



NANDINI NAGAR MAHAVIDYALAYA

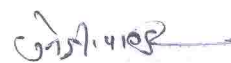
NAWABGANJ, GONDA, U.P. – 271303

SYLLABUS of M.Sc. (Ag.) ENTOMOLOGY

~ AFFILIATED TO ~

Dr. R.M.L. Avadh University, Faizabad

From Session – 2016-17

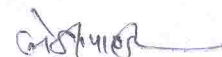


PRINCIPAL

**Nandini Nagar P.G. College
Nawabganj - Gonda**

CONTENT OF M.Sc. (Ag) ENTOMOLOGY SYLLABUS

Sr. No.	Particulars	Page No.
1.	Admission Rule	02
2.	Examination Rule	03-04
3.	Scheme of Examination	05-06
4.	Courses of Study for Part-I (Previous Year)	07-11
5.	Courses of Study for Part-II (Final Year)	12-17



PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

ADMISSION RULE

1. The course leading to the Master of Science in Agriculture (Entomology) degree shall extend over two academic years.
2. For eligibility to enter the Master of Science in Agriculture (Entomology) course a candidate must have passed the B.Sc. (Ag.) examination or B.Sc. (Bio-Group with Zoology & Botany Subject) or equivalent examination with 50% marks from any recognised university.
3. Not more than 60 candidates should be admitted provided they qualify as per university rules.

4. This course will be completed in two years, the details of the different papers studied are as follows -

(A) M.Sc. (Ag.) Entomology Part I (Previous Year)

Paper-I	Insect Morphology
Paper-II	Classification of Insects
Paper-III	Insect Physiology And Nutrition
Paper-IV	Toxicology of Insecticides
Paper-V	Essential Statistical Methods

(B) M.Sc. (Ag.) Entomology Part II (Final Year)

Paper-I	Insect Ecology
Paper-II	Pests of Field Crops
Paper-III	Nematode Diseases of Crops

Title of Special Paper

Paper-IV	Biological Control of Crop Pests and Weeds
----------	--

or

Pests of Horticultural and Plantation Crops

or

Recent Trends in Biological Control


or



Minor Thesis

or

Project

(2)


PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

EXAMINATION RULE

1. The examination for the degree shall consist of two parts.
 - (i) M.Sc. (Ag.) - Entomology Part - I
 - (ii) M.Sc. (Ag.) - Entomology Part - II
2. Candidate will take M.Sc. (Ag.) Part-I (Previous Year) examination at the first year of the course & M.Sc. (Ag.) Part-II (Final Year) at the end of second year of the course.
3. A candidate shall be eligible for appearing at the Part I examination for the M.Sc. (Ag.) - Entomology degree, if he/she has passed B.Sc. (Ag.) examination.
 - (a) Being selected on the basis of admission tests prevailing in the year when admission is sought in the college.
 - (b) There should be minimum of 75% attendance in the theory & practical classes separately.
4. A candidate who after passing M.Sc. (Ag.) - Entomology Part I exam has completed regular course of studies for one academic year and has put in a minimum of 75% attendance in theory & Practical separately shall be eligible for appearing in part II examination for the M.Sc. (Ag.) - Entomology.
5. There shall be annual examination at the end of each year and a candidate will have to pass separately in Part-I (Previous year) and Part-II (Final Year) examination. {separately in theory & practical}
6. Candidates who will not complete 75% attendance in theory and practical separately will not be allowed to appear at the final examination.
7. The result of examination shall be given separately in mark sheets for each year under two heads {Theory & Practical}
8. The degree will include the division on the basis of aggregate marks obtained in M.Sc. (Ag.) - Entomology part I & II all the part i.e.

(A) Theory	(B) Practical
------------	---------------

To pass in theory papers in each of part I & II examination the candidate must secure at least 36% marks


(3)

[Signature]

[Signature]

[Signature]

[Signature]


 PRINCIPAL
 Nandini Nagar P.G. College
 Nawabganj - Gonda

in theory and practical separately.

