COURSE INFORMATION AND SYLLABUS[1]

INSTRUCTORS

Sections	Days / Hour / Room	Instructor	Office	Campus Phone
ES201-01	MTRF / 4 / O101	D. Richards	Moench C101	877-8477
ES201-02	MTRF / 5 / O101			
ES201-03	MTRF / 5 / D115	C. Lui	Moench C102	872-6998

RESOURCES

- Textbook: D. E. Richards, ***Basic Engineering Science—A Systems, Accounting, and Modeling Approach*** (Fall 2007 Edition) is available for purchase at the Rose-Hulman Book Store. Supplements to the textbook, including additional homework problems will be available on the course website.
- Course URL: **www.rose-hulman.edu/~richards/courses/es201/index.htm**
- Handouts distributed throughout the course will supplement the notes.

COURSE GOAL & CONTENT

The goal of this course is to help you ***think like an engineer* so that you can *solve real-life engineering problems***. This course presents a unified framework for solving engineering problems using common engineering science concepts: systems, conservation and accounting principles, material properties, constitutive equations, and physical constraints. This framework combined with the appropriate mathematics provides you with a powerful tool for modeling and predicting the behavior of the physical world. Course goals have been prepared and will be distributed separately. Lists of specific learning objectives will be distributed throughout the quarter to help guide your study and monitor your progress.

COURSE ACTIVITIES & PHILOSOPHY

Mastering any new subject requires continuous effort by you, the learner, to make sense of new concepts and to integrate them with what you already know. Learning to identify, formulate, and solve engineering problems requires diligent practice using a logical problem-solving methodology. Learning to solve *real-life* engineering problems also requires a willingness to deal with ambiguity and uncertainty.

The learning objectives of this course cannot be achieved by passively sitting in a classroom, listening to a lecture repeat the assigned readings, and copying down material you were supposed to have read last night. Studies have repeatedly shown that students learn more when they are *actively engaged* in applying new material, so we will try to make learning an active process. Research has also shown that *collaborative learning* is one of the most productive types of active learning. Active learning requires that you do things to learn, e.g. questioning the material, figuring out how it relates to what you already know, looking for connections, looking for differences, creating a visual outline of the material (concept mapping), outlining, paraphrasing, teaching it to a friend, solving a homework problem—in short, getting to feel like you "own" the material.

Both individual and collaborative active learning exercises will be used throughout this course. In collaborative learning, you interact with others in a small group to perform a specific task. Working with peers provides immediate feedback and support as you work together to complete the task and understand the material. In addition, working in groups teaches you social skills that will be invaluable as you move into the team-oriented world of industry.

Course activities are divided between two types of activities. **Development activities** will occur continuously throughout the quarter and give you opportunities to build your skills and improve your understanding of the material. **Evaluation activities** (three mid-term exams and a final exam) give you opportunities to demonstrate to the instructor your understanding of and ability to apply the course material.

[1] **Caveat:** The instructors reserve the right to notify students of the change and modify the course content, schedule, policies, etc. outlined in this syllabus at any time during the quarter.

DEVELOPMENT ACTIVITIES

Homework (HW): Homework gives you an opportunity to learn and practice new skills. Working it helps you learn. Do the homework daily and don't let it pile up. Attempt to solve all homework problems on your own *before* you discuss the problem or seek help from others. *Experience has shown that it is important to independently attempt the homework, i.e. applying your skills and knowledge with a problem statement and a blank sheet of paper.* In hindsight, most solutions look obvious, so starting on your own helps you judge the limits of your understanding. Once you've tried to work it, don't hesitate to seek help from others; however seek to understand not just copy the process or result. Hints for the homework may be provided.

Readiness assessment tests (RAT): Every day you should come to class prepared to take a brief quiz -- a Readiness Assessment Test (RAT). A RAT will typically cover the key points of the assigned reading, key ideas from the previous lecture(s), and key concepts and definitions you should know. RATs will be brief (approximately 5 minutes) and will be given at the beginning of class. Makeup RATs will not be given to latecomers or absentees.

Active Learning Exercises (ALE): Active learning exercises require you to work individually or in groups and will be used frequently in class to help you understand the course material. These activities may or may not be graded. Makeup ALEs will not be given.

COURSE EXPECTATIONS:

Work Load: This is a four-credit course. The workload for this course should average at least 8 to 12 hours a week outside of class. Spend this time reading the text and notes, working problems, discussing material with your colleagues, and thinking about the material in this course. You should expect 2-4 homework problems daily.

