# DAV UNIVERSITY JALANDHAR

## FACULTY OF AGRICULTURAL SCIENCES

## COURSE CURRICULUM

FOR

**M. Sc. Ag. (Plant Pathology)**

**1st to 4th SEMESTER**

**Examinations 2021–2022 session onwards**

**Applicable for admissions in 2021**

**DAV UNIVERSITY, JALANDHAR**

**Scheme of Courses M.Sc. Ag. (Plant Pathology)**

| **Semester I** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. N.** | **Course Code** | **Course name** | **Course type** | **L** | **T** | **P** | **Cr** |
| 1. | AGS650 | Mycology | Core | 2 | 0 | 2 | 3 |
| 2. | AGS651 | Plant bacteriology | Core | 2 | 0 | 2 | 3 |
| 3. | AGS652 | Principles of plant pathology | Core | 3 | 0 | 0 | 3 |
| 4. | Departmental Elective I ((Optional) | | | 2 | 0 | 2 | 3 |
| 5. | Open Elective I (Interdisciplinary elective I) | | | 2 | 0 | 2 | 3 |
| 6. | CSA559 | Computer fundamentals and programming | Compulsory foundation | 2 | 0 | 2 | 3 |

L: Lectures T: Tutorial P: Practical Cr: Credits

**Departmental Elective I (Choose any one course)**

| **Sr. N.** | **Course Code** | **Course name** | **Course type** | **L** | **T** | **P** | **Cr** |
|---|---|---|---|---|---|---|---|
| 1. | AGS653 | Mushroom production technology | Elective | 2 | 0 | 2 | 3 |
| 2. | AGS654 | Post harvest diseases | Elective | 2 | 0 | 2 | 3 |
| 3. | AGS655 | Diseases of fruits, plantation and ornamental Crops | Elective | 2 | 0 | 2 | 3 |
| 4. | AGS656 | Diseases of vegetable and spices crops | Elective | 2 | 0 | 2 | 3 |
| 5. | AGS657 | Diseases of field and medicinal crops | Elective | 2 | 0 | 2 | 3 |
| 6. | AGS658 | Plant quarantine | Elective | 2 | 0 | 0 | 2 |
| 7. | AGS659 | Biological control of plant diseases | Elective | 2 | 0 | 2 | 3 |

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**Semester II**

| Sr. N. | Course Code | Course name | Course type | L | T | P | Cr |
|---|---|---|---|---|---|---|---|
| 1. | AGS660 | Principles of plant disease management | Core | 2 | 0 | 2 | 3 |
| 2. | AGS661 | Plant virology | Core | 2 | 0 | 2 | 3 |
| 3. | AGS662 | Detection and diagnosis of plant diseases | Core | 0 | 0 | 4 | 2 |
| 4. | Departmental Elective II (Optional) | | | 2 | 0 | 2 | 3 |
| 5. | Open Elective II (Interdisciplinary elective II) | | | 2 | 0 | 2 | 3 |
| 6. | ENG551 | Technical writing and communication skills | Compulsory Foundation | 0 | 1 | 1 | 1 |
| 7. | AGS503 | Intellectual property and its management in agriculture | Compulsory Foundation | 0 | 1 | 1 | 1 |
| 8. | AGS500 | Master's research | Core | 0 | 4 | 8 | 4 |

**Departmental Elective II (Choose any one course)**

| Sr. N. | Course Code | Course name | Course type | L | T | P | Cr |
|---|---|---|---|---|---|---|---|
| 1. | AGS663 | Seed health technology | Elective | 2 | 0 | 2 | 3 |
| 2. | AGS664 | Phytonematology | Elective | 1 | 0 | 2 | 2 |
| 3. | AGS665 | Insect vectors of plant viruses and other pathogens | Elective | 1 | 0 | 2 | 2 |
| 4. | AGS666 | Chemicals in plant disease management | Elective | 2 | 0 | 2 | 3 |
| 5. | AGS667 | Ecology of soil-borne plant pathogens | Elective | 2 | 0 | 2 | 3 |
| 6. | AGS668 | Disease resistance in plants | Elective | 2 | 0 | 0 | 2 |
| 7. | AGS669 | Epidemiology and forecasting of plant Diseases | Elective | 2 | 0 | 2 | 3 |

**Semester III**

| Sr. N. | Course Code | Course name | Course type | L | T | P | Cr |
|---|---|---|---|---|---|---|---|
| 1. | MTH670 | Statistics methods for applied sciences | Compulsory Foundation | 3 | 0 | 2 | 4 |
| 2. | AGS501 | Library and information services | Compulsory Foundation | 0 | 1 | 2 | 1 |
| 3. | AGS504 | Basic concepts of laboratory techniques | Compulsory Foundation | 0 | 1 | 2 | 1 |
| 4. | AGS505 | Agricultural research ethics and rural development programs | Compulsory Foundation | 1 | 0 | 0 | 1 |
| 5. | AGS670 | Integrated disease management | Core | 2 | 0 | 2 | 3 |
| 6. | EVS658 | Disaster management | Compulsory Foundation | 1 | 0 | 0 | 1 |
| 7. | AGS560 | Master's seminar | Core | 0 | 1 | 0 | 1 |
| 8. | AGS500A | Master's research | Core | 0 | 6 | 12 | 6 |

| **Semester IV** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Course Code** | **Course name** | **Course type** | **L** | **T** | **P** | **Cr** |
| **1** | AGS500B | Master's research | Core | 0 | 15 | 30 | 15 |
| **2** | AGS500C | Thesis work | Core | 0 | 15 | 30 | 15 |

