ME146/246 – ENERGY CONVERSION PRINCIPLES (3)
Three hours of lecture per week.

Meeting Time: TuTh 8:00 AM to 9:30 PM in 105 Northgate

Instructor: Prof. Van P. Carey
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office hours: Tu, W, Th 10-11 AM

Course web page: TBA

GSI: Claire Wemp

Text: *Fundamentals of Renewable Energy Processes*, Third Edition, A.V. da Rosa, Elsevier Academic Press, San Diego, CA, 2009, ISBN: 9780123972194.

References
Computer Methods for Engineering with MATLAB® Applications, 2nd Edition
by Yogesh Jaluria, Taylor and Francis, 2011.

Introduction to MATLAB for Engineers, W. J. Palm, III, 3rd edition, McGraw Hill, 2010.

Brief Description
This course covers the fundamental principles of energy conversion processes, followed by development of theoretical and computational tools that can be used to analyze energy conversion processes. The course also introduces the use of modern computational methods to model energy conversion performance characteristics of devices and systems. Performance features, sources of inefficiencies, and optimal design strategies are explored for a variety of applications, which may include conventional combustion-based and Rankine power systems, energy systems for space applications, solar, wind, wave, thermoelectric, and geothermal energy systems.

Remarks
ME146 is an upper division technical elective in the ME undergraduate program. Graduate students must enroll in ME246. Students in ME246 must complete additional advanced-topic tasks designated in homework assignments and projects.

Prerequisites
ME105, ME106, E7 (or their equivalent), and ME109. ME109 may be taken concurrently.

Computer Resources: Each student must have access to a PC, Macintosh or workstation machine with scientific programming capabilities for use in homework and projects.

Grading Policy
The course grade will be based on: 35% Final Exam; 40% Midterms & Projects; 20% Quizzes; 5% Homework Assignments. Quiz Dates: 1/30, 2/13, 2/27, 3/13, 4/3, 4/16 (tentative) (open notes only, lowest dropped).

ME 146/246 COURSE OUTLINE (tentative)

Week	**Topics**	**da Rosa Chapters**
1	Energy resources; review of thermodynamics of energy conversion in closed and open systems; reversibility, exergy and the Second Law	1
2	Heat exchanger design for energy conversion efficiency	
3	Solar energy as a resource, solar thermal collector design analysis, transport and storage of energy in solar thermal systems; solar thermal power generation	12
4	Computational tools for energy conversion analysis; guidelines for algorithm and program development; modeling hierarchy; treatment of properties; numerical differentiation; finding roots of equations; solution of linear equations.	
5	Parametric analysis for component design; steady state performance of components; operating characteristics of compressors, pumps, heat exchangers, solar collectors, and other energy system components.	
6	Thermoelectric phenomena; thermoelectric energy conversion devices and systems	5
7	Physics of photovoltaic devices; design of photovoltaic energy conversion devices and systems	14
8	Heat engines; thermodynamic limitations on energy conversion efficiency; determination of system heat rejection; thermodynamics of Rankine, Brayton, and Stirling cycles and their application to geothermal and solar power generation	2, 3
9	Hydrocarbon fuels; heats of combustion; adiabatic flame temperature; production and use of biofuels	13
10	Combustion engines: gas turbines; Otto and Diesel engines; impact of fuel type	3
11	Thermodynamics of isothermal energy conversion; basic performance analysis of fuel cells and batteries; biochemical energy conversion	9
12	Hydrogen as an energy source; hydrogen use in fuel cells; gas turbines and engines; hydrogen storage	9-11
13	Wind, wave and ocean energy systems for power generation	4, 15, 16
14	Special topics; review	