Revised Course Structure and Syllabi
(as per ICAR guideline)

- M.Sc. (Agriculture) Entomology
- M.Sc. (Agriculture) Plant Pathology
- M.Sc. (Agriculture) Nematology
- Bridge Course for three year Graduates

Department of Plant Protection
Faculty of Agricultural Sciences
Aligarh Muslim University, Aligarh
### M. Sc. (Ag.) Entomology

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(As per ICAR Guidelines)

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IV Semester

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DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
AMU, ALIGARH

M. Sc. (Ag.) Nematology  
(as per ICAR guidelines)

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I Semester

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Approved in the BOS held on 05.02.2018

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**MINOR COURSES**

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**SUPPORTING COURSES**

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**COMPULSORY NON-CREDIT COURSES**

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* NCMA-503: Intellectual Property and its Management in Agriculture
  - Credits: 1+0
  - Sessional: 10
  - Mid: 40
  - End: 50
  - M. Marks: 100

* NCMA-504: Basic Concepts in Laboratory Techniques
  - Credits: 0+1
  - Sessional: 10
  - Mid: 40
  - End: 50
  - M. Marks: 100

* NCMA-505: Agricultural Research, Research Ethics and Rural Development Programmes
  - Credits: 1+0
  - Sessional: 10
  - Mid: 40
  - End: 50
  - M. Marks: 100

* NCMA-506: Disaster Management
  - Credits: 1+0
  - Sessional: 10
  - Mid: 40
  - End: 50
  - M. Marks: 100

* NCMA-507: Master’s Research
  - Credits: 0+20
  - Sessional: Satisfactory/Non-satisfactory
  - End: M. Marks: 100

* NCMA-508: Agricultural Research, Research Ethics and Rural Development Programmes
  - Credits: 1+0
  - Sessional: 10
  - Mid: 40
  - End: 50
  - M. Marks: 100
Bridge Course for Non- Agriculture graduates pursuing  
M.Sc. (Ag.) Entomology, M.Sc. (Ag.) Plant Pathology, M.Sc. (Ag.) Agricultural Microbiology, and Master of Agri-Business Management

Total Credit hrs. 24; Duration : 2 Semesters (one year)

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<td>APH-401 Fundamentals of Horticulture</td>
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<tr>
<td>APP-401 Fundamentals Plant Pathology/Entomology</td>
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<td>AG- 421 Principles of Plant Breeding</td>
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<td>APS-401 Fundamentals of Soil Science</td>
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<td>BPP-401 Introductory Agro-meteorology &amp; Climate Change</td>
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**Total Credits hrs** 24

- An advisor from each respective department shall allot the optional courses to the students.
Approved in the BOS held on 05.02.2018

Revised Course Structure and Syllabi
(as per ICAR guideline)

M.Sc. (Agriculture) Entomology
Department of Plant Protection
Faculty of Agricultural Sciences
Aligarh Muslim University, Aligarh
ENT 501 INSECT MORPHOLOGY

Objective: To acquaint the students with external morphology of the insect’s body i.e., head, thorax and abdomen, their appendages and functions.

Credits : 1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.

UNIT II Head- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites.

UNIT III Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; Legs: structure and modifications.

UNIT IV Abdomen- Segmentation and appendages; Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis. Insect sense organs (mechano-, photo- and chemo- receptors).

Practical

Study of insect segmentation, various tagmata and their appendages: preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia. Sense organs.

Suggested Readings:
ENT 504  CLASSIFICATION OF INSECTS

Objective To introduce the students to the classification of insects up to the level of families with hands-on experience in identifying the families of insects.

Credits Max. Marks Assignment Mid Semester Practical exams End Term
2+1 100 5 30 15 50

Theory

UNIT I Brief evolutionary history of Insects- introduction to phylogeny of insects and Major Classification of Superclass Hexapoda – Classes – Ellipura Collembola, Protura), Diplura and Insecta- Orders contained.


UNIT III Distinguishing characters, general biology, habits and habitats of Insect orders and economically important families contained in them (Continued). Division Neoptera – Subdivision Endopterygota, Section Neuropteroid- Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpoid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.


Suggested Readings:
ENT 505 INSECT ECOLOGY

Objective
To teach the students the concepts of ecology, basic principles of distribution and abundance of organisms and their causes. Study life tables, organization of communities, diversity indices. Train students in sampling methodology, calculation of diversity indices, constructing life tables, relating insect population fluctuations to biotic and/or abiotic causes.

Credits : 1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory


UNIT IV Community ecology- Concept of guild, Organisation of communities- Hutchinson Ratio, May’s d/v, Relation between the two and their association with Dyar’s Law and Przibram’s law. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology

Practical
breadth, activity breadth and diagramatic representation of niches of organisms. Calculation of some diversity indices- Shannon’s, Simpson’s and Avalanche Index and understanding their associations and parameters that affect their values. Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems.

**Suggested Readings:**
ENT 518  TECHNIQUES IN PLANT PROTECTION

Objective  To acquaint the students with appropriate use of plant protection equipments and techniques related to microscopy, computation, pest forecasting, electrophoresis etc.

Credits  :  0+1
Max. Marks :  100
Assignment  :  10
Mid Semester  :  40
End Term  :  50

Theory

UNIT I  Pest control equipments, principles, operation, maintenance, selection, application of pesticides and biocontrol agents, seed dressing, soaking, root-dip treatment, dusting, spraying, application through irrigation water.

UNIT II  Soil sterilization, solarization, deep ploughing, flooding, techniques to check the spread of pests through seed, bulbs, corms, cuttings and cut flowers.

UNIT III  Use of light, transmission and scanning electron microscopy.

UNIT IV  Protein isolation from the pest and host plant and its quantification using spectrophotometer and molecular weight determination using SDS/PAGE.

UNIT V  Use of tissue culture techniques in plant protection. Computer application for predicting/forecasting pest attack and identification.

Suggested Readings:
PL PATH 501 MYCOLOGY

Objective
To study the nomenclature, classification and characters of fungi.