**DAV UNIVERSITY, JALANDHAR**

**SYLLABUS**

**AGS650 MYCOLOGY 2+1**

**Objectives:** To develop an understanding of fungi, importance, classification and different diseases caused by them in plants.

**Theory**

**UNIT I**

Introduction to fungi, definition of different terms, characters and basic concepts.

**UNIT II**

Importance of mycology in agriculture. Importance of fungi and historical background.

**UNIT III**

Concepts of nomenclature and classification, fungal biodiversity and reproduction in fungi.

**UNIT IV**

The comparative morphology, ultrastructure, characters of different groups of fungi up to generic level, Classification of fungi. Lichens 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. Ainsworth GC, Sparrow FK & Susman HS. 1973. The Fungi – An Advanced Treatise. Vol. IV (A & B). Academic Press, New York.
2. Alexopoulos CJ, Mims CW& Blackwell M.2000. Introductory Mycology.5th Ed. John Wiley & Sons, New York.
3. Mehrotra RS & Arneja KR. 1990. An Introductory Mycology. Wiley Eastern, New Delhi.
4. Sarbhoy AK. 2000. Text book of Mycology. ICAR, New Delhi.
5. Singh RS. 1982. Plant Pathogens – The Fungi. Oxford &IBH, New Delhi.
6. Webster J. 1980. Introduction to Fungi. 2 nd Ed. Cambridge Univ. Press, Cambridge, New York.


**AGS651 PLANT BACTERIOLOGY 2+1**

**Objectives:** To develop an understanding of bacteria causing plant diseases. Structure, classification**,** growth reproduction and different bacterial genera causing plant diseases**.**

**Theory**

**UNIT I**

History and introduction to phytopathogenic bacteria, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria. Evolution, classification and nomenclature of phytopathogenic bacteria and important diseases caused by them.

**UNIT II**

Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic bacteria.

**UNIT III**

General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios. Procaryotic inhibitors and their mode of action against phytopathogenic bacteria.

**UNIT IV**

Survival and dissemination of phytopathogenic bacteria.

**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. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
2. Jayaraman J &Verma JP. 2002. Fundamentals of Plant Bacteriology. Kalyani Publ., Ludhiana. Mount
3. MS & Lacy GH. 1982. Phytopathogenic Prokaryotes. Vols. I, II. Academic Press, New York.
4. Verma JP, Varma A & Kumar D. (Eds). 1995. Detection of Plant pathogens and their Management.
5. Angkor Publ., New Delhi.
6. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

**AGS652 PRINCIPLES OF PLANT PATHOLOGY 3+0**

**Objectives:** To acquaint with different pathogens causing plant diseases, their mode of action, disease cycle, epidemiology and management. To understand the host pathogen interactions and different defense mechanisms in plants.

**Theory**

**UNIT I**

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

## UNIT II

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

## UNIT III

Host parasite interaction, recognition concept and infection, symptomatology, mechanism of infection- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

## UNIT IV

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. Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
2. Heitefuss R & Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York.
3. Mehrotra RS & Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.
4. Singh RS. 2002. Introduction to Principles of Plant Pathology. Oxford &IBH, New Delhi.
5. Singh DP & Singh A. 2007. Disease and Insect Resistance in Plants Oxford &IBH, New Delhi.
6. Upadhyay RK & Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford &IBH, New Delhi.

## AGS653 MUSHROOM PRODUCTION TECHNOLOGY 2+1

**Objectives:** To develop understanding on mushroom cultivation, spawn preparation, requirements, maintenance and cultivation technology of different economically important mushrooms.

**Theory**

## UNIT I

Historical development of mushroom cultivation and present status, taxonomy, classification, uses of mushrooms, edible and poisonous mushrooms. Maintenance of pure culture, preparation of spawn and facilities required for establishing commercial spawn laboratory and strain improvement.

## UNIT II

Preparation of substrate for mushroom cultivation, long, short and indoor composting methods, formulae for different composts and their computation, qualities and testing of compost, uses of spent mushroom compost/substrate, spawning and spawn run, casing preparation and its application.

## UNIT III

Setting up mushroom farm for seasonal and environmentally control cultivation, requirement and maintenance of temperature, relative humidity, CO2, ventilation in cropping rooms, cultivation technology of *Agaricusbisporus, Pleurotus*sp., *Calocybeindica, Lentinusedodes*and *Ganodermalucidum.*

## UNIT IV

Insect pests, diseases and abnormalities of cultivated mushroom and their management, post harvest processing and value addition, economics of mushroom cultivation, biotechnology and mushroom cultivation.

