AME 261 – Basic Flight Mechanics
Spring 2015

Instructor Charles Radovich  radovich@usc.edu  RRB 202  Office Hours: MW 10a – 12p and by appt.
Lecture T Th 10 – 11:50 am, ZHS 163
Discussion Friday 2 – 2:50 pm, ZHS 163

Homework & Quizzes 20%
Group Design Project 15%
Two Midterm Exams 30% (15% each, drop lowest of three exams)
Final Exam 35%

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<th>Week</th>
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<th>Reading Assignments</th>
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<td>1</td>
<td>Jan 13-15</td>
<td>Intro/Atmosphere/Continuity and Bernoulli equations Ch. 3 – 4.5</td>
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<td>2</td>
<td>Jan 20-21</td>
<td>Energy equation, viscosity, wings, Mach number and $C_p$ Ch. 4.6-9, 4.15-21 &amp; 5.1-7</td>
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<td>3</td>
<td>Jan 27-29</td>
<td>Induced drag, aircraft drag, propulsion Ch. 5.12-24 &amp; 9.1-6</td>
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<td>4</td>
<td>Feb 3-5</td>
<td>$E_{max}, V_{min}$ and power requirements Ch. 6.1-6 &amp; 6.25</td>
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<td>5</td>
<td>Feb 10-12</td>
<td>Altitude effects, climbing flight, ceiling and gliding flight Ch. 6.7-10 &amp; notes</td>
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<td>6</td>
<td>Feb 11-19</td>
<td>Compressibility, Mach effects, wave drag and swept wing Exam #1 on Feb 19 Ch. 5.7-12, 5.16 &amp; notes</td>
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<td>7</td>
<td>Feb 24-26</td>
<td>Range, optimum cruise altitude and endurance Ch. 6.11-14 &amp; notes</td>
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<td>Mar 3-5</td>
<td>Cruise at different altitudes, speeds and angles of attack Ch. 6.11-14 &amp; notes</td>
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<td>Mar 10-12</td>
<td>Takeoff performance Ch. 6.15 &amp; 5.17</td>
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<td>Mar 11-19</td>
<td>Spring Break (March Madness)</td>
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<td>Landing Performance Exam #2 on Mar 26 Ch. 6.15-16</td>
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<td>Mar 31-Apr 2</td>
<td>Turning performance and energy methods Ch. 6.17-23 &amp; notes</td>
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<td>Apr 7-9</td>
<td>Aircraft moments, stability criteria and partial derivatives Ch. 7.1-6</td>
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<td>Apr 14-16</td>
<td>Longitudinal static stability, effects of wings, tail and canards Exam #3 on Apr 16 Ch. 7.7-12</td>
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<td>15</td>
<td>Apr 21-23</td>
<td>Trim, stick free stability and lateral stability Ch. 7.13-21 &amp; notes</td>
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<td>16</td>
<td>Apr 28-30</td>
<td>Misc. and review</td>
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The Final Exam will be on Tuesday May 13th at 11 am – 1 pm
Instructor: Charles Radovich  radovich@usc.edu

Office Hours: MW 10a – 12p and by appointment, RRB 202


Course Description

**AME-261 Basic Flight Mechanics**

*Units: 4  Recommended preparation: AME-105, AME-150L, AME-201 and PHYS-151*

Performance of flight vehicles; maximum speed, rate-of-climb, range, and endurance; basic stability and control, weight and balance; computer exercises. *(from the USC Course Catalogue)*

Homework will be assigned every week and will be due one week *(i.e., 7 days)* after it is assigned. Approximately half of the homework will involve the use of a computer and will require graphical results. All students should be familiar with the university computer labs; alternatively, a personal computer can be used to solve the assignments. *Homework will not be accepted late for unexcused reasons.* A down computer is not a reason for late homework. Under no condition should you attempt to complete your assignment the night before it is due because most problem sets require more than one evening’s work.

In order to receive credit for your work, all homework, quiz and exam problems must be presented in a clear, organized manner. Solutions must show evidence of work; “magic” answers will not be accepted. Partial credit may be given if the solution is presented in a logical fashion.

Students may work together on the homework by helping each other to discuss the problems, review the lectures, set up the problems, etc. **However, when you sit down to write a computer program or solve the homework problems, each student must do that individually.** You may also discuss each other’s computer programs but **under no circumstances should you copy anyone’s work.** Do not share or email anything; this goes for all courses at USC. **Failure to comply with this requirement will result in an F for the course.** All students should **read and understand the USC Student Code of Conduct outlined in the Academic Dishonesty Guidelines [http://www.usc.edu/student-affairs/SJACS/forms/sjacs_appa.pdf](http://www.usc.edu/student-affairs/SJACS/forms/sjacs_appa.pdf).**

A group **Design Project** will be initiated after the first midterm. Groups of students will be required to design several aspects of an aircraft within given constraints. Details will be discussed further during class.