Theory

<table>
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<tr>
<th>Credits</th>
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<td>100</td>
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UNIT I
Introduction, definition of different terms, basic concepts.

UNIT II
Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology.

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

UNIT IV
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:
NEMA 501  PRINCIPLES OF NEMATOLOGY

Objective: To project the importance of nematodes in agriculture and impart basic knowledge on all aspects of plant nematology.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: History and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.
UNIT II: Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.
UNIT III: Types of parasitism; nature of damage and general symptomatology; interaction of plant parasitic nematodes with other organisms.
UNIT IV: Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.
UNIT V: Principles and practices of nematode management; integrated nematode management.

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

Suggested Readings:
SMED 500  STATISTICAL METHODS AND EXPERIMENTAL DESIGNS
Objective: To give fundamental and applied knowledge of statistical designs and their application.

Credits : 2+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

Theory
UNIT II Principles of experimental designs; completely randomized design (CRD), randomized block design (RBD), Latin square design (LSD) and split plot design (SPD). Missing values. Factorial designs.

Suggested Readings:
NCM 501  LIBRARY AND INFORMATION SERVICES

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.

Credits   :  0+1
Max. Marks :  100
Assignment :  10
Mid Semester :  40
End Term :  50

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.
NCM 502  TECHNICAL WRITING AND COMMUNICATIONS SKILLS

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).

Credits : 0+1
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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:
SEMESTER - II

ENT 502  INSECT ANATOMY, PHYSIOLOGY AND NUTRITION

Objective To impart knowledge to the students on basic aspects of anatomy of different systems, elementary physiology, nutritional physiology and their application in entomology.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I Scope and importance of insect anatomy and physiology.
UNIT II Structure, modification and physiology of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands.
UNIT III Thermodynamics; physiology of integument, moulting; growth, metamorphosis and diapause.
UNIT IV Insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular micro-organisms and their role in physiology; artificial diets.

Practical Dissection of different insects to study comparative anatomical details of different systems; preparation of permanent mounts of internal systems; chromatographic analysis of free amino acids of haemolymph; determination of chitin in insect cuticle; examination of insect haemocytes; determination of respiratory quotient; preparation and evaluation of various diets; consumption, utilization and digestion of natural and artificial diets.

Suggested Readings:
ENT 511  PESTS OF FIELD CROPS

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.

Credits  :  1+1
Max. Marks  :  100
Assignment  :  5
Mid Semester  :  30
Practical exams  :  15
End Term  :  50

Theory  
Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors.

UNIT I  Insect pests of cereals and millets and their management. Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs etc.).

UNIT II  Insect pests of pulses, tobacco, oilseeds and their management.

UNIT III  Insect pests of fibre crops, forages, sugarcane and their management.

Practical  
Field visits, collection and identification of important pests and their natural enemies; detection and estimation of infestation and losses in different crops; study of life history of important insect pests.

Suggested Readings:
Nair MRGK. 1986. *Insect and Mites of Crops in India.* ICAR, New Delhi.
PL PATH 504 PRINCIPLES OF PLANT PATHOLOGY

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

Credits : 3+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

Theory

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

UNIT II Growth, reproduction, survival 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, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

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

UNIT Disease management strategies.

Suggested Readings:
ENT 512  PESTS OF HORTICULTURAL AND PLANTATION CROPS

Objective  To impart knowledge on major pests of horticultural and plantation crops regarding the extent and nature of loss, seasonal history, their integrated management.

Credits   : 1+1
Max. Marks: 100
Assignment: 5
Mid Semester: 30
Practical exams: 15
End Term: 50

Theory
Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops.

UNIT I  Fruit Crops- mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, ber, fig, citrus, aonla, pineapple, apple, peach and other temperate fruits.

UNIT II Vegetable crops- tomato, potato, radish, carrot, beetroot, cole crops, french beans, chow-chow, brinjal, okra, all gourds, gherkin, drumstick, leafy vegetables etc.

UNIT III Plantation crop- coffee, tea, rubber, coconut, arecanut, cashew, cocoa etc.; Spices and Condiments- pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, beetle etc.

UNIT IV Ornamental, medicinal and aromatic plants and pests in polyhouses/protected cultivation.

Practical
Collection and identification of important pests and their natural enemies on different crops; study of life history of important insect pests and non-insect pests.

Suggested Readings:
ENT 519 COMMERCIAL ENTOMOLOGY

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.

Credits : 1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory


UNIT II 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 III 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.


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 pest control 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 and commercial apiaries. Silkworm rearing and management. Lac host and crop management technology and processing of lac. Products and bye-products of lac.

Suggested Readings:
NCM 503  Intellectual Property and its Management in Agriculture

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.

Credits : 1+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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 bio-diversity 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:
PGS 504  BASIC CONCEPTS IN LABORATORY TECHNIQUES

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

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Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; 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:
SEMESTER – III

ENT 508  TOXICOLOGY OF INSECTICIDES

Objective  To orient the students with structure and mode of action of important insecticides belonging to different groups, development of resistance to insecticides by insects, environmental pollution caused by toxic insecticides and their toxicological aspects.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I  Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India.

UNIT II  Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature. Structure and mode of action of organo- chlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals, new promising compounds, etc.

UNIT III  Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides- synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity.

UNIT IV  Insecticide metabolism; pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence.

UNIT V  Insecticide residues, their significance and environmental implications. Insecticide Act, registration and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.

Practical

Insecticide formulations and mixtures; quality control of pesticide formulations; laboratory and field evaluation of bioefficacy of insecticides; bioassay techniques; probit analysis; evaluation of insecticide toxicity and joint action. Toxicity to beneficial insects. Pesticide appliances. Working out doses and concentrations of pesticides; visit to toxicology laboratories. Good laboratory practices.

Suggested Readings:
ENT 510 PRINCIPLES OF INTEGRATED PEST MANAGEMENT

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.

Credits :1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT History and origin, definition and evolution of various related terminologies.
UNIT II Concept and philosophy, ecological principles, economic threshold concept, and economic consideration.
UNIT III 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; 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:
ENT 513  STORAGE ENTOMOLOGY
Objective
To focus on requirement and importance of grain and grain storage, to understand the role of stored grain pests and to acquaint with various stored grain pest management techniques for avoiding losses in storage.