**Practical:** Preparation of spawn, compost, spawning, casing, harvesting and postharvest handling of edible mushroom; identification of various pathogens, competitors of various mushroom.

**Suggested Readings**:

1. Suman, B. C. and Sharma, V. P.2007. Mushroom Cultivation in India. Daya Publishing House, New Delhi.
2. Pandey R.K. and Ghosh S. K. 1999. A Handbook of Mushroom Cultivation. Emkay Publications, New Delhi.

**AGS654 POST HARVEST DISEASES 2+1**

**Objectives:** To develop an understanding of concept of post harvest losses, types, factors and management strategies adopted against post harvest pathogens.

**Theory**

## UNIT I

Concept of post harvest diseases, definitions, importance with reference to environment and health, principles of plant disease management as preharvest and post-harvest, merits and demerits of biological/phytoextracts in controlling post-harvest diseases.

## UNIT II

Types of post harvest problems both by biotic and abiotic causes, rhizosphere colonization, competitive, saprophytic ability, antibiosis, induced resistance, microbial associations, concept, operational mechanisms and its relevance in control.

## UNIT III

Factors governing post harvest problems both as biotic and abiotic, role of physical environment, agro-ecosystem leading to quiescent infection, operational mechanisms and cultural practices in perpetuation of pathogens, pathogens and antagonist and their relationship, role of biocontrol agents and chemicals in controlling post-harvest diseases, comparative approaches to control plant pathogens by resident and introduced antagonists. Isolation, characterization and maintenance of pathogens, role of different storage.

## UNIT IV

Integrated approach in controlling diseases and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentarious for each product and commodity.

**Practical:** Isolation, characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens *in vivo* and *in vitro* conditions. Comparative efficacy of different chemicals, fungicides, phytoextracts and bioagents.

**Suggested Readings**:

1. Pathak VN. 1970. Diseases of Fruit Crops and their Control. IBH Publ., New Delhi.
2. Chaddha KL & Pareek OP. 1992. Advances in Horticulture Vol. IV, Malhotra Publ. House, New Delhi.

**AGS655 DISEASES OF FRUITS, PLANTATION AND ORNAMENTAL CROPS 2+1**

**Objectives:** To develop understanding of different pathogens causing diseases in horticultural crops. To acquaint with symptoms, epidemiology, disease cycle and management of different pathogens.

**Theory**

## UNIT I

Introduction, symptoms, etiology, epidemiology and management of different diseases of fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus and mango

## UNIT II

Introduction, symptoms, etiology, epidemiology and management of different diseases of fruits like grapes, guava, *ber*, banana, pineapple, papaya, fig, pomegranate, date palm

## UNIT III

Introduction, symptoms, etiology, epidemiology and management of different diseases of plantation crops such as tea, coffee, rubber and coconut;

## UNIT IV

Introduction, symptoms, etiology, epidemiology and management of different diseases of ornamental plants such as roses, gladiolus, tulip, carnation, orchids, marigold, chrysanthemum.

**Practical:** Detailed study of symptoms and host parasite relationship of representative diseases of plantation crops. Collection and dry preservation of diseased specimens of important crops.

**Suggested readings:**

1. Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, N Delhi.
2. Singh RS. 2007. Plant Diseases. 8th Ed. Oxford &IBH, New Delhi.

## AGS656 DISEASES OF VEGETABLE AND SPICES CROPS 2+1

**Objectives:** To develop an understanding of different pathogens causing diseases in vegetable and spice crops. Symptoms, epidemiology, disease cycle and management of different pathogens.

**Theory**

## UNIT I

Nature, prevalence, symptoms, factors affecting disease development and management of bulb crops, leafy vegetables and crucifers

## UNIT II

Nature, prevalence, symptoms, factors affecting disease development and management of cucurbits and solanaceaous vegetables.

## UNIT III

Nature, prevalence, symptoms, factors affecting disease development and management under protected cultivation.

## UNIT IV

Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger.

**Practical:** Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.

**Suggested Readings:**

1. Chaube HS, Singh US, Mukhopadhyay AN & Kumar J. 1992. Plant Diseases of International Importance.Vol.II. Diseases of Vegetable and Oilseed Crops. Prentice Hall, Englewood Cliffs, New Jersey.
2. Godara, S,l, Kapoor, BBS and Rathore,B.S.2010. Madhu Publications, Bikaner-India.
3. Gupta VK & Paul YS. 2001. Diseases of Vegetable Crops. Kalyani Publ., New Delhi
4. Sherf AF & Mcnab AA. 1986. Vegetable Diseases and their Control. Wiley Inter Science, Columbia.
5. Singh RS. 1999. Diseases of Vegetable Crops. Oxford &IBH, New Delhi.
6. Gupta SK &Thind TS. 2006. Disease Problem in Vegetable Production. Scientific Publ., Jodhpur.
7. Walker JC. 1952. Diseases of Vegetable Crops. McGraw-Hill, New York.

