January 2011: ME 533-Energy Conversion

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Hours: Appointments on Monday and Wednesday: 1200 -15000; 1800-1900.
Please make appointment by email.

Reference TEXT: Fundamentals of Engineering Thermodynamics, 4th edition, **Moran and Shapiro**- If you have the 3rd or 5th edition these are also acceptable or if you already have an engineering text I will point out the equivalent sections.

Annual Energy Outlook, **IPCC Report**, **Water Report** and other assigned readings (As Rdg) to be provided in digital form.

U.S. D.O.E: E.I.A. Annual Energy Review- Comprehensive summary of US/World Energy Projections. Class notes and selected references for each major conversion system such as Wind, Solar, Nuclear, and Oceanic.

Goals:
1. A major goal of this course is to provide the student with the analysis tools necessary for the determination of the importance of energy conversion technologies. 2.) Provide a comprehensive understanding of Energy Technologies -Nuclear, Solar, Wind, Oceanic and Fossil Fuels. 3.) Provide an analytical frame work for the comparsion of the energy/environmental /economic factors. 4.) Provide a perspective of the scope of the golobal/energy/climate/water problem and possible solutions.

TOPICS:

1. Thermo Review including Exergy, Vapor Power Systems, Gas Power Systems, Refrigeration and Heat Pump Systems 2. Thermodynamic Relations and Ideal Gas Mixtures. 3) Energy Conversion systems-Coal-Oil-Nuclear, Oceanic, Solar, Geothermal and Wind.

Outcomes:

i. Become proficient in the application of Engineering Thermodynamics to the analysis of: 1.) Vapor Power Systems.-Rankine Cycle-Superheat and Reheat- Regenerative Vapor Cycles-Feedwater Heaters-2.) Gas Power Systemsl-Brayton-regenerative gas turbines with reheat and inter cooling 3.) Refrigeration and Heat Pump Systems-using solar, geothermal, and/or conventiaonal methods. 4.) Combined and flexible fuel utilization systems. and 5.)Thermodynamic energy storage such as compressed gas.

ii. Become proficient with the application of Engineering Thermodynamics to :1.) The analysis of large scale Nuclear, Fossil Fuel, Wind, and Solar Energy Conversion Systems employing vapor power and gas power cylces.2.) The analysis of renewable smaller scale wind, tidal, and oceanic current systems.

iii. Gain knowledge and experience of the National and International Energy Research, Development, and Production by: 1.) reviewing the Department of Energy Global Outlook 2.) understanding the national laboratory system, 3.) the power industry institutes such as The Edison Power Research Institute, 4.) industrial associations.

iv. Gain experience in energy conversion systems by: 1.)preparing a state of the art technology review of conversion technology, 2.) determining the potential on a national and regional basis, 3.)performing a thermal analysis of the system, 4.)performing a comparative analysis with alternatives, 5.) performing a cost and energy cost analysis, 6.) assessment of environmental impact, and 7.)a concise presentation of the results.

GRADING: 1.The average grade will be determined by a linear average of 1.) exams and quizes; 2.) Homework-Notebook-Attendance (HA) representing one exam, and 3.) The Energy Conversion Technology Paper representing one exam.

Energy Conversion Paper: Students will select an energy conversion technology to study from a list of projects presented in class. Students will conduct a technology review, identify sources and obtain required information for engineering and economic tradeoffs. Students will present source information and project scope, rational and importance by class 10. The research paper will include thermodynamic and cost analysis of energy conversion technology. Prepare report and presentation for class.

Course Note Book: Students are expected to keep a notebook containing corrected problems, quizzes, and notes and working project papers. This notebook or file should be consistent with good engineering practice.

Tentative Course Outline

CLASS 1	19-Jan	Energy, Climate and Water	As Rdg
CLASS 2	24-Jan	Energy, Climate and Water	As Rdg
CLASS 3	26-Jan	Energy, Climate and Water	As Rdg
CLASS 4	31-Jan	Thermodynamic review	CH: 1-7
CLASS 5	2-Feb	Thermodynamic review	CH: 1-7
CLASS 6	7-Feb	Thermodynamic review	CH: 1-7
CLASS 7	9-Feb	Thermodynamic review-TH Exam	CH: 1-7
CLASS 8	14-Feb	Vapor Power Systems, VPS: Nuclear, coal oil, gas and solar.	CH 8
CLASS 9	16-Feb	VPS	CH 8
CLASS 10	22-Feb	VPS	CH 8
CLASS 11	23-Feb	VPS-Take Home Exam-no class	CH 8
CLASS 12	28-Feb	GAS PCS, BRAYTON CYCLE	CH:9
CLASS 13	2-Mar	GAS PCS,	CH 10
CLASS 14	7-Mar	GAS PCS,	As Rdg
CLASS 15	9-Mar	GAS PCS, Ref, AC and Heat Pumps, TH Exam	As Rdg
CLASS 16	21-Mar	On shore and Offshore Wind Energy	As Rdg
CLASS 17	23-Mar	On shore and Offshore Wind Energy	As Rdg
CLASS 18	28-Mar	On shore and Offshore Wind Energy	As Rdg
CLASS 19	30-Mar	Solar and Geothermal	As Rdg
CLASS 20	4 Apr	Solar and Geothermal	As Rdg
CLASS 21	6-Apr	Solar and Geothermal- Exam	As Rdg
CLASS 22	11-Apr	Oceanic Energy farms	As Rdg
CLASS 23	13-Apr	Oceanic Energy farms	As Rdg
CLASS 24	20-Apr	Advanced topics including Bio fuels	As Rdg
CLASS 25	21-Apr	Advanced topics including Bio fuels-Exam	As Rdg
CLASS 26	25-Apr	Advanced topics including Bio fuels	As Rdg
CLASS 27	26-Apr	Presentations and reports	
CLASS 28	2 May	Presentations and reports	
Class 29	4 May	Presentations and reports	

As Rdg = Assigned Readings.