Sh. L. N. Hindu College, Rohtak (Haryana)

Course Plan

Department of Botany

Program: B.Sc Medical

Botany - SEC

Bio-fertilizer&Pesticide

SCHEME

Course Name	**Biofertilizers and Biopesticides**	**Course Type**	**Theory**
Course Code	**24BOT401SE01**	**Class**	B.Sc,Medical (Botany) I Sem.
Instruction Delivery	**Per week Lectures: 2, Tutorial:1, Practical: -2** **Total No. Classes Per Sem: 48(L), 20(T), 28-(P)** **Assessment in Weightage: Sessional (20%), End Term Exams (80%)**		
Course Coordinator	**Ms. Swati**	**Course Instructors**	Theory: Ms. Swati Practical: Ms. Swati

COURSE OVERVIEW

This course on biofertilizers and biopesticides helps to understand the concepts of using living microorganisms and naturally derived substances to enhance plant growth and control pests, promoting sustainable agriculture by minimizing reliance on chemical inputs while maintaining crop yields and soil heath.

PREREQUISITE

Definition, scope, status, importance, advantages and limitations of biofrtilizers and biopesticides compared to chemical based fertilizers and pesticides. Define the types, structure and characterstic features of bacteia, cyanobacteria and fungi based biofertilizers and biopesticides. Production and applications of biofertilizers and biopestiides. Commercialization and future prospects of biofertilizers and biopesticides.

COURSE OBJECTIVE

To gain knowledge on eco-friendly fertilizers like *Rhizobium, Azospirilium, Azotobactor,* cyanobacteria and mycorrhizae, their identification, growth multiplication and practical application of organic farming and recycling of the organic waste. Knowledge of eco-friendly Biopesticides.

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COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO No.	Course Outcomes
1	Identify different microbes used as biofertilizers and biopesticides and also to understand the advantages and disadvantages of biofertilizers and biopesticides.
2	Acquire skills on isolation, culture of microbial agents, process of production and application of biofertilizers and biopesticides.
3	Evaluate the economic and environmental impacts of using biofertilizers and biopesticides.
4	Gain knowledge about the regulations on the production and use of biofertilizers and biopesticides.

COURSE CONTENT

Content
Unit 1 **Introduction to Biofertilizers :** Biofertilizers: Definition, scope, status, and importance; Advantages and limitations of biofertilizers compared to chemical fertilizers, Types of biofertilizers (e.g. nitrogen-fixing, phosphate-solubilizing, plant growth promoting), Structure and characteristic features of bacterial (*Azospirillum, Azotobacter, Rhizobium*), actinomycetes (*Frankia*), cyanobacterial (*Anabaena, Nostoc, Hapalosiphon*) and fungal (AM and ectomycorrhiza) biofertilizers. **Unit 2** **Production and applications of biofertilizers:** Production of biofertilizers: Strain selection, sterilization, growth, equipment, fermentation (solid state and liquid), mass production of carrier based and liquid bio fertilizers, Factors affecting the production of biofertilizers (i.e., temperature, pH, aeration, carbon source); quality control of biofertilizers, Application methods and dosage of biofertilizers, Effect of biofertilizers on soil fertility, plant growth, and yield. **Unit 3** **Commercialization and future prospects of biofertilizers:** Biofertilizers -storage, shelf life, quality control and marketing; regulatory framework and certification for biofertilizers, Application technology for seeds, seedlings, tubers, sets etc.; factors influencing the efficacy of bio fertilizers, Economic feasibility and cost-benefit analysis of using biofertilizers, Future prospects and potential of biofertilizers in sustainable agriculture and environmental protection.

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Unit 4

Biopesticides and applications: Biopesticides: Definition and classification; advantages and limitations of biopesticides compared to chemical pesticides. Modes of action and mechanisms of biopesticides, Characteristics and applications of microbial pesticides – bacteria, fungi and viruses, Characteristics and applications of botanical pesticides (plant extracts and essential oils) and biochemical (pheromones and repellents), Biocontrol agents (*Trichoderma* spp., *Pseudomonas* spp. and *Bacillus* spp) and their efficacy on seed borne and soil borne plant pathogens.