## AGS657 DISEASES OF FIELD AND MEDICINAL CROPS 2+1

**Objectives:** To develop an understanding of different pathogens causing diseases in field and medicinal plants. Symptoms, epidemiology, disease cycle and management of different pathogens.

**Theory**

### UNIT I

Diseases of Cereal and Pulse crops- wheat, barley, rice, pearl millet, sorghum, maize, gram, common bean, urdbean, mungbean, lentil, pigeonpea and soybean.

### UNIT II

Diseases of Oilseed and Cash crops- rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor, cotton and sugarcane.

### UNIT III

Diseases of Fodder legume crops- berseem, oats, guar, lucerne, cowpea.

### UNIT IV

Medicinal crops- plantago, liquorice, mulathi, sacred basil, mentha, ashwagandha, *Aloe vera.*

**Practical:** Detailed study of symptoms and host-parasite relationship of important diseases of above mentioned crops. Collection and dry preservation of diseased specimens of important crops.

**Suggested Readings:**

1. Joshi LM, Singh DV & Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.
2. Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, N Delhi.
3. Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
4. Singh RS. 2007. Plant Diseases. 8th Ed. Oxford &IBH, New Delhi.
5. Singh US, Mukhopadhyay AN, Kumar J & Chaube HS. 1992. Plant Diseases of International Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.
6. Thind, T.S. 1998. Diseases of field Crops and their management. National Agril. Technology Information Centre, Ludhiana, India.

**AGS658 PLANT QUARANTINE 2+0**

**Objectives:** To develop an understanding of plant quarantine regulations in India, import and export regulations, inspection and diagnosis of quarantine pest**,** WTO and phytosanitory measures.

**Theory**

## UNIT I

Definition of pest, pesticides and transgenics as per Govt. notification; relative importance; quarantine – domestic and international. Quarantine restrictions in the movement of agricultural produce, seeds and planting material; case histories of exotic pests/diseases and their status.

## UNIT II

Plant protection organization in India. Acts related to registration of pesticides and transgenics. History of quarantine legislations, PQ Order 2003. Environmental Acts, Industrial registration; APEDA, Import and Export of bio-control agents.

## UNIT III

Identification of pest/disease free areas; contamination of food with Toxigens and microorganisms, and their elimination; Symptomatic diagnosis and other techniques to detect pest/pathogen infestations; VHT and other safer techniques of disinfestation/salvaging of infected material.

## UNIT IV

WTO regulations; non-tariff barriers; Pest Risk Analysis (PRA), good practices for pesticide laboratories; pesticide industry; Sanitary and Phytosanitary measures.

**Suggested Readings**:

1. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
2. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.

## AGS659 BIOLOGICAL CONTROL OF PLANT DISEASES 2+1

**Objectives:** To develop an understanding about different biocontrol agents, their mechanism of action, mass multiplication and role of biocontrol agents in plant disease management.

**Theory**

### UNIT I

Concept of biological control, definitions, importance, principles of plant disease management with bio-agents, history of biological control, merits and demerits of biological control.

### UNIT II

Types of biological 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 III

Factors governing biological control, role of physical environment, agroecosystem, operational mechanisms and cultural practices in biological control of pathogens, pathogens and antagonists and their relationship, biocontrol agents, comparative approaches to biological control of plant pathogens by resident and introduced antagonists, control of soil-borne and foliar diseases. Compatibility of different bioagents.

### UNIT IV

Commercial production of antagonists-mass multiplication and preparation of formulation, their delivery systems, application and monitoring, biological control in IDM, IPM and organic farming system, biopesticides available in market. Quality control system of biocontrol agents.

**Practical:** Isolation, characterization and maintenance of antagonists, methods of study of mechanisms of antagonism *in vitro*, application of antagonists against pathogen *in vivo* conditions. Enumeration of antagonists.

**Suggested Readings:**

1. Campbell R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
2. Cook RJ & Baker KF. 1983. Nature and Practice of Biological Control of Plant Pathogens. APS, St. Paul, Mennisota.

3. Fokkemma, MJ. 1986. Microbiology of the Phyllosphere. Cambridge Univ. Press, Cambridge.
4. Gnanamanickam SS (Eds). 2002. Biological Control of Crop Diseases. CRC Press, Florida.
5. Heikki MT & Hokkanen James M (Eds.). 1996. Biological Control - Benefits and Risks. Cambridge Univ. Press, Cambridge.
6. Mukerji KG, Tewari JP, Arora DK &Saxena G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.

**AGS660 PRINCIPLES OF PLANT DISEASE MANAGEMENT 2+1**

**Objectives:** To develop understanding for different methods used for plant disease management viz., cultural, biological, physical and chemical methods.

**Theory**

**UNIT I**

Principles of plant disease management through cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures (IDM- module) of plant diseases. Disease resistance and molecular approach for disease management.