Credits : 1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I
Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses in toto vis-à-vis total production of food grains in India. Scientific and socio-economic factors responsible for grain losses.

UNIT II
Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products; traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes.

UNIT III
Ecology of insect pests of stored commodities/grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities. Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage- types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities’ storage conditions.

UNIT IV
Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows. Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures- Hygiene/sanitation, disinfestations of stores/receptacles, legal methods. Curative measures- Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering. Chemical control- prophylactic and curative- Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Integrated approaches to stored grain pest management.

Practical
Collection, identification and familiarization with the stored grains/seed insect pests and nature of damage caused by them; detection of insect infestation in stored food grains; estimation of losses in stored food grains; determination of moisture content in stored food grains; familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques; treatment of packing materials and their effect on seed quality. Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, IGSMRI, Hapur etc. (only where logistically feasible).
Suggesting Readings


NCM 505 Agricultural Research, Research Ethics and Rural Development Programmes

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.

Credits : 1+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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, Cooperatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings:
Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
NCM 506  DISASTER MANAGEMENT

Objectives  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.

Credits  :  1+0
Max. Marks  :  100
Assignment  :  10
Mid Semester  :  40
End Term  :  50

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:
SEMESTER – IV

ENT 507 BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS

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

Credits :1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation.
UNIT II 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 III Mass production of quality biocontrol agents- techniques, formulations, economics, field release/application and evaluation.
UNIT IV 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:
Revised Course Structure and Syllabi
(as per ICAR guideline)

M.Sc. (Agriculture) Plant Pathology

Department of Plant Protection
Faculty of Agricultural Sciences
Aligarh Muslim University, Aligarh
M.Sc. (Ag.) Plant Pathology

I Semester

PL PATH-501*   Mycology

Objective: To study the nomenclature, classification and characters of fungi.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory
UNIT I Introduction, definition of different terms, basic concepts.

UNIT II Importance of mycology in agriculture, relation of fungi to human affairs, history of mycology.

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

UNIT IV 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
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

I Semester

PL PATH-503* Plant Bacteriology

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

Credits: 3 (2+1)
Max. Marks: 100
Assignment: 5
Mid Semester: 30
Practical exam: 15
End Term: 50

Theory

UNIT I History and introduction to phytopathogenic procarya, viz., bacteria, MLOs, spiroplasmas and other fastidious procarya. Importance of phytopathogenic bacteria.

UNIT II Evolution, classification and nomenclature of phytopathogenic procarya and important diseases caused by them.

UNIT III Growth, nutrition requirements, reproduction, preservation of bacterial cultures and variability among phytopathogenic procarya.

UNIT IV General biology of bacteriophages, L form bacteria, plasmids and bdellovibrios.

UNIT V Procaryotic inhibitors and their mode of action against phytopathogenic bacteria.

UNIT VI 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
DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

I Semester

PL PATH 505*  Detection and Diagnosis of Plant Diseases

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

Credits: 2 (0+2)  
Max. Marks: 100  
Assignment: 10  
Mid Semester: 40  
End Term: 50

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 and electrophoretic apparatus, disease diagnostics, serological and molecular techniques for detection of plant pathogens. Evaluation of fungicides, bactericides etc.; field experiments, data collection and preparation of references.

Suggested Readings

DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

I Semester

NEMA 501  Principles of Nematology

Objective: To project the importance of nematodes in agriculture and impart basic knowledge on all aspects of plant nematology.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory

UNIT I History and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.

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

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

UNIT IV Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.

UNIT V Principles and practices of nematode management; integrated nematode management.

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

Suggested Readings
I Semester

SMED-500 Statistical Methods and Experimental Designs

Objective: To give fundamental and applied knowledge of experimental designing and statistical application in agriculture.

Credits : 2 (2+0)
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50


Unit -II Principles of experimental designs; completely randomized design (CRD), randomized block design (RBD), latin square design (LSD) and split plot design (SPD).


Unit -IV Application packages of statistical analysis: R-analysis, Agricola, MINITAB ans SAS.

Suggested Readings/Texts/References
M.Sc. (Ag.) Plant Pathology

I Semester

NCM 501 Library and Information Services

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.

Credits : 1 (0+1)
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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.

Suggested Readings
DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH  

M.Sc. (Ag.) Plant Pathology  

I Semester  

NCM 502  
Technical Writing and Communication Skills  

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).  

Credits  : 1 (0+1)  
Max. Marks : 100  
Assignment : 10  
Mid Semester : 40  
End Term : 50  

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  
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

II Semester

PL PATH 504 Principles of Plant Pathology

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

Credits : 3 (3+0)
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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

UNIT II Growth, reproduction, survival 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, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.

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

UNIT V Disease management strategies.

Suggested Readings
DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH  

M.Sc. (Ag.) Plant Pathology  

II Semester  

PL PATH-502*  
Plant Virology  

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

Credits : 3 (2+1)  
Max. Marks : 100  
Assignment : 5  
Mid Semester : 30  
Practical exam : 15  
End Term : 50  

Theory  
UNIT I  
History of plant viruses, composition and structure of viruses.  

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

UNIT III  
Virus nomenclature and classification, genome organization, replication and movement of viruses.  

UNIT IV  
Isolation and purification, electron microscopy, protein and nucleic acid based diagnostics.  

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

UNIT VI  
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 and ultratomy, PCR.  

Suggested Readings  
II Semester

NEMA 508  Nematode Ecology

Objective:  To understand the life of plant parasitic nematodes in their environment; their survival strategies, and how to exploit these for their control.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory

UNIT I  Definition and scope; components of environment; evolution of nematodes; ecological classification, prevalence, distribution and dispersal of nematodes.

UNIT II  Role of nematodes in the food web; habitat and niche characteristics; community analysis and population estimation models.

UNIT III  Effects of abiotic and biotic factors on nematodes.