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LESSON PLAN (THEORY AND TUTORIAL CLASSES)

L. No	Topic to be Delivered	Tutorial Plan		Unit
1	Introduction of Biofertilizers	MCQ test on Definition, Advantages, Limitations and scope of biofertilizers biopesticides	Diagram test	1
2	Introduction of Biopesticides			
3	Types, structure and importnce of biofertilizers, biopesticides over chemicl based biofertilizer and biopesticides.			
4	Structure and characteristic features of bacterial, cyano-Bacteria and fungal based Biofertilizers			2
5	Production of biofertilizers	MCQ test of Production of biofertilizers	Diagram test	
6	Factors affecting the production of biofertilizers.			
7	Effect of biofertilizers			
8	Application methods and dosage of biofertilzers	MCQ test		
9	Biofertilizers control and marketing.	Diagram test on commercialization and future prospects of biofertilizers and bio – biopesticides		3&4
10	Economic feasibility and cost-benefits of using bio-fertilizers.			
11	Modes of action, characterstic, mechanisms of biopesticides.			
12	Characteristics and applications of biopesticides.			

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Course Plan

Text Book

Sabharwal A. Modern text book of Botany B. Sc. Part-I, Semester-I: Biofertilizers and Biopesticides.

Reference Books

References/Suggested readings:

1. Subba Rao, N.S. (1993) Biofertilizers in Agriculture and Forestry, Oxford and IBH. Publ. Co., New Delhi.

2. Das, A. C., & Mukherjee, A. K. (2019). Biofertilizers for sustainable agriculture: a review of principles, processes, and practices. Springer.

3. Sadasivam, S., & Manickam, A. (2018). Biofertilizers technology. Springer.

4. S. S. Gnanamanickam, (2011) Biopesticides: Pest Management and Regulation, CAB International, Wallingford, UK.

5. B.S. Bisht, J.S. Panwar, and V.P. Bhatt, (2016) Handbook of Microbial Biofertilizers, CRC Press, Boca Raton, FL.

6. Gupta, S., & Prasad, R. (2018). Microbial inoculants in sustainable agricultural productivity, Springer.

Web/Links for e-content

- https://www.youtube.com/watch?v=ExqbV5Ol1FU
- https://www.youtube.com/watch?v=aPWkuxt7UlI
- https://www.youtube.com/watch?v=xXdl8odt3og&t=211s
- https://www.youtube.com/watch?v=7RfGS4o-wS8

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Course Plan

PRACTICE QUESTIONS (QUESTION BANK)

S No	Problem
1	What is Biofertilizer?
2	What is ericoid mycorrhiza?
3	What is arbuscle?
4	Name one species of ectomycorrhizal fungus.
5	Is there any pathogenic relationship in mycorrhiza? Explain.
6	Name two species of higher plants where mycorrhizal associations are found.
7	Distinguish between ectomycorrhiza and endomycorrhiza.
8	What are pseudo mycorrhizae?
9	What are the characteristic features of orchidoid mycorrhizae?
10	Write the role of mycorrhizae in agriculture.
11	Write the role of mycorrhizae in forestry.
12	Write the role of mycorrhizae as phosphate solubilizers.
13	Write the role of ectomycorrhizae in soil fertility.
14	How can you utilize VAM in crop improvement?
15	How can you apply mycorrhizal inoculum in higher plants?
16	How can you prepare mass inoculum of VAM?
17	What are the basic criteria of field application of mycorrhizae?
18	What do you mean by bioinsecticides?
19	Write the advantages and dis advantages of bioinsecticides over synthetic pesticides.
20	What is LD50?
21	What do you mean by integrated Pest Management?
22	What do you mean by cross inoculation groups?
23	Describe the process of commercial manufacture of Azotobacter.
24	Describe how Rhizobium can be isolated form soil?
25	Write the role of PSM in crop production.