9. The candidates are permitted to write their answer in Hindi/English medium.
10. If a candidate is failing in a theory paper by getting less than pass marks, he will be declared successful by giving maximum 08% marks as grace.
11. In M.Sc. (Ag.) - Entomology Part I & II the candidates must obtain 36% marks in part A theory & practical separately shall be declared successful. The unsuccessful candidates shall be permitted to avail the facilities of re-examination in one theory paper under marks/division improvement.
12. A candidate must complete the course of study for the degree of Master of Science in Agriculture in Entomology and pass the final examination within a total period of four years commencing from his/her first admission in the M.Sc. (Ag.) - Entomology.
13. The division shall be assigned to the successful candidates on the following basis.
Third division - 36% and above but below 48% of the aggregate marks.
Second division - 48% and above but below 60% of the aggregate marks.
First division - 60% and above of the aggregate marks.
Distinction 75% or above.

A student securing 75% or above in any paper shall be declared to have obtained distinction in that provided he/she passed in all the papers in the first attempt and this fact shall be mentioned in the degree.

Distinction obtained in any theory papers shall be mentioned in the degree awarded to the candidates.

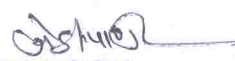
The marks of the part I and part II examination of theory & practical respectively M.Sc.(Ag.)-Entomology will count together for a place on the basis of pass list for determination of division.




[Handwritten signatures and initials]

[Handwritten signature]
PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

**SCHEME OF EXAMINATION
FOR
M.Sc. (Ag) Entomology Part-I (Previous Year)**





Part A Theory		Max. Marks	Min. Pass Marks
	Paper Name		
Paper-I	Insect Morphology	50	18
Paper-II	Classification of Insects	50	18
Paper-III	Insect Physiology And Nutrition	50	18
Paper-IV	Toxicology of Insecticides	50	18
Paper-V	Essential Statical Methods	50	18
Total		250	90
Part B Practical			
Combined Practical on Based on Theory Paper		250	90
Total		250	90
Grand Total		500	180


PRINCIPAL
 Nandini Nagar P.G. College
 Nawabganj - Gonda






**SCHEME OF EXAMINATION
FOR
M.Sc. (Ag) Entomology Part-II (Final Year)**

Part A Theory		Max. Marks	Min. Pass Marks
Paper Name			
Compulsory Paper			
Paper-I	Insect Ecology	50	18
Paper-II	Pests of Field Crops	50	18
Paper-III	Nematode Diseases of Crops	50	18
Special Paper			
Paper-IV	Biological Control of Crop Pests and Weeds	100	36
	or		
	Pests of Horticultural and Plantation Crops		
	or		
	Recent Trends in Biological Control		
	or		
	Minor Thesis		
	or		
	Project		
Total		250	90
Part B Practical			
(i) Combined Practical on Based on Compulsory Paper		150	54
(ii) Practical on Based on Special Paper		50	18
	or		
Viva-voc on Minor Thesis or Project			
(iii) Tour and Viva-voc		50	18
Total		250	90
Grand Total		500	180

(6)


 PRINCIPAL
 Nandini Nagar P.G. College
 Nawabganj - Gonda

SYLLABUS

M.Sc. (Ag.) Entomology
Part-I (Previous Year)


PRINCIPAL

Nandini Nagar P.G. College
Nawabganj - Gonda

M.Sc. (Ag.) Part-I (Previous Year) Entomology

Theory Paper-Ist - Insect Morphology

To acquaint the students with external morphology of the insect's body i.e., head, thorax and abdomen, their appendages and functions. To study the anatomy of different systems.

Principles, utility and relevance: insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation, Head- Origin, structure and modification; types of mouthparts and antennae, tentorium and neck sclerites, 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, Abdomen- Segmentation and appendages; Genitalia and their modifications; embryonic and post-embryonic development; Types of metamorphosis. Insect sense organs (mechano-, photo- and chemo- receptors), Structure of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands.

Theory Paper-IIInd - Classification of Insects

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.