**UNIT II**

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 III**

History of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy

**UNIT IV**

Nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals.

**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. Fry WE. 1982. Principles of Plant Disease Management. Academic Press, New York.
2. Hewitt HG. 1998. Fungicides in Crop Protection. CABI, Wallington. 3.
Marsh RW. 1972. Systemic Fungicides. Longman, New York.
4. Nene YL & Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford &IBH, N Delhi.
5. Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer- Verlag, New York.

6. Vyas SC. 1993 Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

**AGS661 PLANT VIROLOGY 2+1**

**Objectives:** To develop an understanding of plant viruses, structure, nomenclature, virus vector relationship and different diseases caused by viruses in plants

**Theory**

**UNIT I**

History of plant virology, composition and structure of viruses. Symptomatology of important plant viral diseases, transmission, chemical and physical properties, virus-host interaction, virus-vector relationship.

**UNIT II**

Virus nomenclature and classification, genome organization, replication and movement of viruses. Virus isolation and purification, electron microscopy, protein and nucleic acid based diagnostics.

**UNIT III**

Mycoviruses, phytoplasma, arbo and baculoviruses, satellite viruses, satellite RNAs, phages, viroids, prions. Principles of the working of electron-microscope and ultra-microtome.

**UNIT IV**

Virus 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, PCR.

**Suggested readings:**

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

**AGS662 DETECTION AND DIAGNOSIS OF PLANT DISEASES 0+2**

**Objectives:** To acquaint the students with different methods for identification of plant pathogens, microscopic examination, staining methods, serological methods and molecular identification tools. To give practical understanding on disease assessment methods.

**Practical**

**UNIT I**

Methods to prove Koch's postulates with biotroph and necrotroph pathogens, pure culture techniques, use of selective media to isolate pathogens.

**UNIT II**

Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, centrifuge, pH meter, camera lucida.

**UNIT III**

Microscopic techniques and staining methods, phase contrast system, chromatography, use of electron microscope, spectrophotometer, ultracentrifuge, DNA isolation, electrophoresis, disease diagnostics, serological and molecular techniques for detection of plant pathogens, Basic local alignment search tool.

**UNIT IV**

Evaluation of fungicides, bactericides etc., field experiments, data collection and preparation of references.

**Suggested readings:**

1. Baudoin ABAM, Hooper G R, Mathre D E & Carroll R B. 1990. Laboratory Exercises in Plant Pathology: An
2. Instructional Kit. Scientific Publ., Jodhpur.
3. Dhingra O D & Sinclair J B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
4. Fox R T V. 1993. Principles of Diagnostic Techniques in Plant Pathology. CABI Wallington.
5. Mathews R E F. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Boca Raton, Tokyo.
6. Pathak V N. 1984. Laboratory Manual of Plant Pathology. Oxford &IBH, New Delhi.

**AGS663 SEED HEALTH TECHNOLOGY 2+1**

**Objectives:** To acquaint with seed pathology. Seed certification and method of certified seed production.

**Theory**

**UNIT I**

History and economic importance of seed pathology in seed industry, plant quarantine and SPS under WTO. Morphology and anatomy of typical monocotyledonous and dicotyledonous infected seeds.

**UNIT II**

Recent advances in the establishment and subsequent cause of disease development in seed and seedling. Localization and mechanism of seed transmission in relation to seed infection, seed to plant transmission of pathogens.

**UNIT III**

Seed certification and tolerance limits, types of losses caused by seed-borne diseases in true and vegetatively propagated seeds, evolutionary adaptations of crop plants to defend seed invasion by seed-borne pathogens. Epidemiological factors influencing the transmission of seed-borne diseases, forecasting of epidemics through seed-borne infection.

**UNIT IV**

Production of toxic metabolites affecting seed quality and its impact on human, animal and plant health, management of seed-borne pathogen/diseases and procedure for healthy seed production, seed health testing, methods for detecting microorganism.

**Practical:** Conventional and advanced techniques in the detection and identification of seed-borne fungi, bacteria and viruses. Relationship between seed-borne infection and expression of the disease in the field.

**Suggested Readings:**

1. Agarwal VK & JB Sinclair. 1993. Principles of Seed Pathology. Vols. I & II, CBS Publ., New Delhi.
2. Hutchins JD & Reeves JE. (Eds.). 1997. Seed Health Testing: Progress Towards the 21st Century. CABI, Wallington.
3. Paul Neergaard. 1988. Seed Pathology. MacMillan, London.
4. Suryanarayana D. 1978. Seed Pathology. Vikash Publ., New Delhi.

**AGR664 PHYTONEMATOLOGY 1+1**

**Objectives:** To teach students about nematodes, taxonomy of nematodes, nematodes as pests of different crops, symptoms and their management

**Theory**

**UNIT I**

History, morphology and anatomy of body wall, digestive, reproductive, excretory and nervous system; body cavity;

**UNIT II**

Taxonomic concepts, classification with emphasis on phytonematodes; nematological techniques;

## UNIT III

Nematodes as pests of crops, nematode ecology and disease compels; nematode biology and physiology;

## UNIT IV

Different methods of nematode management.

