# Bioengineering Course No. 21020 Credit: 1.0

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

Pathways and CIP Codes:Biochemistry (14.1401); Biomedical (14.0501)

Course Description: **Application Level:** Bioengineering is a rigorous activity, project, and problem-based course in which students investigate and design solutions to solve real-world challenges related to world food security, renewable energy, and clean drinking water. Students completing Bioengineering will develop an understanding of the scientific and technological foundations for each of the problems. Students apply their knowledge and skills as they use an engineering design process to design and test solutions that help solve these global challenges.

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: Understands Biotechnology Engineering procedures

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.1 | Summarize the components of effective communication. |  |
| 1.2 | List the forms of documentation needed for effective communication. |  |
| 1.3 | Outline the steps necessary to keep one’s self safe in a laboratory setting. |  |
| 1.4 | Relates what could happen to experiment results if measurement is performed or recorded incorrectly. |  |
| 1.5 | Describe the difference between accuracy and precision and the role each plays in the design process. |  |
| 1.6 | Explains how both accuracy and precision play a vital role in the design process. |  |

## Benchmark 2: Investigate the history of Biotechnical Engineering

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.1 | Outline the evolution of biotechnical engineering. |  |
| 2.2 | Illustrate and assess the major biotechnical engineering milestones using a wide variety of internet resources. |  |
| 2.3 | Identify the fundamental concepts common to all major industries in biotechnical engineering. |  |
| 2.4 | Identify and explain how biotechnical engineered products impact society. |  |
| 2.5 | Predict future developments in biotechnical engineering. |  |
| 2.6 | Investigate the relationship between financial markets and scientific research. |  |

## Benchmark 3: Values & Ethics in Bioengineering

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 3.1 | Distinguish between values and morals. |  |
| 3.2 | Identify some of the parameters that shape an individual’s ethics. |  |
| 3.3 | Discuss and explain why it is important to consider the bioethical issues of technological advancements.. |  |
| 3.4 | Outline the steps that might be used in determining the societal and environmental ramifications of biotechnology research. |  |
| 3.5 | Explain why it is important to keep an open mind to different perspectives in biotechnical research. |  |

## Benchmark 4: Understanding principles of Bioinformatics

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 4.1 | Summarize the molecular techniques that are used by bio informaticists. |  |
| 4.2 | Create a portfolio demonstrating the research and integration of forensics with engineering. |  |
| 4.3 | Analyze the technology utilized in the field of forensics. |  |
| 4.4 | Apply knowledge of genetic engineering to the design of a novel and beneficial application of the reporter gene, green fluorescent protein. |  |
| 4.5 | Describe how to isolate protein. |  |
| 4.6 | Demonstrate the application of engineering principles by improving upon existing hospital designs or surgical procedures. |  |
| 4.7 | Explain the concepts of product liability, product reliability, product reusability and product failure. |  |

## Benchmark 5: Applying principles of Fermentation

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 5.1 | Describe the applications of fermentation in food production and renewable energy. |  |
| 5.2 | Design a method of instrumentation to be used for measuring rates of fermentation. |  |
| 5.3 | Explain what variables affect CO2 production in yeast in order to determine the ideal conditions for fermentation. |  |

## Benchmark 6: Understanding Biomedical Engineering

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 6.1 | Demonstrate the application of engineering principles by improving upon existing hospital designs or surgical equipment designs. |  |
| 6.2 | Explain the concepts of product liability, product reliability, product reusability and product failure. |  |
| 6.3 | Identify anatomical joint features and movements. |  |
| 6.4 | Design a joint model with the same degrees of freedom as the human counterpart. |  |
| 6.5 | Synthesize skeletal system concepts with the design processor engineering joints. |  |
| 6.6 | Summarize the most common forms of heart disease and disorders. |  |
| 6.7 | Explain procedures involving artificial heart surgery. |  |
| 6.8 | Estimate the cost of a proposed noninvasive implant. |  |
| 6.9 | Design a portable ECG monitor and study the electrical aspects associated with the heart. |  |

## Benchmark 7: Understanding Cardiovascular Devices and Imaging

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 7.1 | Summarize the most common forms of heart disease and disorders. |  |
| 7.2 | Explain procedures involving artificial heart surgery. |  |
| 7.3 | Estimate the cost of a proposed noninvasive implant. |  |
| 7.4 | Design a portable ECG monitor and study the electrical aspects associated with the heart. |  |

## Benchmark 8: Understanding Orthopedics in Bioengineering

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 8.1 | Identify anatomical joint features and movements. |  |
| 8.2 | Design a joint model with the same degrees of freedom as the human counterpart.  |  |
| 8.3 | Synthesize skeletal system concepts with the design process for engineering joints. |  |

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

Instructor Signature:

For more information, contact:

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