New Delhi.
- Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago. Smith Richard W. 1969. Technical Writing. Barnes & Noble, New York.
- Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand, New Delhi.

11060205: INTELLECTUAL PROPERTY & ITS MANAGEMENT IN AGRICULTURE (e-Course) 1(1+0)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR), related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

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; 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 & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw- Hill, New Delhi. India,
- Intellectual Property Rights: Key to New Wealth Generation.2001. NRDC and Aesthetic Technologies, New Delhi.
- Ministry of Agriculture. GoI., 2004. State of Indian Farmer. Vol. 5. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild, Max & Newman, Scott (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, Delhi.
- The Indian Acts - Patents Act, 1970 & amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 & amendments; Layout Design Act, 2000; PPV & FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

11060206: BASIC CONCEPTS IN LABORATORY TECHNIQUES 1(0+1)

Objective

To acquaint the students about the basics of commonly used techniques in laboratory.

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; 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; Neutralisation 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, sandbath, waterbath, oilbath; 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 & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

11060306: AGRICULTURAL RESEARCH, RESEARCH ETHICS & RURAL DEVELOPMENT PROGRAMMES (e-Course) 1(1+0)

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

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; 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.

UNIT-II

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

UNIT-III

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 Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

- Bhalla GS & 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.

11060106: DISASTER MANAGEMENT (E-Course) 1(1+0)

Objective

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory

UNIT-I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

UNIT-II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT-III

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.

Suggested Readings

- Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.

6. Semester-wise Course Structure

6.1. Course Structure: 1st Semester

Course Code	Course Title	Theory +Practical	L	T	P	Credits
11060115	Introductory Mycology	Theory+ Practical	2	0	1	3(2+1)
11060116	Introductory Plant Bacteriology	Theory+ Practical	2	0	1	3(2+1)
11060117	Principles of Plant Disease Management	Theory+ Practical	2	0	1	3(2+1)
11060118	Principles of Plant Pathology	Theory	3	0	0	3(3+0)
11060119	Detection and Diagnosis of Plant Diseases	Practical	0	0	2	2(0+2)
11060106	Disaster Management (e- Course)	Theory	1	0	0	1(1+0)
11060111	Library and Information Services	Practical	0	0	1	1(0+1)
11060406	Master's Research	Practical				

6.2. Course Structure: 2nd Semester

Course Code	Course Title	Theory +Practical	L	T	P	Credits
11060214	Introductory Plant Virology	Theory+ Practical	2	0	1	3(2+1)
11060215	Epidemiology and Forecasting of Plant Diseases	Theory+ Practical	2	0	1	3(2+1)
11060216	Major Pests of Crops and Their Management	Theory+ Practical	1	0	2	3(1+2)
11060217	Biological Control of Crop Pests and Weeds	Theory+ Practical	1	0	1	2(1+1)

11060204	Technical Writing and Communications Skills	Practical	0	0	1	1(0+1)
11060219	Chemicals in Plant Disease Management	Theory+ Practical	2	0	1	3(2+1)
11060205	Intellectual Property & Its Management in Agriculture (e-Course)	Theory	1	0	0	1(1+0)
11060218	Principles of Integrated Pest Management	Theory+ Practical	1	0	1	2(1+1)
11060203	Experimental Designs	Theory+ Practical	2	0	1	3(2+1)
11060220	Physiology of Crop Plants-I	Theory	2	0	0	2(2+0)
11060406	Master's Research	Practical				

6.3 Course Structure: 3rd Semester

Course Code	Course Title	Theory +Practical	L	T	P	Credits
11060306	Agricultural Research, Research Ethics & Rural Development Programmes(e-Course)	Theory	1	0	0	1(1+0)
11060311	Biocontrol of Plant Diseases	Theory+ Practical	2	0	1	3(2+1)
11060312	Seed Pathology	Theory+ Practical	1	0	1	2(1+1)
11060313	Commercial Entomology	Theory+ Practical	1	0	1	2(1+1)
11060314	Mushroom Production	Theory+ Practical	2	0	1	3(2+1)
11060315	Nematode Diseases of Crops	Theory+ Practical	2	0	1	3(2+1)
11060316	Physiology of Crop Plants-II	Theory	2	0	0	2(2+0)
11060405	Master's Seminar	Theory	1	0	0	1(1+0)
11060406	Master's Research	Practical				

6.4. Course Structure: 4th Semester

Course Code	Course Title	Theory +Practical	L	T	P	Credits
11060406	Master's Research	Practical				

7. E- Resources for Information on Plant Pathology

1. American Phytopathological Society. [APS Home \(apsnet.org\)](http://apsnet.org)
2. Indian Phytopathological Society [Indian Phytopathological Society \(ipsdis.org\)](http://ipsdis.org)
3. Indian mycological Society [Welcome to Indian Mycological Society \(imskolkata.org\)](http://imskolkata.org)
4. Central Institute of Medicinal & Aromatic Plants(CIMAP)<http://www.cimap.org/>

5. Central Plantation Crops Research Institute(CPCRI), Kasaragod, Kerala<http://cpcri.nic.in/>
6. Central Tuber Crops Research Institute (CTCRI),Thiruvananthapuram, Kerala<http://www.ctcri.org/>
7. Consultative Group on International Agricultural Research, CGIAR<http://www.cgiar.org/>
8. Coffee Board, India <http://indiacoffee.org/>Department of Agriculture and Co-operation,India<http://agricoop.nic.in/>
9. Department of Bio-technology, India <http://dbtindia.nic.in>Department of Scientific and Industrial Research,India<http://dsir.nic.in/>
10. FAO <http://www.fao.org/>Global Agribusiness Information Network:<http://www.fintrac.com/gain/>:
11. Indian Agricultural Research Institute (IARI) <http://www.iari.res.in/>
12. Indian Council of Agricultural Research (ICAR) <http://www.icar.org.in>
13. Indian Journal of Entomology www.entosocindia.org
14. Indian Journal of Entomology Research www.entomologyjournal.com