Reading Assignments: Complete the reading assignments *before* class. In-class activities assume you are familiar with the material in the assigned reading.

Homework Assignments:
… Homework problems are assigned daily, and each day's homework is treated as a set with 2-4 problems. Unless you are told otherwise, you should begin work on the homework problems immediately following the class period in which they are assigned.
… Homework sets will be collected at the beginning of the class period on the days indicated in the schedule.
… Late homework will typically not be accepted. Ask your instructor about their policy.
… See detailed Homework Guidelines below for more details about format and requirements.

Attendance: You are expected to attend every class and be on time. Excused absences must be arranged in advance and documented as your instructor requests. Students with two or more unexcused absences should expect to have their final course grade reduced one-half letter grade for every two absences. Students with eight or more absences, excused or unexcused, will automatically fail this course. *If you miss class, it is* ***your*** *responsibility to obtain all assignments and handouts from students who were present in class.*

Classroom Etiquette: In class, you are expected to be both mentally and physically present. You should expect the same of the instructor. Anything less undermines our limited time together. With the exception of illness or a personal emergency, please do not leave class until the end of the period. Use of electronic devices for anything but taking notes or working on ALEs is prohibited; this includes answering, reading or responding to an email, tweet, or text message. Should you have a personal emergency where you are expecting an important message, please let the instructor know beforehand or explain the interruption afterword.

Final Exam: The final exam will be comprehensive. Every student must be available to take the final exam during the Final Exam Period scheduled by the Registrar.

COMPONENTS OF FINAL COURSE GRADE:

Development Activities**:
Homework Sets (HW), Readiness Assessment Tests (RAT's), and other graded activities..................... 15 %
Evaluation Activities**
Mid-term Exams (3 x 17% each) .... 51 %
Comprehensive Final Exam .... 34 %
Total.............................. 100 %

NOTE: **To pass the course, your average grade for the Evaluation Activities must be passing. Once you pass the Evaluation Activities, your Development Activities will then be figured into the final grade. Your performance on Development Activities may raise or lower your final grade.

GRADING STANDARDS:

Letter grades in this course are established by comparing your performance against an absolute standard of performance. Typically, 90% and above is an A, 80% and above is a B, 70% and above is a C, and 60% and above is a D. Performance levels below 60% will typically result in a letter grade of F.

You *must* earn at a final grade of C or better in ES201 before you can take the next two courses in the Sophomore Engineering Curriculum: Fluid & Thermal Systems (ES202) and Mechanical Systems (ES204). In the judgment of the SEC faculty, at least C-level performance in ES201 is required for satisfactory performance in ES202 and ES204.

ACADEMIC HONESTY

Any act of academic misconduct is grounds for discipline in accordance with the most recent edition of the Rose-Hulman Institute of Technology *Academic Rules and Procedures*. If in doubt, ASK! The most recent information can be found on the Registrar's web page under *Academic* Rules. See Homework Guidelines for specific guidance about collaboration and the use of files.

HOMEWORK GUIDELINES

Engineering problem solving involves both ***constructing*** *and* ***documenting*** *a solution*. The ability to solve an engineering problem is worthless if the engineer is unable to communicate the solution to those who need it. In industry, engineering solutions are often archived and used later to troubleshoot a problem, as evidence in a lawsuit, or as the basis for a new design; thus, documenting your thought process is essential.

The following guidelines are presented to help you effectively document and communicate *both* the solution to the problem *and* the process used to obtain it. The correctness of any solution can only be judged after evaluating the solution process with its underlying assumptions.

Mechanics of Preparing Solutions

A. Format

1. Standard engineering problem paper *must* be used for all homework. (Recommended for class notes.)
2. Each homework set consists of a **cover page** followed by the homework problems arranged in the order they were assigned. Write your *name* and *campus mail box number* in the upper right-hand corner and the problem number in the upper left-hand corner of the first page of a problem. Without a campus mail box number, your homework may never make it back to you. (See Appendix A of the course text for sample formats.)
3. *Start each problem on a new page* and *use only one side of each page*. (We will not look on the backside.)
4. Multi-page solutions *must* be stapled together and have a notation on *each* page that indicates the number of pages, e.g. Page 2 of 3, or 2/3, or 2 of 3, etc. Note that many students err by trying to cram a solution onto a single page. This not only hurts the appearance but also often "cramps" your logic.
5. Each solution *must* be both legible and understandable. If you use the computer, e.g. Maple, Mathematica, Excel, or EES, to solve any part of a problem, a printout *must* be included with the solution to support your result. Computer printouts are supporting documents but are not the solution. Depending on how they are used they must be annotated appropriately so that they make sense in the context of your solution.

