# Biotechnology in Agriculture Course No. 18308 Credit: 1.0

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| **Student name:** |  | **Graduation Date:** |  |

Pathways and CIP Codes:Biotechnology in Agriculture (26.1201); Comprehensive Agricultural Science (01.9999); Biochemistry (14.1401)

Course Description: **Technical Level:** Agricultural Biotechnology courses apply biological principles and understanding to plant and animal science in order to produce or refine agricultural products. Course topics typically include but are not limited to microbiology, genetics, growth and reproduction, structural basis of function in living systems, chemistry of living systems, quantitative problem-solving, and data acquisition and display. These courses also often cover the ethics of biotechnology.

Directions:The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.

**RATING SCALE:**

4. Exemplary Achievement: Student possesses outstanding knowledge, skills or professional attitude.

3. Proficient Achievement:Student demonstrates good knowledge, skills or professional attitude. Requires limited supervision.

2. Limited Achievement:Student demonstrates fragmented knowledge, skills or professional attitude. Requires close supervision.

1. Inadequate Achievement:Student lacks knowledge, skills or professional attitude.

0. No Instruction/Training:Student has not received instruction or training in this area.

## Benchmark 1.1: Biotechnology in Agriculture

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.1.1 | Define biotechnology and explore the historical impact it has had on agriculture. |  |
| 1.1.2 | Investigate current applications of biotechnology in agriculture. |  |
| 1.1.3 | Examine potential future applications of biotechnology in agriculture and compare them with alternative approaches to improving agriculture. |  |

## Benchmark 1.2: Regulatory Issues & Agencies

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.2.1 | Describe the role of agencies that regulate biotechnology. |  |

## Benchmark 1.3: Ethical, Legal, Social & Cultural Issues

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.3.1 | Explore ethical, legal and social biotechnology related issues. |  |
| 1.3.2 | Explore the emergence, evolution and implications of bioethics. |  |
| 1.3.3 | Explain the meaning of intellectual properties as related to biotechnology. |  |

## Benchmark 2.1: Biotechnology Laboratory Records

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.1.1 | Maintain a biotechnology laboratory notebook. |  |

## Benchmark 2.2: Operate Laboratory Equipment

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.2.1 | Operate basic laboratory equipment and measurement devices. |  |

## Benchmark 2.3: Procedure Using Biological Materials

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.3.1 | Demonstrate basic aseptic techniques in the biotechnology laboratory. |  |
| 2.3.2 | Perform procedures with biological materials according to directions. |  |

## Benchmark 2.4: Safely Manage Biological Materials

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 2.4.1 | Prepare simple chemical solutions using standard operating procedures. |  |
| 2.4.2 | Identify and describe hazards associated with biological and chemical materials. |  |
| 2.4.3 | Maintain a safe environment by properly identifying and disposing of laboratory waste. |  |

## Benchmark 2.5: Perform a Variety of Procedures

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 2.5.1 | Differentiate the types of organisms and demonstrate how to handle them safely. |  |
| 2.5.2 | Explain the structures of DNA and RNA and how genotype influences phenotype. |  |
| 2.5.3 | Extract and purify DNA and RNA. |  |
| 2.5.4 | Perform simple enzyme activity assays to detect proteins. |  |
| 2.5.5 | Describe how antibodies are formed and how they can be used in biotechnology applications. |  |
| 2.5.6 | Explain reasons for detecting microbes and identify sources of microbes. |  |

## Benchmark 3.1: Genetic Engineering Improve Products

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 3.1.1 | Explain biological, social, agronomic and economic reasons for genetic modification of eukaryotes. |  |
| 3.1.2 | Describe enzymes, the changes they cause in foods and the physical and chemical parameters that affect enzymatic reactions. |  |
| 3.1.3 | Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes. |  |
| 3.1.4 | Describe the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of aquatic species. |  |

## Benchmark 3.2: Perform Biotechnology Processes

### Competencies

| **#** | **Description** | **rating** |
| --- | --- | --- |
| 3.2.1 | Explain the functions of hormones in animals. |  |
| 3.2.2 | Identify foods produced through fermentation. |  |
| 3.2.3 | Explain the process of transesterification. |  |
| 3.2.4 | Explain the process of methanogenesis. |  |

## Benchmark 3.3: Monitor & Evaluate Procedures

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 3.3.1 | Describe the selective plant breeding process. |  |
| 3.3.2 | Describe biotechnology processes applicable to animal health. |  |
| 3.3.3 | Give examples of instances in which bioremediation can be applied to clean up environmental contaminates. |  |
| 3.3.4 | Explain the use of microorganisms in biological waste management. |  |
| 3.3.5 | Explain the role of microorganisms in industrial chemical waste treatment. |  |
| 3.3.6 | Explain the global importance of biodiversity. |  |
| 3.3.7 | Explain the consequences of agricultural practices on wild populations. |  |
| 3.3.8 | Explain biomass and sources of biomass. |  |
| 3.3.9 | Define industrial biotechnology, and describe the benefits and risks associated with its use in the manufacturing of fabrics, plastics and other products. |  |

I certify that the student has received training in the areas indicated.

Instructor Signature:

For more information, contact:

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