



Philadelphia University

Faculty of Engineering - Department of Renewable Energy
Engineering
First semester 2025/2026

Course Information

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| Title: | Bio-Energy Systems (611541) |
| Prerequisite: | Introduction to renewable energy (611341) |
| Credit Hours: | 3 credit hours (2 contact hours per week + 1-hour equivalent asynchronous online learning, 15 weeks per semester) |
| Textbook: | Bioenergy Systems for the Future, Francesco Dalena, Angelo Basile and Claudio Rossi 2017 |
| Catalog Description: | This course explores the fundamental principles and technologies of bioenergy systems, emphasizing the use of biomass as a sustainable energy source. Topics include biomass types and properties, conversion processes such as thermochemical (combustion, gasification, and pyrolysis) and biochemical (anaerobic digestion and fermentation) methods, as well as gas recovery techniques for transforming organic materials into useful fuels. The course also addresses bioenergy's role within renewable energy systems, its environmental impacts, and its contribution to sustainable development and energy security. |
| Website: | All course materials, including lecture slides, recorded videos and assignments, will be available on the course page through the university's E-Learning Portal (Moodle). |
| Instructor: | Dr. Zaid Al Atari Email: zalatari@philadelphia.edu.jo Office: Engineering building, Room 726. Lecture hours: Sun & Tue: 12:40 – 13:30 Office hours: Sun & Tue: 11:00 – 12:30 & 13:30 – 15:00 |

Course Topics

| Week | Topic |
|-------|--------------------------------------------------|
| 1 | Introduction to bioenergy |
| 2,3,4 | Biogas technology |
| 5,6 | Utilization of biogas |
| 7 | Solid biomass - feedstock, technology, operation |
| 8,9 | Introduction to Biomass energy |
| 10 | Biomass to energy technology |
| 11 | Solid biomass technology |
| 12 | Environmental impacts of Bioenergy |
| 13 | Bioenergy in Jordan |
| 14 | Project's presentation |
| 15 | Review |

Course Learning Outcomes and Relation to ABET Student Outcomes:

Upon successful completion of this course, a student should:

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|----|-----------------------------------------------------|--------|
| 1. | Understand biomass energy | [a, h] |
| 2. | Deals with Bioenergy systems | [a, h] |
| 3. | Use organic materials (Plants etc..) | [c, h] |
| 4. | Be able to transfer of solid material to gas, | [c, h] |
| 5. | Illustrates how Burning and digestion of wet wastes | [e, h] |
| 6. | Biomass as a source of renewable energy | [a, c] |

Assessment Instruments:

Evaluation of students' performance (final grade) will be based on the following categories:

Exams: Two written exams will be given. Each will cover about 7-weeks of lectures

Project There will be one or two short group projects throughout the term. For each project, the group will complete one of the challenge problems found within the lecture notes or will do a simple research paper. The group should then print a copy of the project cover page found on the course webpage, follows the instructions, and hand the project to the instructor. Students should work in groups of two students and turn in one assignment for the whole group.

Final Exam: The final exam will cover all the class material.

Grading policy:

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|---------------|------|
| Mid Exam | 30% |
| Semester Work | 30% |
| Final Exam | 40% |
| Total: | 100% |

Attendance policy:

Absence from classes and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse, acceptable to and approved by the Dean of the relevant college/faculty, shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.

October 2025