B. Coherence & Correctness

1. Your work must be CLEAR and COMPLETE. In particular, note the following:
   a) *Solutions must be prepared using the* ***problem solving format*** *discussed in the notes*, i.e. Known, Find, Given Data & Schematic, Analysis, and Comments. Assumptions must be explicitly stated, but may be made as appropriate in the Analysis section.
   b) *As a minimum a* ***schematic diagram*** *depicting the* ***physical system*** *should be present*. Sometimes multiple views or details may be helpful. Identify symbols to represent the important physical information.
   c) *The solution should be* ***worked through with symbols*** *as appropriate*. Typically you are actually developing a mathematical model of the physical system. Equations should be reduced to final form, i.e. the unknown isolated on one side of the equal sign, before substitution of any numbers. This will aid you in understanding the physics of the problem without getting bogged down in units.
   Students frequently carry this to extreme producing excessively long expressions. To prevent this,

look for logical intermediate answers to calculate along the way. For example, you may need the mass *m* of gas in a tank in a long equation but the mass also depends on pressure, volume, temperature, and the ideal gas constant through the relation $m_1 = (P_1V_1)/(RT_1)$. Rather than continuing to recopy and manipulate $(P_1V_1)/(RT_1)$, use the symbol m_1 for the mass in the larger equation and do a side calculation to compute the numerical value of m_1. Then at the appropriate point in the problem insert the numerical value. This has the added benefit of giving you multiple places to check the reasonableness of your answers.

d) *Never write the magnitude of a physical quantity without the appropriate* ***units.*** Experience has shown that failing to carry units along in a calculation is a major cause of mistakes. (That's also why using symbols as long as possible is a good idea.) Numerical answers reported without units are worthless and unacceptable! Unit errors are also easier to check when you compute intermediate answers as mentioned above instead of one long equation.

e) *State the source of values not given or calculated*, e.g. From Table 3.1 in Textbook XYZ.

f) *Clearly identify* ***intermediate*** *and* ***final answers***.

2. Check your work. In particular,

   a) check the answer for correct dimensions *and* units.

   b) evaluate the reasonableness of the trends and calculated values.

   c) try to find a "ballpark" estimate to bracket and support the correctness of your answer. (What calculation could your boss perform in thirty seconds on the back of an envelope that checks your results?)

C. Miscellaneous

1. You are encouraged to attempt every homework problem assigned. Homework problems are selected to illustrate specific points or approaches; thus, failing to attempt a problem may keep you from a key learning experience.

2. If you are unsuccessful in solving the problem, but you submit an **acceptable partial solution** you will receive a substantial part of the credit.

   An **acceptable partial solution** *must* include the following sections:

   Known

   Find,

   Given Data & Schematic

   Analysis: This section documents your solution attempt and *must* include an explicit statement or question indicating why you are stumped, e.g. what is giving you problems or what's missing that you need to know to proceed?

Getting Help with Homework[2]

A fundamental principle of academic integrity is that you must fairly represent the source of the intellectual content of work you submit for credit. ***Unless otherwise directed*, *collaboration on homework in this course is allowed as long as all sources consulted (both literature and people) are clearly acknowledged at the end of each problem.*** Failure to acknowledge the contributions of others to your homework solution will be considered cheating. Verbatim copying all or part of a solution that you submit for credit when you have not made any intellectual contribution is academically dishonest.

If you need help on the homework use the following resources:

- Get help from a classmate, but do not copy their solution. Discussion among students to understand homework problems or to prepare for exams is encouraged. Working in a group on the homework can be an excellent way to learn the material; however, do not get in the habit of letting others do the thinking for you. Do not divide up the problems, but help each other when you get stuck. Remember that every student will be individually accountable for the material on the exams.
- Get help from the instructor. Check with your instructor for office hours and availability.
- Try the Learning Center. They have Peer Tutors with experience in the Sophomore Engineering Curriculum.

---

[2] Adapted from the "Academic Honesty" section of *Course Facts* for Unified Engineering Course 16.010 and 16.020, Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, MA.