Philadelphia University

Faculty of Engineering - Department of Renewable Energy Engineering

First Semester 2025/2026

Course Information

Title:	Hydroelectric and wave energy (611543)
Prerequisite:	Fluid mechanics (620320) + Introduction to renewable energy (611341)
Credit Hours:	3 credit hours (16 weeks per semester, approximately 45 contact hours)
Textbook:	• Hydroelectric Energy by Bikash Pandey and Ajoy Karki, 2017
References:	• Hydropower Engineering Handbook, editors in chief; John S. Gulliver and Roger E. A. Arndet
Catalog Description:	The course aims at providing an understand to the behavior of hydraulic infrastructures that are used for hydroelectric energy production. Basics and Hydropower history are first introduced. The hydrology cycle with processes and mechanisms will then be explained. Hydropower drivers and deterrents are clarified. The main, structural, and auxiliary parts will be explained. The course will also cover the topic of turbines; their classification, applications and operating theory. Turbine design will be illustrated covering procedure and a worked example. Wave energy; worldwide potential, types of wave plants, obstacles to wave power commercialization will also be covered by the course.
Website:	https://www.philadelphia.edu.jo/academics/zalmuala/

Instructor: Dr. Zaid Al Muala

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Office: Engineering building, room 6714, ext:2450.

Office hours: Sat, Mon: 09:00-09:45 & 11:00-12:40

Sun, Tues: 09:30 – 11:00 & 12:40-13:40

Course Topics

Week	Topic
1	Background
2	The hydrologic cycle
3	Basics and potential of wave power.
4, 5	Types of wave power plants
6	Obstacles to wave energy.
7, 8	Hydro power plants classifications
9, 10	Main, structural, and auxiliary components of hydropower plants
11, 12, 13	Hydro turbines; types, applications, and principle of operation.
14, 15	Design principles of hydro turbines
16	Review, and final exam

Course Learning Outcomes and Relation to ABET Student Outcomes: Upon successful completion of this course, a student should:

1.	Able to describe the hydrological cycle and how water flows between the different reservoirs on earth.	[K1, K2]
2.	Describe the water flow through a power station and calculate the theoretical energy produced by the plant	[K2, S4]
3.	Understand the main, structural, and auxiliary parts of hydroelectric power plants, and illustrates functions of hydro power components.	[K1, K2]
4.	Perform theoretical calculations on some hydropower components; surge champers and spillway discharge and stilling basins	[S4, C2]
5.	Discuss the different types of hydro turbines and their area of applications and be able to go through their design procedure.	[K1, C4]
6.	Understand the basics of wave energy and the different devices used to convert this energy to electrical power and calculate its potential.	[K1, K2]

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 3-weeks of lectures
Quizzes:	10-minute quizzes will be given to the students during the semester. These quizzes will cover material discussed during the previous lecture(s).
Homework:	Problem sets will be given to students. Homework should be solved individually and submitted before the due date.
	Copying homework is forbidden, any student caught copying the homework or any part of the homework will receive zero mark for that homework
Participation:	Questions will be asked during lecture and the student is assessed based on his/her response
Final Exam:	The final exam will cover all the class material.

Grading policy:

Mid Exam	30%
Homeworks	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