UNIT IV  Environmental extremes and nematode behaviour- aggregation, swarming, orientation, feeding and reproduction.

UNIT IV  Survival strategies of nematodes in adverse environment and absence of host.

UNIT V  Modeling population dynamics and relations with crop performance; ecological considerations in nematode management, data interpretation and systems simulation.

Practical

Study of nematode fauna in varied agro-ecological systems, community analysis of nematode populations, laboratory exercises on influence of abiotic factors on movement and hatching, green-house experiments on effect of abiotic factors on nematode populations and plant growth.

Suggested Readings

DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

II Semester

PL PATH-509 Diseases of Vegetable and Spices Crops

Objective: To impart knowledge about symptoms, epidemiology of different diseases of vegetables and spices and their management.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory


UNIT II Symptoms and management of diseases of different root, bulb, leafy vegetables, crucifers, cucurbits and solanaceaeous vegetable crops.

UNIT III 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
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

II Semester

NCM 503 Intellectual Property and its Management in Agriculture

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.

Credits : 1 (1+0)
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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 bio-diversity 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

DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

II Semester

NCM 504 Basic Concepts in Laboratory Techniques

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

Credits : 1 (0+1)  
Max. Marks : 100  
Assignment : 10  
Mid Semester : 40  
End Term : 50

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; 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
DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

III Semester

PL PATH 508  
Diseases of Fruits, Plantation and Ornamental plants

Objective: To acquaint with diseases of fruits, plantation, ornamental plants and their management.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory

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

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

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

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
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

III Semester

PL PATH 506 Principles of Plant Disease Management

Objective: To acquaint with different strategies for management of plant diseases.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory

UNIT I Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control, integrated control measures of plant diseases. Disease resistance and molecular approach for disease management.

UNIT II 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, 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
DEPARTMENT OF PLANT PROTECTION  
FACULTY OF AGRICULTURAL SCIENCES  
A.M.U., ALIGARH  

M.Sc. (Ag.) Plant Pathology  

III Semester  

PL PATH 510  Seed Health Technology  

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

Credits  : 3 (2+1)  
Max. Marks  : 100  
Assignment  : 5  
Mid Semester  : 30  
Practical exam  : 15  
End Term  : 50  

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  
III Semester

NCM 505 Agricultural Research, Research Ethics and Rural Development Programmes

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.

Credits : 1 (1+0)
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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
III Semester

NCM 506 Disaster Management

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.

Credits: 1 (1+0)
Max. Marks: 100
Assignment: 10
Mid Semester: 40
End Term: 50

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
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M.Sc. (Ag.) Plant Pathology

IV Semester

PL PATH 507  Diseases of Field and Medicinal Crops

Objective: To educate about the nature, prevalence, etiology, factors affecting disease development and control measures of field and medicinal crop diseases.

Credits : 3 (2+1)
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exam : 15
End Term : 50

Theory

UNIT I  Diseases of Cereal crops- wheat, barley, rice, pearl millet, sorghum and maize.

UNIT II  Diseases of Pulse crops- gram, urdbean, mungbean, lentil, pigeonpea, soybean.

UNIT III  Diseases of Oilseed crops- rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor.

UNIT IV  Diseases of Cash crops- cotton, sugarcane.

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

UNIT VI  Medicinal crops- plantago, liquorice, mulathi, rosagrass, 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

Revised Course Structure and Syllabi
(as per ICAR guideline)

M.Sc. (Agriculture) Nematology

Department of Plant Protection
Faculty of Agricultural Sciences
Aligarh Muslim University, Aligarh
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

M. Sc. (Ag.) Nematology

SEMESTER - I

NEMA 501  PRINCIPLES OF NEMATOLOGY

Objective: To project the importance of nematodes in agriculture and impart basic knowledge on all aspects of plant nematology.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: History and growth of Nematology; nematode habitats and diversity- plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.
UNIT II: Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.
UNIT III: Types of parasitism; nature of damage and general symptomatology; interaction of plant parasitic nematodes with other organisms.
UNIT IV: Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.
UNIT V: Principles and practices of nematode management; integrated nematode management.

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

Suggested Readings
NEMA 505  NEMATOLOGICAL TECHNIQUES

Objective: Understanding the principles, theoretical aspects and developing skills in nematological techniques.

Credits : 1+2
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I: Principles and use of light, scanning and transmission electron microscopes, and other laboratory equipments.

UNIT II: Survey and surveillance methods; collection of soil and plant samples; techniques for extraction of nematodes from soil and plant material; estimation of population densities.

UNIT III: Killing, fixing, clearing and mounting nematodes; measurements, preparation of perineal patterns, vulval cones of cyst nematodes, en-face views and body section of nematodes.

UNIT IV: In vitro and in vivo culturing techniques of plant parasitic, bacteriophagous, mycophagus and omnivorous nematodes.

UNIT V: Staining nematodes in plant tissues; microtomy for histopathological studies; collection of plant root exudates and their bioassay; preparation of plant materials for exhibition.

UNIT VI: Application of molecular techniques in Nematology.

Practical

Collection of soil and plant samples; extraction of nematodes from soil by Baermann funnel, sieving and decanting, elutriation and sugar centrifugal methods; extraction of cysts from soil; extraction of nematodes from plant material; estimation of population densities; staining plant material for nematodes; killing and fixing nematodes, clearing nematodes by slow and Seinhorst’s methods; preparation of temporary and permanent mounts; measurements, drawing, microphotography, special preparation of nematodes - perineal patterns, vulval cones, en-face and body sections; collection of root exudates, preparation of exhibits of nematode diseased plant material, in vitro culturing techniques of nematodes- callous culture, excised root and carrot disc techniques.

Suggested Readings


NEMA 507  NEMATODE BIOLOGY AND PHYSIOLOGY

Objective: To develop understanding of life cycle patterns, feeding and metabolic processes in phytонematodes which have implications in their management.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I: Host finding and invasion, feeding, hatching, moulting; life cycle patterns in different types of nematodes.

UNIT II: Types of reproduction, gametogenesis, embryogenesis and post embryogenesis.