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List of Practical:

1. **Nutritional media and their preparations.**
2. **Enumeration of microbial population in soil- bacteria, BGA, fungi, actinomycetes.**
3. **Methods of isolation and purification of microbial cultures.**
4. **Isolation of Rhizobium from legume root nodule.**
5. **Isolation of BGA from rhizosphere.**
6. **Isolation of Mycorrhiza.**
7. **Culture of *Trichoderma* spp., *Pseudomonas* spp. and *Bacillus* spp.**
8. **Quality control tests for biofertilizers, Biopesticides and bioagents.**

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Course Plan

Department of Zoology

Program: B.Sc Medical

Apiculture

SCHEME

Course Name	**Apiculture**	**Course Type**	**Theory**
Course Code	**24ZOO401SE01**	**Class**	B.Sc, Medical (Zoology) Ist Sem.
Instruction Delivery	**Per week Lectures: 4, Tutorial:0, Practical: -2** **Total No. Classes Per Sem: 56(L), 28(T), 28-(P)** **Assessment in Weightage: Sessional (20%), End Term Exams (80%)**		
Course Coordinator	**Manisha Yadav**	**Course Instructors**	Theory: Manisha Yadav Practical: Manisha Yadav

COURSE OVERVIEW

Apiculture, also known as beekeeping, is the practice of raising and managing honeybee colonies and their hives. Apiculture has many benefits, including: Pollination: Bees play a key role in pollinating most fruit and forage crops. Products: Apiculture produces many valuable products, such as honey, wax, pollen, propolis, royal jelly, and venom. These products are used in various industries and in health care. Research: Apiculture provides an environment for scientists to study and understand bee behavior.

PREREQUISITE

Apiculture meaning, Identification; Status of Apiculture Industry in India Classification and Life Cycle of Honey Bee.
Social organization of honey bees.Bee foraging, Seasonal management, swarming in Honey bees, waggle dance, defense in honey bees
Role of Bees in cross pollination, Methods of Artificial Bee keeping, Equipments used in Bee keeping, Methods of extraction of Honey and other products. Products of Apiculture Industry and their Uses
Bee Keeping Industry, Prospects of apiculture as self employment venture.
Economics of Apiculture: Expenditure, Net Income, and Additional benefits

COURSE OBJECTIVE

The course is designed to develop an understanding of the basic bee biology as well as natural history and evolutionary reflationary of bees orders and family. Student can be conversant with scientific literature especially the literature related to Apiculture. This course provides the core knowledge of the potential impact of Apiculture in dialy life. The students can have a visual and hand on experience with biological research materials and methods of Apiculture. By fostering an in-depth

engagement with zoological sciences, it empowers students to contribute meaningfully to the exploration of bee biology.

COURSE OUTCOMES (COs)

After the completion of the course, the student will be able to:

CO No.	Course Outcomes
1	Students will be able to understand the significance of honey bees and Apiculture
2	Students will acquire knowledge about different species and castes of the honey bees
3	Students will learn to manage beehives for honey production and pollination, and Learn various product of honey bees and value addition in these products,
4	Students will be aware about economic importance of honey bees, and use of Apiculture for employment, self employment and conservation of nature
5	Students will gain practical knowledge about various methods of bee keeping and extraction of honey thus create scope for entrepreneurship.

COURSE CONTENT

Content
Unit 1: Apiculture meaning, definition scope and history Status of Apiculture Industry in India Classification and Life Cycle of Honey Bee. Identification of Indigenous and exotic Honey bee species **Unit 2:** Cultivable species of Honey Bee with reference to India Social organization of honey bees: the castes- queen, drone and workers, Nesting behavior of Honey bees, Bee foraging, Seasonal management, swarming in Honey bees, waggle dance, defense in honey bees Diseases and Enemies. of Bees ,Control and Preventive measures. **Unit 3:** Role of Bees in cross pollination in horticulture and agriculture Equipments used in Bee keeping Industry Methods of extraction of Honey and other products

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Unit 4:

Products of Apiculture Industry and their Uses (Honey, Bee Wax, Royal Jelly, Bee Venom, Propolis and Pollen)

Bee Keeping Industry: Present and future

Prospects of apiculture as self employment venture.

