

<b>INSTITUTE</b>	<b>FACULTY OF AGRICULTURE</b>
<b>PROGRAM</b>	<b>BACHELOR OF SCIENCE (Hons.) AGRICULTURE</b>
<b>SEMESTER</b>	<b>6</b>
<b>COURSE TITLE</b>	<b>BIO-PESTICIDES AND BIO-FERTILIZERS</b>
<b>COURSE CODE</b>	<b>16AS0610</b>
<b>COURSE CREDITS</b>	<b>2</b>

**Objective:**

- 1 To exploit the microbial diversity in various agro-ecologies for bio-fertilizer and bio-pesticides application in diversified systems.
- 2 To improve bio-fertilizer and bio-pesticides technology to ensure high quality and improved delivery.
- 3 To study the impact of soil management practices on microbial functions and soil health.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Student will study the history, concept, quality control and application of biopesticides and bio-fertilizers, their importance, scope and potential.
- 2 Student will develop ability to differentiate the structure and characteristic features of various bacterial bio-fertilizers.
- 3 Student will interpret storage, shelf life, quality control and marketing and factors influencing the efficacy of bio-pesticides & bio-fertilizers.
- 4 Student will be able to evaluate mechanism of Production technology of bio-pesticides and bio-fertilizers.

**Pre-requisite of course:**Basics regarding biofertilizers.

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
1	0	2	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>1</b> History and concept of biopesticides	1
2	<b>2</b> Importance, scope and potential of biopesticide	1
3	<b>3</b> Definitions, concepts and classification of biopesticides viz., pathogen, botanical pesticides, and biorationals	1
4	<b>4</b> Mass production technology of bio-pesticides	1

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
5	<b>5</b> Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes	1
6	<b>6</b> Methods of application of biopesticides	1
7	<b>7</b> Methods of quality control and techniques of biopesticides	1
8	<b>8</b> Impediments and limitation in production and use of biopesticide	1
9	<b>9</b> Biofertilizers: Introduction, status and scope	1
10	<b>10</b> Structure and characteristic features of bacterial biofertilizers: Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial biofertilizers: Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers: AM mycorrhiza and ectomycorrhiza	1
11	<b>11</b> Nitrogen fixation: Free living and symbiotic nitrogen fixation	1
12	<b>12</b> Mechanism of phosphate solubilization and phosphate mobilization, K solubilization	1
13	<b>13</b> Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers	1
14	<b>14</b> FCO specifications and quality control of biofertilizers	1
15	<b>15</b> Application technology for seeds, seedlings, tubers, sets etc.	1
16	<b>16</b> Biofertilizers: Storage, shelf life, quality control and marketing	1
17	<b>17</b> Factors influencing the efficacy of biofertilizers	1
<b>Total Hours</b>		<b>17</b>

#### **Suggested List of Experiments:**

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>1</b> Isolation and purification of important biopesticides: Trichoderma, pseudomonas, Bacillus, Metarhizium etc. and its production	2
2	<b>2</b> Identification of important botanicals	2

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
3	<b>3</b> Visit to biopesticide laboratory in nearby area	2
4	<b>4</b> Field visit to explore naturally infected cadavers	2
5	<b>5</b> Identification of entomopathogenic entities in field condition	2
6	<b>6</b> Quality control of biopesticides	2
7	<b>7</b> Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria	2
8	<b>8</b> Mass multiplication and inoculums production of biofertilizers	2
9	<b>9</b> Isolation of AM fungi: wet sieving method and sucrose gradient method	2
10	<b>10</b> Mass production of AM inoculants	2
<b>Total Hours</b>		<b>20</b>

### Textbook :

- 1 NA, NA, NA, NA

### References:

- 1 Biopesticides and Pest Management, Biopesticides and Pest Management, Dhaliwal, G. S. and Koul, O., Kalyani Publishers, 2007
- 2 Recent Developments in Biocontrol of Plant Diseases, Recent Developments in Biocontrol of Plant Diseases, Mukerji, K. G., Tewari, J. P., Arora, D. K. and Saxena, G., Aditya Books, New Delhi, 1992
- 3 Biological Control of Microbial Plant Pathogens, Biological Control of Microbial Plant Pathogens, Campbell, R., Cambridge Univ. Press, Cambridge, 1989
- 4 The Nature and Practice of Biological Control of Plant Pathogens, The Nature and Practice of Biological Control of Plant Pathogens, Cook, R. J. and Baker, K. F., APS, St Paul, Minnesota, 1983

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

<b>Remember / Knowledge</b>	<b>Understand</b>	<b>Apply</b>	<b>Analyze</b>	<b>Evaluate</b>	<b>Higher order Thinking</b>
25.00	25.00	30.00	10.00	5.00	5.00

**Instructional Method:**

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board may also use any of tools such as demonstration, role play, quiz, brain storming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.