

**विज्ञान संकाय**  
**लखनऊ विश्वविद्यालय लखनऊ**

दिनांक:-02.04.2022

**बैठक की कार्यवृत्ति**

राष्ट्रीय शिक्षा नीति-2020 के दृष्टिगत करते हुए M.Sc. Agriculture में तीन नये पाठ्यक्रमों

- 1- M.Sc. (Ag.) Entomology
- 2- M.Sc. (Ag.) Agricultural Economics
- 3- M.Sc. (Ag.) Genetics and Plant Breeding

के पाठ्यक्रमों के निर्धारण के सम्बन्ध में एग्रीकल्चर के अध्ययन मण्डल की बैठक का आयोजन आज दिनांक 02.04.2022 को अपराहन 03:00 बजे संकायाध्यक्ष, विज्ञान संकाय के विस्तार कक्ष में किया गया, जिसमें निम्नलिखित सदस्य उपस्थित हुए:

1. संकायाध्यक्ष, विज्ञान संकाय, ल0वि0वि0।
2. विभागाध्यक्ष, जैव-रसायन विज्ञान विभाग, ल0वि0वि0।
3. विभागाध्यक्ष, जन्तु विज्ञान विभाग, ल0वि0वि0।
4. विभागाध्यक्ष, वनस्पति विज्ञान विभाग, ल0वि0वि0।
5. विभागाध्यक्ष, रसायन विज्ञान विभाग, ल0वि0वि0।
6. विभागाध्यक्ष, भौतिक विज्ञान विभाग, ल0वि0वि0।
7. प्रो0 ए0 सी0 शुक्ल, कोऑर्डिनेटर (एग्री0), वनस्पति विज्ञान विभाग, ल0वि0वि0।

सर्वप्रथम संकायाध्यक्ष महोदय ने समस्त विभागाध्यक्षों का स्वागत किया, तत्पश्चात् बैठक की कार्यवाही प्रारम्भ की गयी।

निम्नलिखित नवगठित तीनों पाठ्यक्रमों पर विस्तृत रूप से विचार विमर्श के उपरान्त संदर्भित पाठ्यक्रमों को संस्तुति कर विज्ञान संकाय परिषद में चर्चा में लाये जाने हेतु अनुमोदन प्रदान किया गया। उक्त पाठ्यक्रम सत्र 2022-2023 से प्रभावी होगा।

- 1- M.Sc. (Ag.) Entomology (43 Pages)
- 2- M.Sc. (Ag.) Agricultural Economics (38 Pages)
- 3- M.Sc. (Ag.) Genetics and Plant Breeding (43 Pages)

धन्यवाद ज्ञापन के साथ बैठक सम्पन्न हुई।

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Sri M.D. Dabry, A Seba  
Faculty Board meeting  
2/4/22

DEAN  
FACULTY OF SCIENCE,  
LUCKNOW UNIVERSITY

02/04/2022

BOS Meeting held on 2.4.22

University of Lucknow  
M.Sc. (Ag.) ENTOMOLOGY  
Programme  
Regulations.....2022-23

(As Per Education Division  
Indian Council of Agricultural Research  
New Delhi, BSMA Committee on Plant Protection, April 2009)

**1. Applicability**

These Regulations shall apply to the M.Sc. (Ag.) Entomology programme from the session .....2022-23.....

**2. Minimum Eligibility for Admission**

- i) Bachelor's degree in respective/ related subjects.
- ii) 7.0/10 or equivalent OGPA/equivalent percentage of marks at Bachelor's degree.

**3. Objective**

- i. Attain a solid foundation in insect biology, including general entomology, basic systematics, morphology, physiology, and biodiversity.
- ii. Understand evolution and biodiversity generation through macro- and micro-evolutionary processes, including how these processes have formed and diversified insects.
- iii. Develop the ability to read and interpret scientific papers in entomology, and critically assess content.
- iv. Develop the ability to design and perform a scientific study on insects, and to analyze results.

**4. Program Outcome**

There is no dearth of jobs in agriculture sector for educated and trained professional who have not only done the degree course but also have gained real life exposure because of practical pedagogy. After completing the course, the students can look for work opportunities in the field of agro research, agro marketing, food management, soil management, Survey Entomology and Forest Entomology. They can choose to do Ph.D. in Agriculture Science after the course as well.

