

Sec. 001: MWF 2:00 PM, AH 257

Instructor: Prof. J. M. McDonough
514H CRMS Building
Phone 257-5164
e-mail: jmmcd@uky.edu

Prerequisites: ME 220, MA 214 and Engineering Standing.

Course Description: Gas mixtures, air-water vapor mixtures. Air conditioning system design. Principles and design of energy conversion devices, power and refrigeration cycles. Principles of combustion, chemical equilibrium, one-dimensional gas dynamics. Nozzle design.

Text: *FUNDAMENTALS OF ENGINEERING THERMODYNAMICS*, 4th Ed. by Moran and Shapiro. Reading assignments will accompany most lectures, and for maximum benefit should be completed *before* the lecture to which they correspond. The course will cover Chaps. 8–14, with heaviest emphasis in lectures placed on Chaps. 8, 9, 13 and 14. Students will, however, be responsible for **all** assigned reading, independent of whether it was specifically covered in lecture. This applies especially to parts of Chapters 10 and 12 which will be treated only briefly in lectures.

CONCEPTS AND TOPICS TO BE INTRODUCED:

Carnot cycle (review)	psychrometric chart
vapor power systems	complete combustion
analysis of Rankine cycle	air-fuel ratio
gas power systems	enthalpy of formation
internal combustion engines	adiabatic flame temperature
gas turbine engines	Gibbs function
Otto, Diesel & Brayton cycles	equilibrium criterion
Ericsson & Stirling cycles	chemical potential
refrigeration & heat pump systems	equilibrium constant
virial equation of state	speed of sound
mass & mole fractions	Mach number
relative humidity	stagnation properties
dew-point temperature	choked flow
dry-, wet-bulb temperatures	normal shock

EXPECTED OUTCOMES:

Upon conclusion of the course, the student should be able to do the following:

1. Define, discuss and apply all of the above concepts.
2. Express all parameters encompassed in these concepts in their appropriate dimensions.
3. Calculate thermal efficiencies for various classes of engineering devices and cycles.
4. Draw diagrams and discuss details of the various power and refrigeration cycles discussed in the text and in lecture (*e.g.*, Otto, Diesel and Brayton cycles).
5. Calculate enthalpy of combustion, adiabatic flame temperatures, equilibrium constants and compositions for various combusting systems.
6. Perform isentropic and normal shock calculations associated with 1-D gas dynamics.

Homework: Problem sets will be due AT THE START OF THE PERIOD one week from the date on which they were assigned unless specifically noted otherwise. They should be written on 8.5" × 11" paper, ONE SIDE ONLY, and stapled in the upper left-hand corner. Only one problem from each set, chosen at random, will be graded in detail on the basis of 10 points: essentially correct (10 pts.), mostly correct (7 pts.), some significant effort (3 pts.), or no credit. In addition, one point per problem will be awarded for **completion** of each of the other problems in a problem set. NO CREDIT will be given for LATE HOMEWORK submitted after the lecture period.

The overall percentage value (10%) assigned to homework is relatively minor and will be used primarily to decide the outcome of borderline cases in the final letter grade assignment curve. As such, your primary objective in completing homework assignments should be to develop understanding so as to effectively apply the fundamental principles introduced in lecture, thereby improving your problem-solving skills. This objective is best achieved through disciplined, *independent* effort—simply copying or routinely consulting the work of classmates is typically ineffective in terms of mastering the subject matter, with corresponding consequences on the examinations.

Examinations: The examinations in ME 321 will consist of two (2) one-hour midterms, and the usual two-hour final examination.

The *midterm* schedule is as follows:

Monday, Oct. 1, 2001
Monday, Nov. 5, 2001

Students who fall ill, or who know in advance that they must miss an exam for a valid reason (*e.g.*, family emergency, attending a conference, *etc.*), should notify Prof. McDonough by telephone (leave voice mail if necessary, or contact a ME Department secretary at 257-2662), or (preferably) by e-mail prior to the exam. Students missing an exam without a valid excuse will receive a grade of **zero (0)** for that exam. NO make-up exam will be given in such cases.

The *FINAL EXAM* will take place on Friday, Dec. 14, 2001 from 8:00 to 10:00 AM.

The midterm examinations will mainly cover only the material discussed since the most recent previous exam. However, it must be cautioned that, as with essentially any other technical course, knowledge required to solve problems is intrinsically cumulative. So while questions specific to lectures prior to a previous exam will not be explicitly asked, it may prove necessary to recall portions of such material at least in a general way. **The final exam will be comprehensive**, but with approximately 50% focused on material since the second midterm. The remaining ~50% will be taken from all parts of the course.

It must also be made clear that ME 321 is NOT simply a “plug and chug” course. Emphasis will be placed on **understanding** the basic physics and engineering *principles* associated with thermodynamics and the ability to translate this understanding into conceptual problem solving. This will be strongly reflected in the nature of written examinations (and to a lesser extent, homework assignments); as a consequence, calculators will not be needed, and their use will NOT be permitted during examinations.

Grading:	Two Midterm Exams @ 22.5%	45%
	Homework	10%
	Final Exam	45%

Any (and hence, *every*) student attaining a 90%, or better, straight-curve score for the entire course is guaranteed a grade of **A**; a student achieving 33%, or less, is guaranteed a grade of **E**. In general, however, a curved grading scale will be used. (Specific details will be provided via example after

the first midterm.) Thus, it is possible to earn an **A** grade with a total score below 90%, and conversely an **E** with a score above 33%. It is expected that the overall class GPA will be in the range 2.3 to 2.7, and this will have some influence on the setting of break points in the curve used for final letter grade assignment.

Copying, Cheating, etc.: While it is recognized that engineering problem solving often benefits from the exchange of ideas that occurs in a group effort, the *maximum* learning benefit for the student typically results from a balance of serious INDIVIDUAL effort and occasional group consultation. This is especially true in basic courses such as ME 321 in which a considerable amount of fundamental information is being encountered for the first time, and such information can prove to be as important to later engineering analyses as are the addition and multiplication facts to arithmetic. With this in mind, students are strongly discouraged from doing their homework assignments solely in a group framework. The teaching assistant has been instructed to identify homework that displays evidence of verbatim copying—ALL such solutions will receive zero credit, regardless of who copied from whom. Moreover, a record of the occurrence will be entered in the grade sheet, and will be taken into consideration when deciding grade assignments in borderline cases. Penalties for other aspects of cheating (particularly on examinations) will be applied as published in the *Student Rights and Responsibilities Code* of the University.

Office Hours: Office hours will be held at two specific hours set by student input in an attempt to find a time that is convenient for as many students as possible. Consultation by appointment is also a possibility. Send e-mail to set up a time.