**Practical:** Sampling and extraction techniques for endo and ecto-parasitic nematodes; counting estimation of soil populations; killing; fixing and preserving, preparing mounts; staining nematode in plant tissues; pathogenecity techniques; morphology studies of different body systems, drawing measurement of nematodes; identification of phyto-parasitic nematodes upto genetic level; familiarity with important nematode diseases and their control.

**Suggested readings**

1. Barrington EJW. 1967. *Invertebrate Structure and Function*. Nelson, Nairobi.
2. Blackwelder RE. 1967. *Taxonomy - A Text and Reference Book.* John Wiley & Sons, New York.
3. Chen ZX, Chen SY & Dickson DW. 2004. *Nematology: Advances and Perspectives. Vol. I. Nematode Morphology, Physiology and Ecology*. CABI, Wallingford.

## AGS665 INSECT VECTORS OF PLANT VIRUSES AND OTHER PATHOGENS 1+1

**Objectives:** To develop an understanding of different vectors of viruses and other pathogens. To study in detail the virus vector relationship and management of vector transmitted pathogens.

**Theory**

## UNIT I

History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.

## UNIT II

Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors. Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.

## UNIT III

Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers. Transmission of plant viruses by psyllids, beetles and mites.

**UNIT IV**

Epidemiology and management of insect transmitted diseases through vector management.

**Practical:** Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; culturing and handling of vectors; demonstration of virus transmission through vectors- aphids, leafhoppers and whiteflies.

**Suggested Readings:**

1. Basu AN. 1995. *Bemisia tabaci* (Gennadius) - Crop Pest and Principal Whitefly Vector of Plant Viruses. Oxford & IBH, New Delhi.
2. Harris KF & Maramarosh K. (Eds.).1980. Vectors of Plant Pathogens. Academic Press, London.
3. Maramorosch K & Harris KF. (Eds.). 1979. Leafhopper Vectors and Plant Disease Agents. Academic Press, London.
4. Youdeovei A & Service MW. 1983. Pest and Vector Management in the Tropics. English Language Books Series, Longman, London.

**AGS666 CHEMICALS IN PLANT DISEASE MANAGEMENT 2+1**

**Objectives:** To develop an understanding of different chemicals used in plant disease control. The classification, chemical nature, mode of action and method of application of different chemicals.

**Theory**

**UNIT I**

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 II**

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 III**

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

**UNIT IV**

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. Bindra OS & Singh H. 1977. Pesticides - An Application Equipment. Oxford &IBH, New Delhi.
2. Nene YL &Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rdEd. Oxford &IBH, New Delhi.
3. Torgeson DC (Ed.). 1969. Fungicides. Vol. II. An Advanced Treatise. Academic Press, New York.
4. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

## AGS667 ECOLOGY OF SOIL-BORNE PLANT PATHOGENS 2+1

**Objectives:** To develop understanding of different soil borne pathogens, rhizobacteria, suppresive soils, fungistasis and management of soil borne pathogens.

**Theory**

### UNIT I

Soil as an environment for plant pathogens, nature and importance of rhizosphere and rhizoplane, host exudates, soil and root inhabiting fungi.

### UNIT II

Bio-control agents and their types.

### UNIT III

Inoculum potential and density in relation to host and soil variables, competition, predation, antibiosis and fungistasis.

### UNIT IV

Suppressive soils, biological control- concepts and potentialities for managing soil borne pathogens.

**Practical:** Quantification of rhizosphere and rhizoplane microflora with special emphasis on pathogens; pathogenicity test by soil and root inoculation techniques, correlation between inoculum density of test pathogens and disease incidence, demonstration of fungistasis in

natural soils; suppression of test soil-borne pathogens by antagonistic microorganisms. Isolation and identification of different biocontrol agents.

**Suggested Readings**:

1. Baker KF & Snyder WC. 1965. Ecology of Soil-borne Plant Pathogens. John Wiley, New York.
2. Cook RJ & Baker KF. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.
3. Garret SD. 1970. Pathogenic Root-infecting Fungi. Cambridge Univ. Press, Cambridge, New York.
4. Hillocks RJ & Waller JM. 1997. Soil-borne Diseases of Tropical Crops. CABI, Wallington.
5. Parker CA, Rovira AD, Moore KJ & Wong PTN. (Eds). 1983. Ecology and Management of Soil-borne Plant Pathogens. APS, St. Paul, Minnesota.

## AGS668 DISEASE RESISTANCE IN PLANTS 2+0

**Objectives:** To develop understanding of different resistance mechanisms in plants. Detailed study on variability, true resistance, physiological races, host defences, hypersensitive response etc.

**Theory**

### UNIT I

Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centre's as sources of resistance, disease resistance terminology.