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(Pradeep Kumar Singh)

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(Dr. Satyendra K Singh)

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**M.Sc. (Ag.) ENTOMOLOGY**  
**NAME OF DEPARTMENT: ENTOMOLOGY**

Course No.	Course Title	Credit(s)		
		T	P	
<b>SEMESTER I</b>				
1	ENTMA-101	CLASSIFICATION OF INSECT	2	1
2	ENTMA-102	INSECT MORPHOLOGY	2	1
3	ENTNMA-103	INSECT ANATOMY, PHYSIOLOGY AND NUTRITION	2	
4	ENTMA-104	INSECT ECOLOGY	2	
5	ENTNSS-101	ESSENTIAL STATISTICAL METHODS	2	
6	ENTNC-101	LIBRARY AND INFORMATION SERVICES	-	
7	ENTNNC-102	BASIC CONCEPTS IN LABORATORY TECHNIQUES	-	
8	ENTRES-101	RESEARCH WORK	0	
			10	
		<b>Total Credit</b>		<b>17</b>
<b>SEMESTER II</b>				
1	ENTMA-201	BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS	2	1
2	ENTMA-202	TOXICOLOGY OF INSECTICIDES	2	1
3	ENTMI-201	PRINCIPALS OF PLANT PATHOLOGY	2	1
4	ENTMI-202	DISEASE OF FIELD AND MEDICINAL CROP	2	1
5	ENTNC-201	DISASTER MANAGEMENT	-	
6	ENTNC-202	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	-	
7	ENTRES- 201	RESEARCH WORK	0	
			8	
		<b>Total Credit</b>		<b>16</b>
<b>SEMESTER III</b>				
1	ENTMA-301	PESTS OF FIELD CROPS	2	
2	ENTSS-301	STORAGE ENTOMOLOGY	2	

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3	EENTSS-302	PRINCIPLES OF INTEGRATED PEST MANAGEMENT	2	1
4	ENTRES-301	MASTERS' SEMINAR	0	1
5	ENTNC- 301	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	-	-
6	ENTRES-301	M.SC.(AG.) RESEARCH	0	6
			6	10
		<b>Total Credit</b>		<b>16</b>
<b>SEMESTER IV</b>				
1	ENTNC-401	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	-	-
2	ENTRES-401	RESEARCH WORK, RESEARCH REPORT AND VIVA-VOCE	-	8
		<b>Total Credit</b>		<b>8</b>
<b>Grand Total Credits</b>				<b>57</b>

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## DEPARTMENT OF ENTOMOLOGY

### M.Sc.(Ag.) ENTOMOLOGY

#### Course Contents

#### ENTMA- 101 CLASSIFICATIONS OF INSECTS (2+1)

##### 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.

##### Program Outcome

After completing the course, the students will be able to identify the insects up to the level of families with hands-on experiences.

##### 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 II

Distinguishing characters, general biology, habits and habitats of Insects 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, Embioptera, Zoraptera), Subdivision:Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

##### UNIT:

Distinguishing characters, general biology, habits and habitats of Insects orders and economically important families contained in them. Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera, Subdivision:Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.

##### UNIT IV

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 Panorpid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.

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### Practical.

1. Study of Orders of insects and their identification using taxonomic keys.
2. Keying out families of insects of different major Orders: Odonata, Orthoptera, Blattodea, Mantodea, Isoptera, Hemiptera, Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera.
3. Field visits to collect insects of different orders.

### Text Books

- Richards OW & Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman & Hall, London.
- CSIRO 1990. The Insects of Australia: A Text Book for Students and Researchers. 2nd Ed. Vols. I & II, CSIRO. Cornell Univ. Press, Ithaca.
- Singh and Shaha (2020). Entomology ( Insect Morphology, Anatomy and Taxonomy), New Astha Publication, Lucknow U.P. ( ISBN No. 9788192294414 )

### Suggested Readings

- Freeman S & Herron JC. 1998. Evolutionary Analysis. Prentice Hall, New Delhi.
- Ross HH. 1974. Biological Systematics. Addison Wesley Publ. Co.
- Triplehorn CA & Johnson NF. 1998. Borror and DeLong's Introduction to the Study of Insects. 7th Ed. Thomson/ Brooks/ Cole, USA/Australia.

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## ENTMA-102 INSECT MORPHOLOGY

(2+1)

### Objective

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

### Program Outcome

After completing the course, the students will be able to know the morphology of the insect's body i.e., head, thorax and abdomen, their appendages and their functions.