UNIT III: Chemical composition of nematodes, hydrolytic enzymes, pseudocoelome and function of transport.

UNIT IV: Physiology of digestive system, intermediary metabolism.

UNIT V: Osmoregulation, physiology of excretory-secretory and neuromuscular systems.

Practical

Studies on embryogenesis and post-embryogenesis, hatching, moulting, life cycle development, feeding, enzymatic assay by electrophoresis.

Suggested Readings


**Objective:** To give fundamental and applied knowledge of statistical designs and their application.

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**Theory**


**UNIT II:** Principles of experimental designs; completely randomized design (CRD), randomized block design (RBD), latin square design (LSD) and split plot design (SPD). Missing values. Factorial designs.

**Suggested Readings**

NCM 501  LIBRARY AND INFORMATION SERVICES

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.

Credits : 0+1
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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.
NCM 502  TECHNICAL WRITING AND COMMUNICATIONS SKILLS

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).

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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

SEMESTER - II

NEM 502  PRINCIPLES OF TAXONOMY

Objective: To sensitize the students on the theory and practice of classifying organisms and the rules governing the same.

Credits : 2+0
Max. Marks  : 100
Assignment : 10
Mid Semester : 40
End Term : 50

Theory

UNIT I: Introduction to history and principles of systematics and importance. Levels and functions of systematics. Identification, purpose, methods- character matrix, taxonomic keys. Descriptions- subjects of descriptions, characters, nature of characters, analogy vs homology, parallel vs convergent evolution, intraspecific variation in characters, polythetic and polymorphic taxa, sexual dimorphism.

UNIT II: Classification of animals: Schools of classification- Phenetics, Cladistics and Evolutionary classification. Components of Biological Classification: Hierarchy, Rank, Category and Taxon. Species concepts, cryptic, sibling and etho-species, infra-specific categories. Introduction to numerical, biological and cytogenetical taxonomy.


Suggested Readings
NEMA 503  STRUCTURAL AND FUNCTIONAL ORGANIZATION OF NEMATODES

Objective: Familiarization with structural organization of nematode body so as to enable the students to understand biology, physiology and classification of nematodes.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: Introduction and general organization of nematode body.
UNIT II: Morphology and anatomy of nematode cuticle, hypodermis, musculature and pseudocoelom.
UNIT III: Digestive system- structural variations of stoma, oesophagus, intestine and rectum in nematodes.
UNIT IV: Reproductive system- terminology and variations in female and male reproductive systems, nemic eggs and sperms, types of reproduction, spermatogenesis and oogenesis.
UNIT V: Types and structure of excretory-secretory systems; nervous system and associated sense organs.

Practical
Studies on variations in nematode shapes and sizes, morphological details of cuticle, cuticular markings and ornamentation, variations in stoma, oesophagus, rectum; types and parts of female and male reproductive systems, sense organs, and excretory system.

Suggested Readings
Objective: To understand the life of plant parasitic nematodes in their environment; their survival strategies, and how to exploit these for their control.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: Definition and scope; components of environment; evolution of nematodes; ecological classification, prevalence, distribution and dispersal of nematodes.
UNIT II: Role of nematodes in the food web; habitat and niche characteristics; community analysis and population estimation models.
UNIT III: Effects of abiotic and biotic factors on nematodes.
UNIT IV: Environmental extremes and nematode behaviour- aggregation, swarming, orientation, feeding and reproduction.
UNIT IV: Survival strategies of nematodes in adverse environment and absence of host.
UNIT V: Modeling population dynamics and relations with crop performance; ecological considerations in nematode management, data interpretation and systems simulation.

Practical
Study of nematode fauna in varied agro-ecological systems, community analysis of nematode populations, laboratory exercises on influence of abiotic factors on movement and hatching, green-house experiments on effect of abiotic factors on nematode populations and plant growth.

Suggested Readings
Objective: To acquaint with disease resistance mechanisms in plants.

Credits: 2+0
Max. Marks: 100
Assignment: 10
Mid Semester: 40
End Term: 50

**Theory**

**UNIT I:** Introduction and historical development, dynamics of pathogenicity, process of infection, variability in plant pathogens, gene centres 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 defence system, morphological and anatomical resistance, preformed chemicals in host defence, post infectious chemicals in host defence, 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**


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.

Credits : 1+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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 bio-diversity 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


NCM 504 BASIC CONCEPTS IN LABORATORY TECHNIQUES

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

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Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; 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
SEMESTER – III

NEMA 504  CLASSIFICATION OF NEMATODES

Objective: Development of skills in the identification of plant parasitic nematodes up to genera and species levels.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I: Principles of nematode systematics.
UNIT II: Placement of nematodes in Animal Kingdom and comparison with related organisms.
UNIT III: Classification of Phylum Nematoda- Orders of Class Adenophorea and Secernentea; Diagnosis of Order Tylenchida- Suborder Tylenchina, Hoplolaimina and Criconematina; Infraorders Tylenchata and Anguinata- their families and genera.
UNIT IV: Diagnosis of genera and families of Suborders Hoplolaimina and Criconematina.
UNIT V: Orders Aphelenchida, Dorylaimida, Enoplida, Rhabditida with emphasis on economically important taxa.

Practical

Identification of common plant parasitic nematodes belonging to Orders Tylenchida, Dorylaimida, Aphelenchida and Enoplida up to generic level; and up to species level for major nematode pests (root-knot, cyst nematodes etc.) of crops. Identification of EPNs belonging to Order Rhabditida.

Suggested Readings
NEMA 506  NEMATODE DISEASES OF CROPS

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

Credits: 3 +1
Max. Marks: 100
Assignment: 5
Mid Semester: 30
Practical exams: 15
End Term: 50

Theory

Diagnosis of causal organism, distribution, host range, biology and life cycle, nature of damage, symptoms, interaction with other organisms, and management of nematode diseases in different crops.

UNIT I: Cereal crops- Ear-cockle and tundu diseases of wheat, molya disease of wheat and barley; rice root nematode, rice root-knot and cyst nematode problems, ufra and white tip diseases of rice; lesion nematodes, cyst nematodes of maize and sorghum.