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, Distinguishing characters, general biology, habits and abitats of Insect orders and economically important families contained in them. Collembola, Protura, Diplura. Class Insecta: Subclass Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera– Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea,

(8)

PRINCIPAL

Nandini Nagar P.G. College
Nawabganj - Gonda

Embioptera, Zoraptera), Subdivision: Hemipteroid orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera, 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, Neuropterand Coleoptera, Section Panorpid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

Theory Paper-IIIrd - Insect Physiology & Nutrition

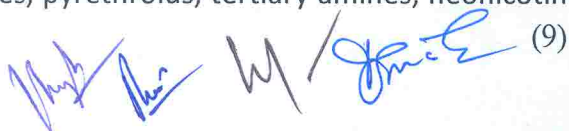
To impart knowledge to the students on the elementary physiology, nutritional physiology and their application in entomology.

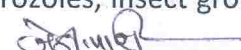
Scope and importance of insect physiology and nutrition, physiology of different systems- digestive, circulatory, respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands, thermodynamics; physiology of integument, moulting; growth, metamorphosis and diapauses, 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,

Theory Paper-IVth - Toxicology of Insecticides

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.

Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India, 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

 (9)


PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

regulators, microbials, botanicals, new promising compounds, etc., 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, Insecticide metabolism; pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence, 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.

Theory Paper-Vth - Essential Statical Methods

This course is meant for students who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.

Classification, tabulation and graphical representation of data. Box-plot, Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation, Discrete and continuous probability distributions: Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on Normal, chi-square, t and F distributions. Large sample theory, Introduction to theory of estimation and confidence - intervals. Correlation and regression. Simple and multiple linear regression model, estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients. Coefficient of determination, Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence. Median test, Kruskal- Wallis test, Friedman two-way ANOVA by ranks. Kendall's coefficient of concordance.



M.Sc. (Ag.) Part-I (Previous Year) Entomology Practical


1. Dissection of cockroach/ grass hopper to study comparative anatomical details of different systems. 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.
2. Study of Orders of insects and their identification using taxonomic keys. Keying out families of insects of different major Orders: Odonata, Orthoptera, Blattodea, Mantodea, Isoptera, Hemiptera, Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera. Field visits to collect insects of different orders.
3. 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.
4. 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.
5. Exploratory data analysis, Box-Cox plots; Fitting of distributions ~ Binomial, Poisson, Negative Binomial, Normal; Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F; Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution; Correlation and regression analysis, Nonparametric tests.

[Handwritten signatures]

[Handwritten signature]
PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

SYLLABUS

M.Sc. (Ag.) Entomology **Part-II (Final Year)**



PRINCIPAL

Nandini Nagar P.G. College
Nawabganj - Gonda

M.Sc. (Ag.) Part-II (Final Year) Entomology Paper-Ist

Insect Ecology

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.

History and Definition. Basic Concepts. Organisation of the Biological world. Plato's Natural Balance vs Ecological Dynamics as the modern view. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalised action on insects. Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis, Systems approach to ecology, Basic concepts of abundance- Model vs Real world. Population growth- basic models – Exponential vs Logistic models. Discrete vs Continuous growth models. Concepts of Carrying capacity, Environmental Resistance and Optimal yield. Vital Statistics- Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) - aestivation, hibernation, Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain-web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions - The argument of cost-benefit ratios. Competition- Lotka- Volterra model, Concept of niche- ecological homologues, competitive exclusion. Prey-predator interactions- Basic model- Lotka-Volterra Model, Volterra's principle. Functional and numerical response. Defense mechanisms against predators/parasitoids- Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies, Community ecology- Concept of guild, Organisation of communities- Hutchinson Ratio, May's d/w , 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,

[Handwritten signatures and dates]
 23/5/17
 (13)

[Signature]
PRINCIPAL
 Nandini Nagar P.G. College
 Nawabganj - Gonda

relevance to pest management. Pest management as applied ecology.

Theory Paper-IIInd - Pests of Field Crops

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.

Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors, 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.), Insect pests of pulses, tobacco, oilseeds and their management, Insect pests of fibre crops, forages, sugarcane and their management.