### 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 (mechanoreceptors, photo and chemoreceptors).

### Practical.

1. Study of insect segmentation, various tagmata and their appendages.
2. Preparation of permanent mounts of different body parts and their appendages of taxonomic importance
3. Preparation of permanent mounts of male and female genitalia.
4. Study about Sense organs in Insects.
5. Identification of different types of Insect Antennae.
6. Modification of different type of legs and wings.

### Text Books

- Richards OW & Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman & Hall, London.
- Chapman RF. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
- Saxena RC & Srivastava RC 2007. Entomology: At a Glance. Agrotech Pub Acad Jodhpur
- Snodgrass RE. 1993. Principles of Insect Morphology. Cornell Univ. Press, Ithaca.
- Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.

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- Duntson P.A. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
- Singh and Shaha (2020). Entomology ( Insect Morphology, Anatomy and Taxonomy), New Astha Publication, Lucknow U.P. ( ISBN No. 9788192294414 )

**Suggested Readings**

- David BV & Ananthkrishnan TN. 2004. General and Applied Entomology. Tata-McGraw Hill, New Delhi.

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## ENTMA- 103 INSECT ANATOMY, PHYSIOLOGY AND NUTRITION (2+1)

### Objective

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

### Program Outcome

After completing the course, the students will be able to know the basic aspects of anatomy of different systems, elementary physiology, nutritional physiology and their application in entomology.

### 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 microorganisms and their role in physiology; artificial diets.

### Practical

1. Dissection of different insects to study comparative anatomical details of different systems.
2. Preparation of permanent mounts of internal systems.
3. Chromatographic analysis of free amino acids of haemolymph.
4. Determination of chitin in insect cuticle; examination of insect's haemocytes; determination of respiratory quotient.
5. Preparation and evaluation of various diets; consumption, utilization and digestion of natural and artificial diets.

### Text Books

- Richards OW & Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Vol. 1. Structure, Physiology and
- Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
- Saxena RC & Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy, Jodhpur.
- Kerkut GA & Gilbert LI. 1985. Comprehensive Insect Physiology, Biochemistry and Pharmacology. Vols. I-XIII. Pergamon Press, New York.
- Singh and Shaha (2020). Entomology ( Insect Morphology, Anatomy and Taxonomy), New Astha Publication, Lucknow U.P. ( ISBN No. 9788192294414 )

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**Suggested Readings**

- Chapman RF. 1998. Insects: Structure and Function. ELBS Ed., London.
- Patnaik BD. 2002. Physiology of Insects. Dominant, New Delhi.
- Development. Chapman & Hall, New York.

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## ENTMA- 104 INSECT ECOLOGY

(2+1)

### 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.

### Program Outcome

After completing the course, the students will be able to know the concepts of ecology, basic principles of distribution and abundance of organisms; including sampling methodology, calculation of diversity indices, constructing life tables, and their causes.

### Theory

#### UNIT I

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.

#### UNIT II

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.

#### UNIT III

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 nicheecological 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.

#### UNIT IV

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, relevance to pest management. Pest management as applied ecology.

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1. Types of distributions of organisms. Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters-
2. 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.
3. Fitting Holling's Disc equation.
4. Assessment of prey-predator densities from natural systems and understanding the correlation between the two.
5. Assessing and describing niche of some insects of a single guild.
6. Calculation of niche breadth, activity breadth and diagrammatic representation of niches of organisms.
7. Calculation of some diversity indices- Shannon's, Simpson's and Avalanche Index and understanding their associations and parameters that affect their values.
8. Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems.

#### Text Books

- Peter W Piece, Robert F. Denno, Micky D. Eubanks, Deborah L. Finke & Ian Kaplan Insect Ecology: Behavior, Populations and Communities Paperback – 18 August 2011
- Chapman JL & Reiss MJ. 2006. Ecology: Principles & Applications. 2nd Ed. Cambridge Univ. Press, Cambridge.
- Krebs CJ. 1998. Ecological Methodology. 2nd Ed. Benjamin-Cummings Publ. Co., New York.
- Magurran AE. 1988. Ecological Diversity and its Measurement. Princeton Univ. Press, Princeton.
- Abundance. 5th Ed. Benjamin-Cummings Publ. Co., New York.
- Speight MR, Hunta MD & Watt AD. 2006. Ecology of Insects: Concepts and Application. Elsevier Science Publ., The Netherlands.
- Singh and Shaha (2021). Entomology –II ( Insect Ecology and Integrated Pest Management ) New Astha Publication, Lucknow U.P. ( ISBN No- 9788192294403
- Satyendra K. Singh (2021). Manual of Applied Entomology, New Astha Publication, Lucknow, U.P.

