Course Title
Biotechnical Engineering (BE)

Course Description: The major focus of the Biotechnical Engineering (BE) course is to expose students to the diverse fields of biotechnology including biomedical engineering, bio-molecular genetics, bioprocess engineering, and agricultural and environmental engineering. Lessons engage students in engineering design problems that can be accomplished in a high school setting related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bio-ethics.

Desired Results (Stage 1)

Established Competencies

Students will be able to…

1. **Develop a portfolio to organize and display evidence of their work.**
2. **Utilize an engineering notebook to show proper documentation of entire design process of a variety of course projects.**
3. **Apply the steps of the design process to solve biotechnology engineering problems.**
4. **Demonstrate an understanding of laboratory procedures for ensuring accuracy and precision in collecting data.**
5. **Practice laboratory protocols to ensure safety during course.**
6. **Identify and explain how biotechnical engineered products impact society.**
7. **Demonstrate the ability to generate three-dimensional computer models.**
8. **Analyze technology used in the field of biotechnical engineering.**

Acquisition

Students will know…

- What biotechnical engineering and biotechnical engineers contribute to society.
- That there are many connections between biology, engineering, and current events and the 'real world'.

Students will be skilled at…

- *Critical Thinking*
- *Problem Solving*

Evidence (Stage 2)	
Evaluative Criteria	**Assessment Evidence**
Rubrics Test/Quizzes	*Summative assessments include tests, quizzes and biology and engineering problems to solve in the different strands of biotechnology..* *-Laboratory activities, projects, and reports*

Course Title
Biotechnical Engineering (BE)
Unit 1: Safety and Documentation

Course Description: The major focus of the Biotechnical Engineering (BE) course is to expose students to the diverse fields of biotechnology including biomedical engineering, bio-molecular genetics, bioprocess engineering, and agricultural and environmental engineering. Lessons engage students in engineering design problems that can be accomplished in a high school setting related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bio-ethics.

Desired Results (Stage 1)

Established Competencies

Students will be able to…

1. **Develop a portfolio to organize and display evidence of their work.**
2. **Utilize an engineering notebook to show proper documentation of entire design process of a variety of course projects.**
4. **Demonstrate an understanding of laboratory procedures for ensuring accuracy and precision in collecting data.**
5. **Practice laboratory protocols to ensure safety during course.**

Acquisition

Students will know...

- Why laboratory safety is so important.
- Laboratory safety procedures.
- The difference between accuracy and precision.
- How accuracy and precision play a vital role in a design process.
- What components and why they are necessary for effective communication.

Students will be skilled at...

- Documenting course work in an engineering notebook.
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Evidence (Stage 2)	
Evaluative Criteria	**Assessment Evidence**
Rubrics Test/Quizzes	*Summative assessments include tests, quizzes and biology and engineering problems to solve in the different strands of biotechnology..* *-Laboratory activities, projects, and reports*

Biotechnical Engineering – Competency #1: **Develop a portfolio to organize and display evidence of their work.**				
Skill Assessed	1-Novice	2-Developing	3-Effective	4 - Advanced
Portfolio, **Overall Aesthetics,** **Quality of Work,** **Organization**	Poor Evidence. Pages missing, out of order. No organization	Fair Evidence. Seldom prepares documentation in a manner appropriate for display or college/job evaluation.	Good Evidence. Usually prepares documentation in a manner appropriate for display or college/job evaluation.	Excellent Evidence. Always prepares documentation in a manner appropriate for display or college/job evaluation.

Biotechnical Engineering – Competency #2: **Utilize an engineering notebook to show proper documentation of entire design process of a variety of course projects.**				
Skill Assessed	1-Novice	2-Developing	3-Effective	4 - Advanced
Engineering Notebook: Journal entries	Journal entries are confusing, incomplete, or reflect poor sentence structure. Entries are not dated and many details necessary for creating initial sketches are missing.	Journal entries are well-written but are missing details. Information is not recorded in a logical order and is not enough to create initial sketches. The creation of initial sketches cannot be validated.	Journal entries are well-written but are missing details. All journal entry dates have information recorded. Information is recorded in a logical order and is enough to create initial sketches.	Journal entries are well-written in complete sentences and are dated. All entries are complete. Entries have the information structured in a usable format. Information for the design of the project is well- documented and validates creation of initial sketches.
Engineering Notebook: Project notebook entries	Project notebook entries are confusing, incomplete, and do not use proper notation. Entries are not dated and many details necessary for using the notebook effectively are missing.	Project notebook entries are written but are missing details or lacking proper notation. Information is not recorded in a logical order and is not enough to create initial sketches. Pictures, symbols, or diagrams are used but are irrelevant to the project.	Project notebook entries are well-written but are missing 1 or 2 details. Information is recorded in a logical order and is enough to create initial sketches. Pictures, symbols, or diagrams are used and are incomplete.	Project notebook entries are well-written in complete sentences and are dated. All entries are complete with appropriate sketches, pictures, symbols, and diagrams. Entries have the information structured in a usable format. Notes are provided that explain why a strategy or process was used.

Biotechnical Engineering – Competency #7: Demonstrate the ability to generate three-dimensional computer models.				
Skill Assessed	1-Novice	2-Developing	3-Effective	4 - Advanced
3D Modeling	Models are not complete, are not related to initial drawings.	Models are presented but are not accurate in sizes and are not proportional to the structure.	Models are well-presented but 2 or 3 key aspects are inaccurate or missing.	Models of drawings are accurate and show clearly accurate sizes and proportion of the structure.
Dimensions and Annotation	Poor Skills. Has not added dims or annotations, leaving only software determined defaults	Fair Skills. Omits many dims and/or annotations. Some mislabeling	Good Skills. Supplies most dims and annotations. Locates most of them correctly	Excellent Skills. Dimensions and annotates properly and clearly

Biotechnical Engineering Budget Considerations (Yearly Consumables)

Product/Equipment	Quantity	Price
Bioremediation by oil eating bacteria, enough for 10 groups	1	$79.00
Green Fluorescent Protein (GFP) Chromatography Kit	1	$101.00
pGlo Bacterial Transformation Kit	2	$178.00
Where's the Victim? Blood Spatter Analysis Kit Carolina Biological #21-2100	1	$49.95
Disposable serological pipette, polystyrene, negative and reverse graduations, 10ml capacity, VWR #53300-523 consumable	1 – Case of 200	$63.00
Disposable serological pipette, polystyrene, negative and reverse graduation, 5ml capacity, VWR #32314-008 consumable	1 – Case of 200	$32.00
Glove Exam Latex PF Medium TIL024102	1 Box	$9.26
Glove Exam PF Small TIL024101	1 Box	$4.35
1 lb. sucrose (granulated table sugar)	1	$1.66
Yeast (3 brands)	10	$15.60
1 Gallon bleach	1	$1.52
Bottle of corn syrup	1	$1.50
1 Gallon deionized water	1	$1.28
Coffee filters	10	$11.60
	Total	***$529.72***