UNIT II: Pulses, Sugar, Fibre, Fodder and Oilseed crops- Pigeon pea cyst nematode, root knot nematode, reniform nematode, lesion, lance nematode, sugarbeet cyst and soybean cyst nematode problems.

UNIT III: Vegetable crops- root-knot disease, reniform nematode, potato cyst nematode; stem and bulb nematode. Nematode problems of protected cultivation.

UNIT IV: Fruit crops- root-knot disease, reniform nematode, slow decline of citrus. Mushroom- nematode problems.


Practical

Diagnosis of causal organisms; identification of different life cycle stages; study of symptoms and histopathology of nematode damage in different crops, study tours for field diagnosis of nematode problems.

Suggested Readings


NEMA 591  MASTER’S SEMINAR
Objective: To develop communicative skill and personality development and to obtain relevant field knowledge.

Credits : 1+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50
NEMA 509  NEMATODE INTERACTIONS WITH OTHER ORGANISMS
Objective:  To understand the role of nematodes in disease complexes involving fungal, bacterial, viral and other organisms.

Credits :  2+1
Max. Marks : 100
Assignment :  5
Mid Semester : 30
Practical exams :  15
End Term :  50

Theory
UNIT I:  Concept of interaction and its importance in disease complexes and their management involving nematode and other organisms.
UNIT II:  Interaction of plant parasitic nematodes with wilt causing fungal pathogens.
UNIT III:  Interaction of plant parasitic nematodes with root rot and other fungal pathogens.
UNIT IV:  Interaction of plant parasitic nematodes with bacterial pathogens, other nematode species and arthropods.
UNIT V:  Virus transmission by nematodes.

Practical
Green-house experiments to study the role of plant parasitic nematodes in wilt/rot causing fungal and bacterial pathogens.

Suggested Readings
NEMA 511  BENEFICIAL NEMATODES

Objective: To sensitize about the use of nematodes for the biological control of insect pests of crops, and application of some nematodes as biological models and as indicators of environmental pollution.

Credits : 1+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: Beneficial nematode fauna- predators, parasites of insects, molluscs and other pests; Entomophilic nematodes- important groups, types of nematode- insect associations; taxonomic characteristics of nematode parasites of insects.
UNIT II: Host-parasite relations and life cycle of mermithids, entaphelenchids, thelastomids, sphaerularids and tylenchids.
UNIT III: Entomopathogenic nematodes- Steinernema and Heterorhabditis, their morphological characteristics, taxonomic status, biology and mode of action.
UNIT IV: Entomopathogenic nematodes- mass multiplication techniques, formulations, field applications and efficacy, success stories.
UNIT V: Nematodes as biological models, nematodes as indicators of pollution, role of nematodes in organic matter recycling.

Practical
Isolation, identification, mass rearing and application methods of entomopathogenic nematodes.

Suggested Readings
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.

Credits : 1+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
End Term : 50

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

Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.


NCM 506 DISASTER MANAGEMENT

Objectives: 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.

Credits: 1+0
Max. Marks: 100
Assignment: 10
Mid Semester: 40
End Term: 50

Theory

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


SEMESTER – IV

NEMA 510  NEMATODE MANAGEMENT

Objective: To impart comprehensive knowledge about the principles and practices of nematode management.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I: Concepts and history of nematode management; crop loss estimation, ecological and socio-economic aspects, cost-benefit ratios and pest risk analysis.

UNIT II: Chemical methods- nematicides, their types, classification, mode of action, applicators and application methods, antidotes, and economizing nematicidal use.

UNIT III: Cultural practices- crop rotations and cropping sequences, fallowing, flooding, soil solarisation, time of sowing, organic amendments of soil, bio- fumigation, antagonistic and trap crops, sanitation etc. Physical methods- use of heat, hot water treatment and other methods of disinfestations of planting material.

UNIT IV: Biological methods- concepts and terminology, use of predators and parasites as biological control agents, their mass multiplication and field use; phytotherapeutic methods – use of antagonistic plants and antinemic plant products.

UNIT V: Genetic methods- plant resistance; legal methods- quarantine regulations; integrated nematode management- concepts and applications.

Practical

In vitro screening of synthetic chemicals and plant products for nematicidal activity, and their application methods; methods for screening of crop germplasm for resistance against nematodes, laboratory exercises on biocontrol potential of fungal, bacterial parasites, and predacious fungi and nematodes.

Suggested Readings

NEMA 599   MASTER’S RESEARCH

Objective:  To train the student to conduct research experiments and to prepare
dissertation/ thesis.

Credits       : 0+20
Max. Marks    : 100
End Term      : 100
DEPARTMENT OF PLANT PROTECTION
FACULTY OF AGRICULTURAL SCIENCES
A.M.U., ALIGARH

Ph. D. (Ag.) Nematology

NEMA 601     ADVANCES IN STRUCTURE AND SYSTEMATICS OF NEMATODES

Objective: Studies on the ultrastructure of plant parasitic nematodes based on TEM and SEM, and appraisal of recent developments in their classification.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory

UNIT I: Ultrastructure of nematode body wall- cuticle, hypodermis and muscles; nematode feeding apparatus, and other parts of alimentary canal.

UNIT II: Ultrastructure of nematode sense organs, reproductive and excretory-secretory systems.

UNIT III: Principles and rules of nomenclature and classification; preparation of illustrations, keys and compendia for nematode species and other taxa.

UNIT IV: Non-conventional approaches of nematode identification- molecular, biochemical, immunodiagnostic, molecular characterization and DNA finger-printing techniques.

UNIT V: Development of computer-based nematode identification programmes.

Practical

Detailed studies of morphological structures and identification of plant parasitic nematodes up to species level. Drawing and measurements of nematodes, preparation of compendia and keys. Identification of species/races of root-knot and cyst nematodes using PAGE.

Suggested Readings
Objective: To update knowledge on the recent research trends in the field of plant nematode relationships at genetic and molecular level.