#### Suggested Readings

- Gotelli NJ & Ellison AM. 2004. A Primer of Ecological Statistics. Sinauer Associates, Inc., Sunderland, MA.
- Gotelli NJ. 2001. A Primer of Ecology. 3rd Ed. Sinauer Associates, Inc., Sunderland, MA
- Gupta RK. 2004. Advances in Insect Biodiversity. Agrobios, Jodhpur.
- Krebs CJ. 2001. Ecology: The Experimental Analysis of Distribution and
- Price PW. 1997. Insect Ecology. 3rd Ed. John Wiley, New York.
- Real LA & Brown JH. (Eds). 1991. Foundations of Ecology: Classic Papers with Commentaries. University of Chicago Press, Chicago.
- Southwood TRE & Henderson PA. 2000. Ecological Methods. 3rd Ed.

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- Methuen & Co. Ltd., London.
- Wilson EO & William H Bossert WH. 1971. A Primer of Population Biology. Harvard University, USA.
- Wratten SD & Fry GLA. 1980. Field and Laboratory Exercises in Ecology. Arnold, London.

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## ENTNSS- 101 ESSENTIAL STATISTICAL METHODS (2+1)

### Theory

#### Objective

The subject of Agricultural Statistics revolves around crop statistics with crop area, reduction and yield as its main parameters. Since agriculture is a land based economic activity, the Land Use Statistics has a primacy in the agricultural statistics.

#### Program Outcome

After completing the course, the students will be able to know the concepts of Agricultural Statistics revolves around crop statistics with crop area, reduction and yield as its main parameters.

#### UNIT I

Descriptive statistics: probability distributions, binomial, probability distributions of functions of random variables. Classification and tabulation of data. Diagrammatic and Graphical representations of research results.

#### UNIT II

Sampling distributions of sample mean and sample variance from Normal population, aim, method. Normal distribution - marginal and conditional distributions.

#### UNIT III

Distribution of quadratic forms. Regression and correlation rank correlation, Regression analysis, partial and multiple correlation and regression, linear and nonlinear relationship. Mechanical errors. Principles of experimental design, precision and accuracy, advantage of replication, experimental technique. Analysis of variance, fundamental principles of analysis of variance. Critical difference, limitations of the analysis of variance.

#### UNIT IV

Statistical analysis and advantage and disadvantage of basic design-completely randomized design, randomized block design, Latin square design. Factorial concept: simple effects, main effects and interaction, factorial experiments (without confounding), Yates method. Confounding, principles of confounding in a  $2^3$  factorial experiments. Split plot design. Missing plot technique; Bartlett's techniques for missing plots, cross-overdesign or switch-over trials, Rotational experiments, progeny selection, compact family block design, uniformity trial, sire index, sampling in field experiments.

#### Practical:

1. To the study about CRD, RBD and LSD designs.
2. Data analysis on co relation and regression on experimental data.
3. Data presentation in bar and pie diagram.

#### Text Books

- Gupta C. B., An Introduction to Statistical Methods (English, Paperback), 23 Revised Edition.

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- Dr. SP Gupta. Statistical Methods Paperback – 1 January 2019, Sultan Chand and sons.
- A. Majumder, P.K. Sahu. Statistical Methods (English, Paperback) Edition 2018
- Chakrabarti MC. 1962. Mathematics of Design and Analysis of Experiments. Asia Publ House.

**Suggested Readings**

- Cochran WG & Cox DR. 1957. Experimental Designs. 2nd Ed. John Wiley.
- Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer.
- Dey A & Mukerjee R. 1999. Fractional Factorial Plans. John Wiley.

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## ENTNC-101 LIBRARY AND INFORMATION SERVICES

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### Objective

The main objective of this paper is to keep as much information as possible about the literature coming in the library.

### Program Outcome

After completing the course, the students will be able to know the literature available on various agricultural aspects as well as their information services.

### UNIT I

To equip the library users with skills to trace information from libraries efficiently.

### UNIT II

To apprise them of information and knowledge resources, to carry out literature survey.

### UNIT III

To formulate information search strategies.

