

# Renewable Energy

1. **Course number and name:** 020ERNES6 Renewable Energy
2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week
3. **Name(s) of instructor(s) or course coordinator(s):** Bassam Riachi
4. **Instructional Materials:** PowerPoint slides

Textbooks/References:

- Renewable and efficient electric power systems, G. M. Masters, 20040.
- Principles of energy conversion, Archie W. Culp. Jr.,19790.
- Powerplant Technology, M. M. El-Wakil, 1984.

## 5. Specific course information:

### a. Catalog description:

This course offers a comprehensive exploration of the latest advancements in renewable energy technologies and their diverse applications. It aims to foster an understanding among students about the potentials and unique characteristics of renewable energies, particularly in the area of electricity generation. The course addresses key questions such as the nature of these energy resources, methods for their capture and transformation, and the various forms in which they can be utilized.

Throughout the program, participants will explore specific topics, including the Principles of Solar Radiation (covering the solar spectrum, impact of geometry, and atmospheric attenuation), Solar Thermal and Solar Electric Photovoltaics (PV) with a focus on applications, PV System Components, Design, Selection & Sizing, as well as the Basics of Solar Energy System Engineering Economics. The curriculum also explores the origin and power of wind, historical perspectives on wind turbines, Wind Energy System Components, Turbine Design & Control, Electrical Aspects of Wind Turbines, and the essentials of Wind Energy System Selection & Sizing, along with Wind Energy System Engineering Economics Basics. This comprehensive examination equips participants with the knowledge and skills needed to navigate the complex landscape of renewable energies.

**b. Prerequisite:** None.

**c. Required** for EE program.

## 6. Educational objectives for the course

### a. Specific outcomes of instruction:

By the end of the course, the students will:

- Acquire an understanding of the latest advancements in renewable energy technologies, covering both solar and wind energy systems.
- Be able to apply theoretical knowledge to real-world scenarios through hands-on experience in designing, selecting, and sizing solar and wind energy systems.
- Understand the economic aspects of renewable energy projects, including engineering economics principles and develop skills to assess the economic viability of such projects.

**b. PIs addressed by the course.**

PI	1.1	1.2	1.3	2.1	2.2	4.2	7.1	7.2
Covered	X	X	X	X	X	X	X	X
Assessed	X	X	X	X	X			

**7. Brief list of topics to be covered and approximate number of lectures:**

- Course introduction, (**2 Lectures**)
- **Wind Energy:** Origin and power of wind, historical perspectives on wind turbines, Wind Energy System Components, Turbine Design & Control, Electrical Aspects of Wind Turbines, and the essentials of Wind Energy System Selection & Sizing, along with Wind Energy System Engineering Economics Basics. (**8 Lectures**)
- **Solar Energy:** Principles of Solar Radiation (covering the solar spectrum, impact of geometry, and atmospheric attenuation), Solar Electric Photovoltaics (PV) with a focus on applications, PV System Components, Design, Selection & Sizing, as well as the Basics of Solar Energy System Engineering Economics. (**10 Lectures**)
- **Thermal Solar Systems:** Development of solar thermal energy uses. Different technologies of solar thermal panels for domestic hot water production: Unglazed collectors, flat plate collectors, evacuated tube collector. Operating conditions and design. Efficiency and performance, (**2 Lectures**)
- **Energy Storage:** Existing technologies; Principle of operation, performance and efficiencies of: Fuel cells, super capacitors, compressed air, flywheels, chemical batteries, hydraulic storage. (**2 Lectures**)