Theory Paper-IIIrd - Nematode Diseases of Crops

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

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. 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. Pulses, sugar, fibre, fodder and oilseed crops-pigeon pea cyst nematode, root knot nematode, reniform nematode, lesion, lance nematode, sugar beet cyst and soybean cyst nematode problems. Vegetable crops-root-knot disease, reniform nematode, potato cyst nematode; stem and bulb nematode. Nematode problems of protected cultivation. Fruit crops- roo-knot disease, reniform nematode, slow decline of citrus, mushroom-nematode problems. Plantation, medicinal and aromatic crops-burrowing nematode problem of banana, spices and condiments, root-knot and lesion

23/5/17 (14)

PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

nematode problems coffee and tea, red ring disease of coconut. Forest-pines wilt disease.

Theory Paper-IVth - Biological Control of Crop Pests and Weeds

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

History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control- importation, augmentation and conservation, 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, Mass production of quality biocontrol agents- techniques, formulations, economics, field release/ application and evaluation, 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.

or

Pests of Horticultural and Plantation Crops

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

Systematic position, identification, distribution, host range, bionomics and seasonal abundance, nature and extent of damage and management of insect pests of various crops, Fruit Crops- mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, ber, fig, citrus, aonla, pineapple, apple, peach

W 23/5/17 (15)

PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

and other temperate fruits, Vegetable crops- tomato, potato, radish, carrot, beetroot, cole crops, french beans, chow-chow, brinjal, okra, all gourds, gherkin, drumstick, leafy vegetables etc., Plantation crop- coffee, tea, rubber, coconut, arecanut, cashew, cocoa etc.; Spices and Condiments- pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, beetlevine etc., Ornamental, medicinal and aromatic plants and pests in polyhouses/ protected cultivation.

or

Recent Trends In Biological Control

To appraise the students with advanced techniques in handling of different bioagents, modern methods of biological control and scope in cropping system-based pest management in agro-ecosystems.

Scope of classical biological control and augmentative biocontrol; introduction and handling of natural enemies; nutrition of entomophagous insects and their hosts, dynamics of biocontrol agents *vis-à-vis* target pest populations, Mass culturing techniques, insectary facilities and equipments, basic standards of insectary, viable mass- production unit, designs, precautions, good insectary practices, Colonization, techniques of release of natural enemies, recovery evaluation, conservation and augmentation of natural enemies, survivorship analysis and ecological manipulations, large-scale production of biocontrol agents, bankable project preparation, Scope of genetically engineered microbes and parasitoids in biological control, genetics of ideal traits in biocontrol agents for introgressing and for progeny selections, breeding techniques of biocontrol agents.

[Handwritten signatures and date]
29/5/17

[Handwritten signature]
PRINCIPAL
Nandini Nagar P.G. College
Nawabganj - Gonda

M.Sc. (Ag.) Part-II (Final Year) Entomology

(A) Combined Practical



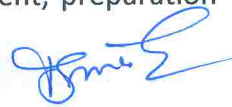
- 1- Types of distributions of organisms. Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters- Measures of central tendencies, Poisson Distribution, Negative Binomial Distribution. Determination of optimal sample size. Learning to fit basic population growth models and testing the goodness of fit. Fitting Holling's Disc equation, Assessment of prey-predator densities from natural systems and understanding the correlation between the two. Assessing and describing niche of some insects of a single guild. Calculation of niche breadth, activity breadth and diagrammatic 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.
2. 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.
3. Diagnosis of causal organisms; identification of different life cycle stages; study of symptoms and histopathology of nematode damage in different crops/ field diagnosis of nematode problems.


(B) 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.

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.

Mass rearing and release of some commonly occurring indigenous natural enemies; assessment of role of natural enemies in reducing pest populations; testing side effects of pesticides on natural enemies; effect of semiochemicals on natural enemies, breeding of various biocontrol agents, performance of efficiency analyses on target pests; project document, preparation for establishing a viable mass-production unit /insectary.

  (17) 


PRINCIPAL
 Nandini Nagar P G College
 Nawabganj - Gonda