**UNIT IV** To use modern tools (Internet, OPAC, search engines etc.) of information search.

### Practical

1. Introduction to library and its services
2. Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources.
3. Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.).
4. Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases.
5. Online Public Access Catalogue and other computerized library services.
6. Use of Internet including search engines and its resources; access methods.

### Text books

- Sharma C.K., Library & Information Science Critique and Definitional Questions, Publisher: Atlantic Publishers & Distributors Pvt Ltd, ISBN: 9788126908912, 9788126908912, Edition: 2007.

### Suggested Readings

- Bunge, Charles A. 1999. "Ethics and the Reference Librarian." The Reference Librarian, no. 66: 25-33.
- Connaway, Lynn S., and Marie L. Radford. 2011.
- Dublin, OH: OCLC Research. [www.oclc.org/en/reports/synchronicity.html](http://www.oclc.org/en/reports/synchronicity.html). Genz, Marcella D. 1998. "Working the Reference Desk." Library Trends 46, no. 3 (Winter): 505-525.
- Hernon, Peter, Ellen Altman, and Robert E. Dugan. 2015. Assessing Service Quality: Satisfying the

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- Expectations of Library Customers. 3rd ed. Chicago: American Library Association.
- Katz, William A. 2001. Introduction to Reference Work. 2 vols. New York: McGraw-Hill.
- Radford, Marie L. 1999. The Reference Encounter: Interpersonal Communication in the Academic Library . Chicago: Association of College and Research Libraries.

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## ENTNNC -102 BASIC CONCEPTS IN LABORATORY TECHNIQUES

(0+1)

### Objective

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

### Program Outcome

After completing the course, the students will be able to know the basics of commonly used techniques in laboratory.

### Theory

#### UNIT I

Safety measures while in Lab. Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; washing, drying and sterilization of glassware.

Drying of solvents/chemicals.

#### UNIT II

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.

#### UNIT III

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

#### UNIT IV

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.

### Practical

1. To the study about safety measures while in Lab.
2. Handling of chemical substances.
3. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccumets; washing, drying and sterilization of glassware.
4. Drying of solvents/chemicals.
5. 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, sand-bath, water-bath, oil-bath; Electric wiring and earthing. Preparation of media and methods of sterilization.
6. Study about Seed viability testing, testing of pollen viability.
7. Study about tissue culture of crop plants

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### Text Books

- S. Meena, S. Y. Rajesh 2015. PRINCIPLES OF LABORATORY TECHNIQUES AND METHODS (PB 2015) ISBN-10 : 8123926855, ISBN-13 : 978-8123926858
- Patra JK, Shukla AC and Das G. (2020). Advances in Pharmaceutical Biotechnology (Eds.), Springer Nature Publications [ISBN 978-981-15-2194-2], pp 478.
- Shukla, AC and Dikshi, A. (2016). Protocols in Medicinal and Aromatic Plants (Eds.), Today and Tomorrow's Printers and Publisher, New Delhi, IN [ISBN 81-7019-542-6 (IN); ISBN 1-55528-397-7 (USA)], pp 448.

### Suggested Readings

- Shukla, A.C. (2014). Advances in Medicinal and Aromatic Plants (Vol-1), (Eds.), Agrobios (India) Pub, Jodhpur [ISBN No. 978-81-7754-525-8], pp 244.
- Gabb MH & Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.
- Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.

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**ENTRES-101 RESEARCH WORK (0+2)**

The Masters in Agriculture course has 20 credits allotted for research work. In the first semester, the student will conduct trials related to his subject and collect data, this work will continue till the second year, will re-trial in the third semester and complete his thesis in the final year / iv semester. Examiners in thesis work will be appointed by Lucknow of University, Lucknow. The student's synopsis will be prepare by the student of the same subject/ minor subjects of the college and sent to the Dean Lucknow of University for final approval.

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## ENTMA-201 BIOLOGICAL CONTROL OF CROP PESTS AND WEEDS (2+1)

### 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.

### Program Outcome

After completing the course, the students will be able to know the theory and practices of biological control, mass production techniques and field evaluation of various biological control agents.

### 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

1. Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers.
2. 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
3. Identification of phytophagous natural enemies of weeds.
4. Field collection of parasitoids and predators.
5. Hands-on training in culturing, identification of common insect pathogens.
6. Quality control and registration standards for biocontrol agents.

