

MECH 470: Energy Conversion Systems

(3 credits)

Lectures: Tues, Thurs 11:00–12:30; Ponderosa Annex E, Room 127

Instructor: Prof. W. K. Bushe
CEME 2069
Phone: 604-822-3398
e-mail: wkb@mech.ubc.ca

Grading:

Quizzes:	20%
Project Report:	20%
Presentation:	10%
Final:	50%

Course Synopsis

This course is intended for Mechanical Engineering students interested in the energy conversion chain. We will begin by examining the current state of that chain, considering different broad applications and how the needs are currently being met. After a brief review of the underlying laws of thermodynamics, including the thermodynamics of reacting systems and brief coverage of turbulent reacting systems, we will talk about electrical power generation using thermal power plants. This will necessarily include talking about the Rankine cycle steam power and the Brayton cycle gas turbine power plants and the various permutations and modifications to these. We will then consider energy conversion systems used in transportation and the constraints on these, which will lead to us considering the Otto, Diesel and Brayton cycles and their variants.

In the latter third of the course, we will be discussing renewable alternatives, including biofuels, hydro, solar and wind, along with solutions that have been proposed for transportation that would use renewables. For this part of the course, the class will be divided into small groups; each group will be responsible for investigating one of the following topics: Biofuels, Hydroelectric power, Solar power (with Photovoltaics), Solar power (w/ thermal generation), Wind, Geothermal, Batteries and Fuel Cells. Each group is expected to submit a report on their topic in the first lecture after “Reading” week (Feb. 23) and to then present their topic in the appropriate lecture thereafter.

First class: Tuesday, January 5, 2016

Course Outline by Lecture Period

Date	Topic
Jan. 5	Introduction
Jan. 7	Review of Thermodynamics: First Law
Jan. 12	Review of Thermodynamics: Second Law
Jan. 14	Review of Thermodynamics: Reacting Systems
Jan. 19	Review of Fluid Dynamics: Turbulence
Jan. 21	Review of Heat & Mass Transfer
Jan. 26	Chemical Kinetics
Jan. 28	Combustion
Feb. 2	Quiz 1
Feb. 4	Steam power plants
Feb. 9	Steam power plants (cont.)
Feb. 11	Stationary gas turbines
Feb. 15–19	“Reading” week
Feb. 23	Spark-Ignited engines (Report due!)
Feb. 25	Compression-Ignited engines
Mar. 1	Jet engines
Mar. 3	Design considerations - fossil fuels edition
Mar. 8	Quiz 2
Mar. 10	Biofuels
Mar. 15	Hydroelectric power
Mar. 17	Wind
Mar. 22	Geothermal
Mar. 24	Solar power (thermal)
Mar. 29	Solar power (PV)
Mar. 31	Batteries/Fuel Cells
Apr. 5	Design considerations - renewables edition
Apr. 7	Review