Economics of Apiculture: Expenditure, Net Income, and Additional benefits

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LESSON PLAN (THEORY AND TUTORIAL CLASSES)

L. No	Topic to be Delivered	Tutorial Plan		Unit
1	Introduction to Apiculture	MCQ test on Apiculture And life cycle of honey bee	Diagram test on life cycle	1
2	Classification and Life Cycle of Honey Bee.			
3	Identification of Indigenous and exotic Honey bee species			
4	Social organization of honey bees: the castes- queen, drone and workers			2
5	Nesting behavior of Honey bees	MCQ test of Social organisation and bee behaviour	Diagram test	
6	Bee foraging, Seasonal management, swarming in Honey bees, waggle dance			
7	Defense in honey bees;Diseases and Enemies. of Bees ,Control and Preventive measures.			
8	Role of Bees in cross pollination in horticulture and agriculture	MCQ test on Methods of Artificial Bee keeping & extraction of Honey and other products		3
9	Methods of Artificial Bee keeping Equipments used in Bee keeping Industry			
10	Methods of extraction of Honey and other products			
11	Products of Apiculture Industry and their Uses			4
12	Bee Keeping Industry: Present and future Prospects of apiculture as self employment venture.			
13	Economics of Apiculture: Expenditure, Net Income, and Additional benefits			

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Course Plan

Text Book

Honey Bees and their Management by Withhead S B, Agrobios

Reference Books

References:

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.

2. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.

3. Singh S. (1964). Beekeeping in India, Indian council of Agricultural Research, NewDelhi

4. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. I. Apiculture in relation to agriculture.

6. The Social Behaviour of the Bees, 1974 : By Missioner C.D

Web/Links for e-content

- https://www.youtube.com/watch?v=xVl3frJRdc4&t=338s
- https://www.youtube.com/watch?v=IZnu_afKKfs
- https://www.youtube.com/watch?v=UJiH34fD5zA
- https://www.youtube.com/watch?v=YVTUALhasps

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PRACTICE QUESTIONS (QUESTION BANK)

S No	Problem
1	Give an account of various products of apiculture industry mentioning their utility in human life.
2	What are the materials that can be used to induce smoking in bee hive?
3	What are the different types of beekeeping equipment and their uses?
4	What are the different methods of honey extraction, both indigenous and modern?
5	What are the different types of bee diseases and their causative agents?
6	What criteria is used to select bee species for apiculture?
7	What is the social organization of a bee colony?
8	What are the different stages of a honey bee's life cycle, and what is the role of the worker bee?
9	What are the symptoms of bee poisoning?
10	How can beekeeping help enhance crop yield through pollination?
11	Why is beeswax easy to shape and carve?
12	What is duty of queen bee?
13	Brief introduction to Apiculture
14	Describe Honey, its composition & Uses
15	Explain honeybee wax, its composition & Uses
16	Write down about Propolis, its composition & Uses
17	Write short note on Pollen, its composition & Uses
18	Write a short note on social organization of bee colony.
19	Give an account of different types of bee diseases mentioning their causative agents.
20	Write a short note on “Selection of Bee species for Apiculture”.
21	Describe different types of indigenous and modern methods of extraction of honey.
22	Give an account of various types of bee-keeping equipments and their uses in apiculture.
23	Describe the different stages of life cycle of a honey bee mentioning the role of worker bee.
24	Give the brief description of Bee Pasturage.
25	Draw a labelled diagram of a Langstroth beehive and describe different steps of artificial bee rearing in it.

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