### Text Books

- Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publ., New Delhi.
- Huffaker CB & Messenger PS. 1976. Theory and Practices of Biological Control. Academic Press, London.

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- Ignacimuthu SS & Jayaraj S. 2003. Biological Control of Insect Pests. Phoenix Publ., New Delhi.
- Saxena AB. 2003. Biological Control of Insect Pests. Anmol Publ., New Delhi.
- Shukla, AC and Dikshi, A. (2016). Protocols in Medicinal and Aromatic Plants (Eds.), Today and Tomorrow's Printers and Publisher, New Delhi, IN [ISBN 81-7019-542-6 (IN); ISBN 1-55528-397-7 (USA)], pp 448.
- Shukla, A.C. (2014). Advances in Medicinal and Aromatic Plants (Vol-1), (Eds.), Agrobios (India) Pub, Jodhpur [ISBN No. 978-81-7754-525-8], pp 244.
- Burges HD & Hussey NW. (Eds). 1971. Microbial Control of Insects and Mites. Academic Press, London.

**Suggested Readings**

- De Bach P. 1964. Biological Control of Insect Pests and Weeds. Chapman & Hall, New York.
- Gerson H & Smiley RL. 1990. Acarine Biocontrol Agents – An Illustrated Key and Manual. Chapman & Hall, New York.
- Van Driesche & Bellows TS, Jr. 1996. Biological Control. Chapman & Hall, New York.

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## ENTMA-202 TOXICOLOGY OF INSECTICIDES

(2+1)

### 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.

### Program Outcome

After completing the course, the students will be able to know the structure and mode of action of important insecticides belonging to different groups, development of resistance to insecticides by insects, and the related environmental pollution.

### 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 organochlorines, 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. 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

1. The study about Insecticide formulations and mixtures.
2. To the study quality control of pesticide formulations; laboratory and field evaluation of bioefficacy of insecticides.
3. Studied about bioassay techniques; probit analysis.
4. Evaluation of insecticide toxicity and joint action.
5. Toxicity to beneficial insects.
6. Pesticide appliances. Working out doses and concentrations of pesticides.
7. To the study about numerical based problem pesticide formulation
8. To Good laboratory practices.
9. Visit to toxicology laboratories.

### Text Books

- Gupta HCL.1999. Insecticides: Toxicology and Uses. Agrotech Publ., Udaipur.
- Ishaaya I & Degheele (Eds.). 1998. Insecticides with Novel Modes of Action. Narosa Publ. House, New Delhi.
- Matsumura F. 1985. Toxicology of Insecticides. Plenum Press, New York.

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- Perry AS, Yamamoto I, Ishaaya I & Perry R. 1998. Insecticides in Agriculture and Environment. Narosa Publ. House, New Delhi.
- Prakash A & Rao J. 1997. Botanical Pesticides in Agriculture. Lewis Publ., New York.

**Suggested Readings**

- Chattopadhyay SB. 1985. Principles and Procedures of Plant Protection. Oxford & IBH, New Delhi.

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## ENTMI-201 PRINCIPLES OF PLANT PATHOLOGY

(2+1)

### Objective

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

### Program Outcome

After completing the course, the students will be able to know various aspects of Plant Pathology, its concepts and principles as well as host pathogen interaction.

### 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.

Disease management strategies.

### Practical

1. Isolation of plant DNA
2. Preparation of culture media
3. Method of sterilizations.
4. Electrophoreses.
5. Identification of plant disease.
6. Visit of different biological labs and Institution.

### Text Books

- Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
- Singh DP & Singh A. 2007. Disease and Insect Resistance in Plants. Oxford & IBH Pub, New Delhi.

### Suggested Readings

- Heitefuss R & Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York.
- Mehrotra RS & Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.
- Singh RS. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.

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- Upadhyay RK & Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.

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## ENTMI-202 DISEASES OF FIELD AND MEDICINAL CROPS (2+1)

### Objective

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

### Program Outcome

After completing the course, the students will be able to know various aspects of disease development and control measures of field and medicinal crop diseases.

### Theory

#### UNIT I

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

#### UNIT II

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

Diseases of Cash crops- cotton, sugarcane.

#### UNIT III

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

#### UNIT IV

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

### Practical

1. Detailed study of symptoms and host parasite relationship of important diseases of above mentioned crops.
2. Collection and dry preservation of diseased specimens of important crops.
3. Numerical based problem of fungicide application.
4. Calibration of different equipments related to fungicide application.