Credits : 2+1
Max. Marks : 100
Assignment : 5
Mid Semester : 30
Practical exams : 15
End Term : 50

Theory
UNIT I: Mechanisms of pathogenesis, cytological and biochemical changes induced by nematode feeding.
UNIT II: Plant defense systems, role of phytoalexins etc. against major plant parasitic nematodes.
UNIT III: Genetic basis of plant resistance to nematodes and identification of resistance genes against economically important nematodes.
UNIT IV: Application of biotechnological methods in the development of nematode resistant crop cultivars; resistance markers; incorporation of resistance by conventional breeding and transgenic approaches.
UNIT V: Influence of microorganisms on plant nematode interactions.

Practical
Microscopy for study of histopathological changes induced by important nematodes, screening techniques for assessment of resistance in crop germplasm against nematodes.

Suggested Readings
NEMA 603  ADVANCES IN NEMATODE MANAGEMENT

Objective: To keep abreast with latest developments and trends in nematode management.

Credits  : 2+1
Max. Marks  : 100
Assignment  : 5
Mid Semester  : 30
Practical exams  : 15
End Term  : 50

Theory
UNIT I: Isolation, identification, host specificity, mode of action, culturing and field application potential of promising bio-control agents- predacious and parasitic fungi; nematotoxic fungal culture filtrates.

UNIT II: Isolation, identification, host specificity, mode of action, culturing and field application potential of promising bio-control agents- parasitic and nematode antagonistic bacteria; predacious mites and predacious nematodes.

UNIT III: Mass culturing, formulation, quality control, bio-safety and registration protocols of bio-control agents.

UNIT IV: Phytoalexins, allelochemicals, phytotherapeutic substances, novel nematicides, deployment of resistant varieties and non-host crops in nematode suppressive cropping systems, emergence of resistance breaking biotypes, recent regulatory provisions and methods, quarantine and disinfection.

UNIT V: Nematode management modules for integrated pest and disease management in cropping systems. Nematode management options and approaches for organic farming and precision farming. Application of GIS and GPS technology for surveillance and management.

Practical
Green-house experiments on the efficacy of fungal and bacterial bio-control agents, botanicals.

Suggested Readings


NEMA 604  PHYSIOLOGICAL AND MOLECULAR NEMATOLOGY

Objective: Appraisal on the application of modern biotechnological tools in Nematology.

Credits : 2+1  
Max. Marks : 100  
Assignment : 5  
Mid Semester : 30  
Practical exams : 15  
End Term : 50

Theory

UNIT I: Cell biology- Structural and functional aspects; genetics and evolution in plant parasitism in nematodes.

UNIT II: Caenorhabditis elegans- a model system for gerontology, cytogenetics, physiology, nutritional, toxicological and pharmacological studies; Heterodera glycines as a model for biology, proteomic and genomic studies.

UNIT III: Chemoreception, neurobiology, and biochemical basis of communication in nematodes, molecular basis of host recognition.

UNIT IV: Biochemical, genetical and molecular basis of plant nematode interaction; histopathological, cellular and molecular changes in host feeding cells, resistance genes and RNAi technology.

UNIT V: Biochemical and molecular basis of survival strategies in nematodes, molecular mechanism of host resistance against plant parasitic nematodes, molecular and novel approaches for nematode management.

Practical

Isolation and quantification of proteins from nematode juveniles and eggs; molecular weight determination of nematode protein; β-esterase polymorphism in root-knot nematode; nematode DNA isolation from juveniles and eggs; RFLP of nematode DNA; nematode DNA amplification using PCR for nematode identification, RNAi technology.

Suggested Readings


NEMA 605  PLANT BIOSECURITY AND BIOSAFETY

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

Credits : 2+0
Max. Marks : 100
Assignment : 10
Mid Semester : 40
Practical exams : 15
End Term : 50

Theory

UNIT I: History of biosecurity, concept of biosecurity, components of biosecurity, Quarantine, Invasive Alien Species, biowarfare, emerging/resurgence of pests and diseases.

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

UNIT III: Biosafety, policies and regulatory mechanism, Cartagena Protocol on Biosafety and its implications, issues related to release of genetically modified crops.

Suggested Readings


Biosecurity New Zealand. www.biosecurity.govt.nz

DEFRA. www.defra.gov.uk/animalh/diseases/control/biosecurity/index.htm


Revised Course Structure and Syllabi
(as per ICAR guideline)

Bridge Course for three year Graduates

Department of Plant Protection
Faculty of Agricultural Sciences
Aligarh Muslim University, Aligarh
Bridge Course for Non- Agriculture graduates pursuing
M.Sc. (Ag.) Entomology, M.Sc. (Ag.) Plant Pathology, M.Sc. (Ag.)
Agricultural Microbiology, and Master of Agri-Business Management

Total Credit hrs. 24; Duration : 2 Semesters (one year)

<table>
<thead>
<tr>
<th>Compulsory Courses (15 Credits)</th>
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<tbody>
<tr>
<td>APA-401  Elements of Crop Production</td>
<td>3 (2+1)</td>
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<tr>
<td>APH-401  Fundamentals of Horticulture</td>
<td>3 (2+1)</td>
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<tr>
<td>APP-401  Fundamentals Plant Pathology/Entomology</td>
<td>3 (2+1)</td>
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<tr>
<td>AG-421  Principles of Plant Breeding</td>
<td>3 (2+1)</td>
</tr>
<tr>
<td>APS-401  Fundamentals of Soil Science</td>
<td>3 (2+1)</td>
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| Sub Total | 15 |

