COURSE SECTION/NUMBER: ME 305   Thermodynamics II

INSTRUCTOR INFORMATION
Instructor Name: Dr. Will Schreiber
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COURSE DESCRIPTION
Thermodynamic cycle analysis; thermodynamics of non-reacting and reacting mixtures; chemical equilibrium: and one-dimensional compressible flow.

COURSE PREREQUISITES
ME 215 (Thermodynamics I) and MATH 227 (Calculus II)

DISTANCE EDUCATION: Students receiving the lectures on dvd will have an extra three (3) working days to turn in assignments and get exams in. It is recommended that you either fax or scan and email all work for purposes of expediency.

COURSE OBJECTIVES
• Define the assumptions associated with a basic power cycle for application in preliminary design analysis.
• Define the assumptions associated with an Air Standard Power Cycle for application in preliminary design analysis.
• Analyze the operation of a simple internal combustion engine through the ideal Otto and Diesel cycles and apply a first law analysis to show the effects of basic design parameters on overall system performance.
• Analyze the operation of a simple gas turbine through the ideal Brayton cycle and apply a first law analysis to show the effects of basic design parameters on overall system performance.
• Calculate the system thermal efficiency and net work output for an ideal Brayton cycle with regeneration, intercooling, and/or reheat and be able to explicitly show cycle improvements over the simple Brayton cycle.
• Analyze a jet aircraft engine based on the Brayton cycle
• Analyze the operation of a simple steam power plant through the ideal Rankine cycle and apply a first law analysis to show the effects of basic design parameters on overall system performance.
• Calculate the system thermal efficiency and net work output for a Rankine cycle with reheat and/or regeneration and show cycle improvements over the simple Rankine cycle.
• Calculate the degradation in system performance for the deviations from ideal operation conditions for the simple Rankine cycle and the variants of this cycle on temperature versus entropy diagrams.
• Define a refrigeration/air conditioning system and calculate the cooling capacity and coefficient of performance for an ideal vapor-compression refrigeration cycle. Calculate the degradation of system performance from system deviation from ideal cycle operation.
• Calculate thermodynamic properties for mixtures of ideal gases.
• Define and calculate thermodynamic properties of air-water vapor mixtures. Be able to use psychometric charts for obtaining properties of air-water vapor mixtures.
• Define terms associated with the combustion of a hydrocarbon fuel and apply conservation of mass to balance a chemical equation.
• Apply the First Law of Thermodynamics to calculate the heat released during the combustion of a hydrocarbon fuel.
• Calculate the adiabatic flame temperature for combustion of a hydrocarbon fuel.
• Define the requirements for chemical equilibrium.
• Calculate the equilibrium composition of a mixture of ideal gases at a specified temperature.
• Calculate the velocity of sound.
Determine conditions at various locations along the axis of a nozzle undergoing isentropic flow.
Calculate conditions downstream of a shockwave.

Upon successful completion of this course the student will be able to:

- Analyze problems concerning gas and two-phase power cycles.
- Analyze problems dealing with refrigeration theory.
- Perform calculations on thermodynamic systems of gas mixtures.
- Determine energy release from combustion processes.
- Perform chemical equilibrium analyses.
- Analyze problems concerning simple one-dimensional compressible flow.

REQUIRED TEXT

ASSESSMENT
The final grade for the course will be based on the student's average score and will incorporate the plus/minus system.

10% Homework Preparation
Homework in the form of reading assignments and problem assignments will be assigned for each module. You are welcome to work on the homework problems with others. Remember, however, that the bulk of the grade for this course comes from your performance on the exams; therefore, regardless of how you manage to complete the homework assignments, it behooves you to understand the principles and procedures behind the problems. The solutions to problems will be posted online immediately following the due date. Homework will not be accepted after the due date.

60% Two fifty minute exams @30% as scheduled in the syllabus

30% Final exam