MAE180A Spacecraft Guidance, Navigation, and Mission Design

**Text:** None. (Since the material to be covered is not contained in any single textbook, I did not assign required textbooks.) However, some potentially books are listed below.

**Objective:** The course will be directed toward providing the students with abilities which will enable them to contribute fully to any future project which might arise involving the mission planning and control of a satellite or more general spacecraft.

**Grading:** [The following is tentative, and we reserve the right to make small changes during the first few weeks.] The final course grade will be calculated as follows:

- Homework: 29%
- Quiz 1: 18%
- Quiz 2: 22%
- Quiz 3: 22%
- Take-Home Final: 9%
- Class Participation Modifier: ±2%

(Typically, the overwhelming majority have 0% modification; it is very rare to have a negative modifier.)

- Homework will be due at the **beginning** of class. Homework handed in later that day will still be accepted but with a loss of 15% of that homework grade. Homework cannot be handed in later than 6:30PM on the due date. **The policies regarding due time are strict; do not hand your homework in late.**

Not all homework problems will be graded.

- One homework assignment grade (that with the lowest percentage) will be dropped.

- The overall grade for the homework portion of the class will be computed simply by summing the non-dropped homework scores. For example, with four assignments receiving grades of 45/50, 39/40, 50/100 and 68/70, the overall homework grade would be 152/160 (i.e., 95%).
As always, although you may discuss problems together, the work you hand in must be clearly your own. This has occasionally led to difficulties in the past, so please take care.

The homework assignments will require both numerical analysis and software implementation.

**Content:** The equations of Orbital Mechanics will be discussed with an emphasis on the propagation of spacecraft trajectories. First, the differential equations which describe the motion will be given. This will be followed by the standard solution for the case of two spherical bodies and a discussion of numerical methods appropriate for more complex situations. The relevant coordinate systems and transformations between them will be covered. We may also discuss orbital maneuvers at this point.

Other possible topics include trajectory optimization, navigation, spacecraft control, and flight through planetary atmospheres.

**References:** Bate, Mueller and White; Fundamentals of Astrodynamics, Dover, 1971 (Inexpensive and handy!).
Prussing and Conway – Orbital Mechanics.
Bryson and Ho – Applied Optimal Control (unlikely topic).