### Text Books

- Joshi LM, Singh DV & Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi.
- Ricanel C, Egan BT, Gillaspie Jr AG & Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.
- Shukla AC, Facknath, S, Mandal D, and Montanari B. (2021). Medicinal and Aromatic Plants: Production, Processing and Pharmaceutics (4 vol) (Ed) AAP\_CRC Press, Taylor & Francis Gr
- Shukla, AC and Dikshi, A. (2016). Protocols in Medicinal and Aromatic Plants (Eds.), Today and Tomorrow's Printers and Publisher, New Delhi, IN [ISBN 81-7019-542-6 (IN); ISBN 1-55528-397-7 (USA)], pp 448.
- Shukla, A.C. (2014). Advances in Medicinal and Aromatic Plants (Vol-1), (Eds.), Agrobios (India) Pub, Jodhpur [ISBN No. 978-81-7754-525-8], pp 244.

### Suggested Readings

- Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed.. Prentice Hall of India, N Delhi.
- Singh RS. 1998. Plant Diseases. 7th Ed. Oxford & IBH, New Delhi.

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- Singh US, Mukhopadhyay AN, Kumar J & Chaube HS. 1992. Plant Diseases of International Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.

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## ENTNC-201 DISASTER MANAGEMENT

(1+0)

### 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.

### Program Outcome

After completing the course, the students will be able to know various concepts and practices of natural disaster management.

### Theory

#### UNIT I

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

#### UNIT II

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

#### UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements.

#### UNIT IV

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.

### Practical

1. Pollution case studies. Case Studies- Field work.
2. Visit to a local area to document environmental assets river/ forest/ grassland,.
3. Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural
4. Study of common plants and study of simple ecosystems-pond, river etc.

### Text Books

- Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management. Routledge. Sharma VK. 2001. Disaster Management. National Centre for Disaster Management, India.

### Suggested Readings

- Gupta HK. 2003. Disaster Management. Indian National Science Academy. Orient Blackswan.

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## ENTNC-202 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.

### Program Outcome

After completing the course, the students will be able to know about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government of India.

### 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.

#### UNIT IV

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.

### Practical

1. To the study about Global agricultural research system.
2. To the study about Regional Agricultural Research Institute.
3. Prepare reports Integrated Rural Development Programme (IRDP).
4. Visit agriculture research institute

### Text Books

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Pub.
- Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ

### Suggested Readings

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

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- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.

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**ENTRES-201 RESEARCH WORK (0+4)**

Research continued.

The student's will prepare the synopsis on the same subject/ minor subjects of the college, and will be sent to the concerned Dean/ Coordinator (Agriculture) at the University of Lucknow, for final approval.

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ENTMA-301

**PESTS OF FIELD CROPS**

(2+1)

**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.

**Program Outcome**

After completing the course, the students will be able to know about the nature of damage and seasonal incidence of insect pests that cause loss to major field crops and their effective management by different methods.

**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.

**UNIT II**

Non-insect pests -mites, birds, rodents, snails and slug and their management.

**UNIT III**

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

**UNIT IV**

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

**Practical**

1. Collection and identification of important pests and their natural enemies.
2. Detection and estimation of infestation and losses in different crops; numerical problem of insecticide formulation.
3. Study of life history of important insect pests.
4. Field Visit

**Text Books**

- Atwal AS, Dhaliwal GS & David BV. 2001. Elements of Economic Entomology. Popular Book Depot, Chennai.
- Dhaliwal GS, Singh R & Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi.
- Dunston AP. 2007. The Insects: Beneficial and Harmful Aspects. Kalyani Publ., New Delhi
- Evans JW. 2005. Insect Pests and their Control. Asiatic Publ., New Delhi.
- Saxena RC & Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy, Jodhpur.

**Suggested Readings**

- Nair MRGK. 1986. Insect and Mites of Crops in India. ICAR, New Delhi.
- Prakash I & Mathur RP. 1987. Management of Rodent Pests. ICAR, New Delhi.

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**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.

**Program Outcome**

After completing the course, the students will be able to know about the 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.

**Theory****UNIT I**

Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses *in toto visà-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.

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### Practical

1. Collection, identification and familiarization with the stored grains/seed insect pests and nature of damage caused by them.
2. Detection of insect infestation in stored food grains; estimation of losses in stored food grains.
3. 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
4. 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.