<table>
<thead>
<tr>
<th>Optional Courses (9 Credits)</th>
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<tbody>
<tr>
<td>APS-468  Soil Testing &amp; Fertilizer Recommendation</td>
<td>3 (2+1)</td>
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<tr>
<td>AGP-411  Fundamentals of Genetics</td>
<td>3 (2+1)</td>
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<tr>
<td>APV-412  Vegetable Crops</td>
<td>3 (2+1)</td>
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<tr>
<td>APP-410  Diseases of Field Crops</td>
<td>3 (2+1)</td>
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<tr>
<td>APP-430  Diseases of Horticultural Crops</td>
<td>3 (2+1)</td>
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<tr>
<td>APE-430  Pests of Field Crops and Stored Grains</td>
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<td>APE-431  Pests of Horticultural Crops</td>
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<tr>
<td>AEC-435  Farm Management, Production and Resource Economics</td>
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<tr>
<td>AEC-412  Fundamentals of Agricultural Economics</td>
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<tr>
<td>BPP-401  Introductory Agro-meteorology &amp; Climate Change</td>
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</tr>
<tr>
<td>BPM-409  Elementary Mathematics</td>
<td>3 (2+1)</td>
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</tbody>
</table>

| Sub Total | 9 |

| Total Credits hrs | 24 |

- An advisor from each respective department shall allot the optional courses to the students.
Compulsory Courses (15 Credits)

APA-401 Crop Production Technology  Credit hours: 3(2+1)
Theory
Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & Jute; forage crops-sorghum, cowpea, cluster bean and napier. Rabi crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; other crops- potato. Forage crops-berseem, lucerne and oat.

Practical
Rice nursery preparation, transplanting of Rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops. Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

APH-401 Fundamentals of Horticulture  Credit hours: 3(2+1)
Theory
Horticulture-Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; kitchen gardening; garden types and parts; lawn making; medicinal and aromatic plants; species and condiments; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity.

Practical

APP-401. Fundamentals of Plant Pathology  Credit hours: 3(2+1)
Theory


Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.

Viruses: nature, architecture, multiplication and transmission.

Study of phanerogamic plant parasites.

Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina etc.)

Principles and methods of plant disease management.

Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical


Study of morphological features and identification of plant parasitic nematodes. Extraction of nematodes from soil.


APP-401. Fundamentals of Entomology

Credit hours: 4(3+1)

Part - I

Part-II

Part III

Part – IV
Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Sciaridae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical
Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

AG-421. Fundamentals of Plant Breeding Credit hours: 3(2+1)
Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer’s Rights.

Practical


APS-401. Fundamentals of Soil Science Credit hours: 3(2+1)

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination
Optional Courses (9 Credits)

APS-468. Manures, Fertilizers and Soil Fertility Management  Credit Hours: 3(2+1)
Theory


Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.


Practical


AGB-411. Fundamentals of Genetics  Credit hours: 3(2+1)
Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square. Dominance relationships, gene interaction.


Practical

Study of microscope. Study of cell structure. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross
and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structure.

APP-410. Diseases of Field Crops  
Credit hours: 3(2+1)

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose; Bajra: downy mildew and ergot; Groundnut: early and late leaf spots, wilt

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic; Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well-mounted specimens.

APP-430. Diseases of Horticultural Crops  
Credit hours: 3(2+1)

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic; Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical
Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well-mounted specimens.

APE-430. Pests of Field Crops and Stored Grains  
Credit hours: 3(2+1)

Theory

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, plantation crops, narcotics, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

AEC-412. Fundamentals of Agricultural Economics  
Credit hours: 3(2+1)

Theory


AEC-435. Farm Management, Production and Resource Economics Credit hours: 3(2+1)

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock’s enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

and budget, farm records and accounts and profit & loss accounts. Collection and analysis of
data on various resources in India.

**AGM-401. Introductory Agro-meteorology & Climate Change Credit hours: 3(2+1)**

**Theory**

Earth atmosphere- its composition, extent and structure; Atmospheric weather variables;
Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal
variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and
properties of solar radiation, solar constant, depletion of solar radiation, short wave,
longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature
inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of
temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor
pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation,
process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud
formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in
Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme
weather conditions such as heat-wave and cold-wave. Agriculture and weather relations;
Modifications of crop microclimate, climatic normals for crop and livestock production.

**Practical:**

Visit of Agrometeorological Observatory, site selection of observatory, exposure of
instruments and weather data recording. Measurement of total, shortwave and longwave
radiation, and its estimation using Planck’s intensity law. Measurement of albedo and
sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum
and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of
soil temperature and computation of soil heat flux. Determination of vapor pressure and
relative humidity. Determination of dew point temperature. Measurement of atmospheric
pressure and analysis of atmospheric conditions. Measurement of wind speed and wind
direction, preparation of windrose. Measurement, tabulation and analysis of rain.
Measurement of open pan evaporation and evapotranspiration. Computation of PET and
AET.

**BPM-409. Elementary Mathematics Credit hours: 3(2+1)**

**Theory**

Straight lines : Distance formula, section formula (internal and external division), Change of
axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes,
Slope-intercept form of equation of line, Slope-point form of equation of line, Two point
form of equation of line, Intercept form of equation of line, Normal form of equation of line,
General form of equation of line, Point of intersection of two st. lines, Angles between two st.
lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of
triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known,
General equation of a circle, Equation of circle passing through three given points, Equation
of circle whose diameters is line joining two points \((x_1, y_1) & (x_2, y_2)\), Tangent and Normal to
a given circle at given point (Simple problems), Condition of tangency of a line \(y = mx + c\) to
the given circle $x^2 + y^2 = a^2$. Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of $x^n$, $e^x$, $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).

Integral Calculus: Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

APE-431. Insect Pests of Fruit, Vegetable and Ornamental Crops Credit hours: 3(2+1)

Theory

Identification, distribution, host range, nature of damage, biology and management of insect pests of Tropical and Subtropical (mango, guava, citrus, litchi, banana, papaya, ber, grapevine, peach etc.) and Temperate (Apple, walnut, cherry etc.) fruit crops. Distribution, host range, nature of damage, biology and management of insect-pests of Winter (Brassica and Solanaceous), Summer (Cucurbits etc.) vegetables. Insect pests of important ornamental crops.

Practical

Collection, identification and preparation of life cycle of important insect pests of fruit, vegetable and ornamental crops.
Revised Course Structure and Syllabi
(as per ICAR-BSMA guideline)
w.e.f. 2018-19

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w.e.f. 2018-19

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w.e.f. 2017-18

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