There will be **three Midterm Exams** in the course as noted in the syllabus. Please note the exam dates on your calendar now so that you will not miss any of them. All exams will be closed notes unless stated otherwise.

The **Final Exam** will be given on Tuesday, May 12th from 11:00 am to 1:00 pm.

**Calculators:** Standard scientific calculators are allowed for use during all quizzes, midterms and the final exams. Programmable calculators and wireless devices *(e.g., cell phone, iPod/Pad, etc.)* are not permitted.

**Final grades** will be computed as follows:

- Homework & Quizzes: 20%
- Group Design Project: 15%
- Two Midterm Exams: 30% *(15% each, drop lowest of three exams)*
- Final Exam: 35%
HOMEWORK SOLUTIONS

IMPORTANT RULES AND TIPS

Technical communication is an extremely important skill required of all engineers. If you cannot present your work well to your boss or co-workers, do not expect a raise. Likewise, if you cannot present your technical work well in this class, you will not get a good grade on your assignments. Thus, all homework must be presented in a professional manner. Follow the guidelines below:

1. A hard copy of your work must be submitted in order to receive credit; scanned/faxed/emailed submissions will not be accepted. Print your name on each page of your homework and staple all pages together.

2. Homework is to be done on 8.5” x 11” paper only. Write on only one side of each page and be sure that mistakes are clearly erased or carefully crossed out so that anyone can read and follow your work without difficulty. If the grader cannot follow your logic or your work is messy, the homework will be returned to you ungraded and a score of zero recorded.

3. It is necessary that you present your work neatly, logically and professionally. To receive full credit on homework and exam problems all of the following must be shown:
   a) Write down all given data at the beginning of the problem solution.
   b) Include a free hand sketch of the problem whenever possible.
   c) State the assumptions used in the problem.
   d) Write the equations to be used in symbolic form. Indicate where you obtained the equations and verify that the assumptions embedded within the equations are consistent with the problem you are attempting to solve. Manipulate the equations in symbolic form to obtain the desired form before substituting in the numerical values (see example problems 4.3 and 4.4 in your book). No exceptions!
   e) Algebraic steps are an important part of your work and should be shown. Again, no exceptions.
   f) Work through the Units in your calculations and show conversion of the units as needed. Be sure to give BOTH THE NUMERICAL VALUE AND THE UNITS in your answer. Why? Because 4 ≠ 4 m/s.
   g) Round off the final numbers and report only Significant Digits consistent with the accuracy of the data (i.e., if the data are given to 3 significant digits, DO NOT present an answer with 8 significant digits). If some of the data have only one digit given, e.g. angle of attack \( \alpha \), you should assume that two digits are implied (i.e., \( \alpha = 8.0^\circ \)). In this case, your answer should contain only two significant digits although three significant digits will be accepted. Generally, you should have three significant digits in your answer unless you can justify more or less based upon the given data.

4. Remember that the most important aspect of homework and exam solutions (typically 80-90% of the grade for the problem) is the method and not the correct answer. Thus, indicate how the solution was obtained by showing each step in the solution and where the data were acquired.

5. Place a box around your answer to clearly indicate your final answer.
Figure 1 is provided above to show the relationship between the homework scores (normalized to 100 points) and the grades on the exams (colored by the final grades given in the course). This data is from a previous semester, but the trend is consistent year after year. Several items are very striking. First, there is a strong correlation between how well students do on their homework and how well they do on their exams; do not think that the homework is inconsequential. If you are having trouble with your homework, seek some help either by seeing the instructor, the teaching assistant or get additional tutoring (Viterbi Academic Resource Center). Secondly, data over the past several year’s shows that about one third of the students in the class earn an A, one third earn a B and the remaining third earn a C or lower. Lastly, looking at the individual homework scores (not shown), the lower scores were primarily due to students not submitting several of their assignments; it was not because they did poorly on all of their assignments. Hence, be sure that you complete, understand the concepts within and turn in ALL of your homework if you want an A or B in the course.

Tutoring is available for this course through the Viterbi Academic Resource Center (http://viterbi.usc.edu/VARC/).

The Department of Aerospace & Mechanical Engineering adheres to the University’s policies and procedures governing Academic Integrity as described in the USC Catalogue. All engineering faculty, staff and students share the responsibility for maintaining an environment of integrity. Students are expected to be aware of and observe the academic integrity standards described in the USC Catalogue and you should expect those standards to be enforced in AME-261. In case you missed it earlier in this document, read this: http://www.usc.edu/student-affairs/SJACS/forms/sjacs_appa.pdf.
Statement on Academic Conduct and Support Systems

Academic Conduct
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in Scampus in Section 11, Behavior Violating University Standards https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in Scampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems
A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.