### Text Books

- Khader V. 2004. Textbook on Food Storage and Preservation. Kalyani Publ., New Delhi.
- Khare BP. 1994. Stored Grain Pests and Their Management. Kalyani Publ., New Delhi.

### Suggesting Readings

- Hall DW. 1970. Handling and Storage of Food Grains in Tropical and Subtropical Areas. FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome.
- Jayas DV, White NDG & Muir WE. 1995. Stored Grain Ecosystem. Marcel Dekker, New York.
- Subramanyam B & Hagstrum DW. 1995. Interrelated Management of Insects in Stored Products. Marcel Dekker, New York.

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## ENTSS -302 PRINCIPLES OF INTEGRATED PEST MANAGEMENT (2+1)

### Objective

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. 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.

### Program Outcome

After completing the course, the students will be able to know about the pest management and their integration- legislative, cultural, physical and mechanical methods as well as the IPM programmes.

### Theory

#### UNIT I

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.

#### UNIT IV

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

1. Characterization of agro-ecosystems
2. Sampling methods and factors affecting sampling; population estimation methods.
3. Crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses.
4. Computation of EIL and ETL
5. Study about crop modelling; designing and implementing IPM system.

### Text Books

- Dhaliwal GS & Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publ., New Delhi.
- Dhaliwal GS, Ram Singh & Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi.
- Ignacimuthu SS & Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.

### Suggested Readings

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- Flint MC & Bosch RV. 1981. Introduction to Integrated Pest Management. 1st Ed., Springer, New York.
- Horowitz AR & Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.
- Metcalf RL & Luckman WH. 1982. Introduction of Insect Pest Management. John Wiley & Sons, New York.
- Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.
- Norris RF, Caswell-Chen EP & Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.
- Subramanyam B & Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

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ENTRES-301

MASTERS SEMINAR

0+1

All P. G. agriculture students will prepare their seminar on any burning topic related to their subjects/ research work.

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## ENTNC-301 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE (0+1)

### 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.

### Program Outcome

After completing the course, the students will be able to know about the intellectual property rights (IPR) related protection systems, their significance and use of IPR.

### Theory

#### UNIT I

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;

Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks.

#### UNIT II

Protection of plant varieties and farmers' rights and biodiversity protection Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection;

#### UNIT III

National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture

#### UNIT IV

Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

### Practical

1. To the study about Indian Legislations for the protection of various types of IPR.
2. Study about Licensing of technologies.
3. Write the methods of Material transfer agreements

### Text Books

- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.

### Suggested Readings

- Erbisch FH & Maredia K. 1998. Intellectual Property Rights in Agricultural Biotechnology. CABL.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw H
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Tech

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- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

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ENTRES-301 M.Sc. (AG.) RESEARCH (0+6)

The students of Agriculture will analyse the data, and compile the results.

Ramya  
25-3/22

*CR*

Darshini  
25/3/22

## ENTNC-401 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).

### Program Outcome

After completing the course, the students will be able to know about the skills to write dissertations, research papers etc.

### Theory

#### UNIT I

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion)

#### UNIT II

Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

#### UNIT III

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:

#### UNIT IV

Participation in group discussion: Facing an interview; presentation of scientific papers.

### Practical –

1. Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.
2. Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion).
3. Methods 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
4. 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); To the study about 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.

*Ramg*  
25-3-22

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*[Signature]*

*Dasrigh*  
25/3/22

### Text Books

- Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.

### Suggested Readings

- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India, Collins' Cobuild English Dictionary. 1995. Harper Collins.
- Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
- James HS. 1994. Handbook for Technical Writing. NTC Business Books.
- Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
- Mohan K. 2005. Speaking English Effectively. MacMillan India. Richard WS. 1969. Technical Writing. Barnes & Noble.
- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
- Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
- Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.

Raniga  
25.3.22

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Raniga  
25/3/22

**ENTRES-401 RESEARCH WORK, RESEARCH REPORT AND VIVA-VOCE(0+8)**

In the fourth semester of Masters Agriculture programme, the student will complete his research work and write the thesis and submit it to the college. The college will send the thesis to the Controller of Examinations, University of Lucknow, Lucknow for evaluation.

Further, in the IV semester; there will be oral viva- voce of the students by the examiners.

*[Handwritten signatures and dates]*  
Rajendra  
25-35/22  
02/04/2022  
4-ky  
02/04/22  
ASV  
2/4/22  
25/3/22