### UNIT II

Disease escapes, disease tolerance, disease resistance, types of resistance, identification of physiological races of pathogens, disease progression in relation to resistance, stabilizing selection pressure in plant pathogens.

### UNIT III

Host defense system, morphological and anatomical resistance, preformed chemicals in host defense, post infectional chemicals in host defense, phytoalexins, hypersensitivity and its mechanisms.

### UNIT IV

Gene-for-gene concept, protein-for-protein and immunization basis, management of resistance genes. Strategies for gene deployment.

**Suggested Readings**:

1. Deverall BJ. 1977. Defence Mechanisms in Plants. Cambridge Univ. Press, Cambridge, New York.
2. Mills Dallice et al.1996. Molecular Aspects of Pathogenicity and Resistance: Requirement for Signal Transduction. APS, St Paul, Minnesota.
3. Parker J. 2008. Molecular Aspects of Plant Diseases Resistance. Blackwell Publ. 4. Robinson RA. 1976. Plant Pathosystems. Springer Verlag, New York.
5. Singh BD. 2005. Plant Breeding – Principles and Methods. 7th Ed. Kalyani Publ., Ludhiana
6. Van der Plank JE. 1975. Principles of Plant Infection. Academic Press, New York.
7. Van der Plank JE. 1978. Genetic and Molecular Basis of Plant Pathogenesis. Springer Verlag. New York.
8. Van der Plank JE. 1982. Host Pathogen Interactions in Plant Disease. Academic Press, New York.

## AGS669 EPIDEMIOLOGY AND FORECASTING OF PLANT DISEASES 2+1

**Objectives:** To develop an understanding on different elements and factors of plant disease epidemics. To study about crop loss assessment, forcasting and modeling of plant disease epidemics.

**Theory**

### UNIT I

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

### UNIT II

Common and natural logrithms, 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 for prediction of crop losses.

### UNIT IV

Principles and pre-requisites of forecasting, systems and factors affecting various components of forecastings, some early forecasting, and 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 CL & Madden LV. 1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons. New York
2. Cowling EB & Horsefall JG. 1978. Plant Disease. Vol. II. Academic Press, New York.
3. Laurence VM, Gareth H & Frame Van den Bosch (Eds.). The Study of Plant Disease Epidemics. APS, St. Paul, Minnesota.
4. Nagarajan S & Murlidharan K. 1995. Dynamics of Plant Diseases. Allied Publ., New Delhi.
5. Thresh JM. 2006. Plant Virus Epidemiology. Advances in Virus Research 67, Academic Press, New York.
6. Van der Plank JE. 1963. Plant Diseases Epidemics and Control. Academic Press, New York.
7. Zadoks JC & Schein RD. 1979. Epidemiology and Plant Disease Management. Oxford Univ. Press, London.

**AGR670 INTEGRATED DISEASE MANAGEMENT 2+1**

**Objectives:** To acquaint with different principles of plant disease management. To give detailed understanding about different components of IDM and its successful examples in different crops.

**Theory**

**UNIT I**

Introduction, definition, concept and tools of disease management

**UNIT II**

Components of integrated disease management- their limitations and implications.

**UNIT III**

Development of IDM- basic principles, biological, chemical and cultural disease management.

**UNIT IV**

IDM in important crops- rice, wheat, cotton, sugarcane, chickpea, rapeseed mustard, pearlmillet, *kharif*pulses, vegetable crops and fruit crops.

**Practical:** Application of biological, cultural, chemical and biocontrol agents, their compatibility and integration in IDM; demonstration of IDM in certain crops as project work.

**Suggested Readings**:

1. Gupta VK& Sharma RC. (Eds). 1995. Integrated Disease Management and Plant Health. Scientific Publ., Jodhpur.

2. Mayee CD, Manoharachary C, Tilak KVBR, Mukadam DS & Deshpande Jayashree (Eds.). 2004. Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publ. House, New Delhi.
3. Sharma RC & Sharma JN. (Eds). 1995. Integrated Plant Disease Management. Scientific Publ., Jodhpur.

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**AGS501 (0+1)**

**Practical:**

## LIBRARY AND INFORMATION SERVICES

**Objective:** This course is intended to equip students with skills to use different e-resources to get information.

**Practical**

### UNIT I

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library;

### UNIT II

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.);

### UNIT III

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;

### UNIT IV

Use of Internet including search engines and its resources; e-resources access methods.

**Suggested Readings**:


1. Wu Diana Yuhfen and Liu Mengxiong. 2001. Academic librarianship: changing roles in the digital age. Available at http//www.sssu.edu/ridwu/academic librarianship P&F. Accessed March 10, 2008
2. Library.2004. Encyclopedia Britannica premium service http//www.britannica.com/eb/ article eu=09616. Accessed March 10, 2008
3. Young, P.V. (1984). Scientific social survey and research. Rev. 4th Ed. Prentice Hall, New Delhi.
4. https://guides.library.manoa.hawaii.edu/PlantPath/Books
5. https://unl.libguides.com/c.php?g=51695&p=334113
6. https://libraries.unl.edu/citation-tools


## AGS503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1+0

**Objective:** To impart knowledge about IPRs and issues related to IPRs.
**Theory**

### UNIT I

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;

**UNIT II**

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,

**UNIT III**

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;

**UNIT IV**

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**


1. Erbisch FH & Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
2. Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.


