# **MECH 403**: Energy Engineering

WALTER SCOTT, JR. COLLEGE OF ENGINEERING
COLORADO STATE UNIVERSITY

**Instructor:**
Mohammad Abutayeh
E-mail: abutayeh@colostate.edu
Web: https://www.engr.colostate.edu/me/

**Description:**
The course provides introductory coverage of energy production, conversion, distribution and storage systems for different sources of energy including fossil fuel; nuclear power; biomass energy; geothermal energy; hydropower; wind energy, and solar energy. Emphasis is placed on the sustainable use of energy in light of economic, environmental, and societal constraints.

**Prerequisite:**
CBE 310 or ECE 341 or MECH 237 or MECH 337 or PH 361.

**Textbook:**
None.

**Disability Accommodation:**
Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 requires Colorado State University to provide academic adjustments or accommodations for students with documented disabilities. Students seeking academic adjustment or accommodations must self-identify with the Office of Resources for Disabled Students (ORDS). After meeting with ORDS staff, and based on their recommendations, students are encouraged to meet with their instructors to discuss their needs, and if applicable, any lab safety concerns related to their disabilities.

**Resources:**
The CSU Writing Center is an excellent resource to support the development of your writing skills throughout your college career. While students are not required to access services, you are strongly encouraged to seek consultation on your writing projects required for this course. In addition to contact information, there are useful resources available on their website. The Morgan Library reference librarians can direct you to books and articles for the research paper and the oral presentation.

**Professional Honesty:**
This course adheres to the Academic Integrity Policy of the Colorado State University General Catalog and the Student Conduct Code. Honors students enrolled in this course are held to high standards of integrity. Academic integrity is expected within all assignments for this course. Students will be required to make an honor pledge to complete this course. The honors pledge will be completed as a class. It is expected that students will use their own knowledge and skill for assignments unless directed to do otherwise. Incidents of cheating, plagiarism or knowingly providing false or incorrect information are considered serious and will be treated seriously. Consequences of these incidents are at the discretion of the faculty member involved and may consist of confiscation of assignments, an F-grade, or reporting to the CSU Student Conduct office. It is expected that students will demonstrate concern for others, respect the confidentiality of information about, the property of and the decisions made by others.

**Assessment:**

Course learning outcomes are assessed using the following rubric:

| | |
|---|---|
| Homework | 0% |
| Project | 50% |
| Exam I (Topics 1 – 5: Introduction – Solar Radiation) | 25% |
| Exam II (Topics 1 – 13: Comprehensive) | 25% |

**Learning Outcomes:**

- Ability to apply knowledge of mathematics, science, and engineering to solving basic problems related to the production, conversion and distribution of energy.
- Ability to design basic energy systems to meet economic, environmental, and societal constraints.
- Ability to demonstrate knowledge of contemporary issues related to the sustainable use of energy.

**Project:**

Design a parabolic trough collector based concentrating solar power plant using the physical model of the System Advisor Model (SAM). SAM can be downloaded for free from the US National Renewable Energy Lab (NREL) web site. The plant should have a 50 MWe net generation capacity and is located in Fort Collins, CO. Use the commercial financing option and keep the default financial inputs.

**Topics:**

| Week | Topic | Homework |
|---|---|---|
| 1 | Introduction | |
| 2 | Power Generation | Homework Set 1 |
| 3 | | |
| 4 | Fossil Fuels | Homework Set 2 |
| 5 | | |
| 6 | Solar Energy | Homework Set 3 |
| 7 | Solar Radiation | |
| 8 | Concentrating Solar | Homework Set 4 |
| 9 | Solar Photovoltaics | |
| 10 | Nuclear Energy | Homework Set 5 |
| 11 | Geothermal Energy | |
| 12 | Hydroelectric energy | Homework Set 6 |
| 13 | Wind Energy | |
| 14 | Biomass Energy | Project Report and Presentation |
| 15 | Electrochemical Energy | |