**AGS504 BASIC CONCEPTS IN LABORATORY TECHNIQUES 0+1**

**Objectives**

To explain students about the basic lab techniques, instruments and their use with their applications in research and precautionary measures in lab.

**Outcome**

Students learn the use of lab instruments and chemicals for their research purposes.

**Practical**

**UNITI**

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.

**UNITII**

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.

**UNITIII**

Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing.

**UNITIV**

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**

1. Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
2. Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

**AGS505 AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES 1+0**

**Objective:** To acquaint students about Agriculture Research Systems globally, research ethics and about various rural development programmes.

**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):

**UNIT II**

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.

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)

**UNIT IV**

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**

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

**ENG551 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1**

**DAV UNIVERSITY, JALANDHAR**

**Objective:** This course is intended to help students in enhancing their technical writing and communication skills

**Practical**

## UNIT I

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);

## UNIT II

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;

## UNIT III

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;

## UNIT IV

Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

**Suggested Readings**:


1. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
2. Collins' Cobuild English Dictionary. 1995. Harper Collins.
3. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
4. Gupta RH. 2010. Essentials of Communication. 7th Ed. Pragati Prakashan. Hornby AS. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
5. James HS. 1994. Handbook for Technical Writing. NTC Business Books.
6. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
7. Mohan K. 2005. Speaking English Effectively. MacMillan India.
8. Richard WS. 1969. Technical Writing. Barnes & Noble.
9. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
10. Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India

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**CSA559 COMPUTER FUNDAMENTALS AND PROGRAMMING 2+1**

**Objective:** To impart knowledge of computers and to develop skills to operate computers, different operating systems.

**Theory**

**UNIT I**

Computer Fundamentals - Number systems: decimal, octal, binary and hexadecimal; Representation of integers, fixed and floating point numbers, character representation; ASCII, EBCDIC.

**UNIT II**

Functional units of computer, I/O devices, primary and secondary memories. Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Representation of integer, character, real, data types; Constants and variables; Arithmetic expressions, assignment statement, logical expression.

**UNIT III**

Sequencing, alteration and iteration; Arrays, string processing. Sub-programs, recursion, pointers and files.

**UNIT IV**

Program correctness; Debugging and testing of programs. Practical Conversion of different number types; Creation of flow chart, conversion of algorithm/flowchart to program; Mathematical operators, operator precedence; Sequence, control and iteration; Arrays and string processing; Pointers and File processing.

**Practicals:** Introduction to computer parts, Input output devices, learning various operators, learning Microsoft office.

**Suggested reading:**


1. Goel, A. (2010). Computer fundamentals, Pearson publishers.
2. Wempen, F. (2015) Computing Fundamentals: Introduction to Computers. John Willey & Sons Inc.


**EVS658 DISASTER MANAGEMENT 1+0**

**Objective:** To impart knowledge about various calamities and their management at national and international level and role of different organizations in disaster management.

**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

**UNIT IV**

Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

**Suggested Readings:**

1. Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.
2. Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.
3. Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.

**MTH670 STATISTICAL METHODS FOR APPLIED SCIENCES**

**3+1**

**Objective:** It would help students in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure of data presentation, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques

**Theory**

**UNIT I**

Classification, tabulation and graphical, representation of data. Box-plot, Descriptive statistics. Exploratory data analysis;

**UNIT II**

Measures of central tendency- Mean, Median, Mode, Geometric mean, Harmonic mean. Measures of Dispersion- Range, Quartile deviation, Mean deviation, Standard deviation.

**UNIT III**

Theory of probability. Random variable and mathematical expectation. Discrete and continuous probability distributions. Correlation and regression

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**UNIT IV**

Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distributions.

**Practical**

Exploratory data analysis, Box-Cox plots; Fitting of distributions: Binomial, Poisson, Negative Binomial, Normal; Large sample tests, testing of hypothesis based on exact sampling distributions-chi square, t and F; Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution; Correlation and regression analysis, fitting of orthogonal polynomial regression; applications of dimensionality reduction and discriminant function analysis; Nonparametric tests.

**Suggested Readings**


1. Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley.
2. Goon AM, Gupta MK & Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I
3. Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics. Vol. I.
4. Hoel PG. 1971. Introduction to Mathematical Statistics. John Wiley.
5. Aggrawal, S. C. and Rana, R. K., 2007. Basis Statistics. VK publication.
6. Singh, S., Singh, T.P., Babsal, M.L. and Kumar R. 2004. Statistical Method for Research workers. Kalyani Publishers, Ludhiana.


**AGR560 MASTER'S SEMINAR 1+0**

**AGR500 MASTER'S RESEARCH 0+20**