# ASTRONOMY 0087: Basics of Space Flight (Spring 2018)

**Lecture Class:** Tu, Th, 2:30-3:45 pm, 104 Thaw Hall
**Recitation Class:** As assigned. See below.


**Instructor:** John G. Radzilowicz, EdM
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**Office Hours:** The Instructor will hold office hours in 834 Alumni Hall on Wednesdays from 3:30-4:30 pm, and by appointment as needed. Please schedule appointments in person, either before or after class, or by email. The course TA will schedule and post office hours during the first week of class.

**Text Book:** There is no required text to purchase for this course. Instead, lectures are based, in part, on two FREE online resources:

First, *Basics of Spaceflight* (2016), a text designed specifically for this course, by Professor Emeritus Regina E. Schulte-Ladbeck. Dr. Schulte-Ladbeck taught this course at Pitt for many years. Her book is available online at https://reslscience.weebly.com/space-books.html.

Second, we will make use of the NASA-JPL Tutorial, "Basics of Space Flight", that is available online at http://www.jpl.nasa.gov/basics/.

Readings will be assigned, as appropriate, through CourseWeb.

**Course Description:** This is a self-contained course for students not majoring in the physical sciences. The course focuses on identifying and understanding the general concepts associated with space flight. The course explores the history and technology of space flight, including both human and robotic missions. The course is conceptual and descriptive in nature but, since physics and astronomy are quantitative sciences, some of the lectures will make use of simple arithmetic and geometry.

Topics covered include: an introduction to the nature of scientific inquiry, a brief overview of the Universe and the solar system, the history of space flight, U.S. and foreign space policy, gravitation and mechanics, rocket propulsion, the Moon landings, interplanetary trajectories and planetary orbits, remote sensing, interstellar space travel, and life in the universe.

Specific examples of orbital and planetary space missions (both human and robotic) and their scientific instruments, goals and results will be discussed. Particular emphasis will be placed on current missions. At the end of the course the students will have a deeper understanding of space flight, its goals and purposes, its difficulties, and its inherent dangers and benefits.

This course fulfills the Physical Science course requirement for School of Arts and Sciences students. It forms an appropriate sequence with Astronomy 0089 (Stars, Galaxies and the Cosmos), Astronomy 0088 (Stonehenge to Hubble), Physics 0081 (Space and Time, Light and Matter) or Physics 0089 (Physics and Science Fiction).

**Content Areas:**

I. The Nature and Process of Science.
II. Our Place in the Cosmos – Size, Structure, and Motion of the Earth-Moon System, the Solar System, and the Universe.
III. The History and Development of Rocket Science.
IV. Politics and Space Policy.
V. Astrodynamics – the Physics of Space Flight and Interplanetary Travel.
VI. Applications, Benefits, and Dangers – Communication, Research and Exploration, Robotic and Human Space Flight past and present.
VII. The Future: Deep Space, Life in the Universe, and Interstellar Travel.

**Course Learning Objectives:**

By the end of this course, students will be able to…

1. Identify and describe the key steps and unique processes of scientific inquiry.
2. Describe the basic features – such as size, shape, structure and motion – of space from the local to galactic scales, and explain our place in it.
3. Relate the overall history of rocket science in broad outline, and identify the key stages in its development, including modern space policy.
4. Apply the basic laws of physics to solve fundamental problems in astrodynamics.

5. Analyze the applications, benefits, and dangers of robotic and human spaceflight - past, present and future.

**Course Notes and Other Materials:** The course Syllabus**,** PowerPoint lecture files, external links, and any other relevant course materials will be found posted on CourseWeb. Students should also consult CourseWeb regularly for announcements or updates. Assigned reading material will be clearly identified and may appear on the Exams.

**Recitation Class Sections:** Each student should be signed up for one of the recitation class sections which are offered on Wednesdays, 12:00-12:50 pm or 1:00-1:50 pm, in 11Thaw Hall. The recitation classes provide time for: discussion of readings/homework assigned in the lecture class, discussion of questions on lecture class topics, more detailed consideration of any in-class demonstrations, and several exercises/quizzes throughout the semester dealing with class material in more depth. They will also be used for Exam review sessions.

Attendance at recitation is for your benefit, and is **not** mandatory. However, attendance is strongly recommended, and material covered in recitations may appear on Exams. **Recitation sessions will begin the week of January 15th.**

**Exams and Exam Policy:** Students must bring their **ID cards** to all Exams, and must have their **PeopleSoft Number**. Four Exams of equal point value (50 points for each Exam) will be given and the lowest grade will be dropped (**leaving 150 total Exam points counted toward the Course Grade**).

The first three Exams will each cover one-third of the course material, but the final Exam will be **cumulative**. The Exam questions will be multiple-choice.

**The FINAL EXAM is optional for those who are satisfied with their 3 previous exam scores. Because of the policy of dropping the lowest Exam grade, make-up Exams will NOT be given in this course, except under extreme circumstances as determined by the instructor.**

**The tentative Exam dates are:**

_ Exam 1: **Thursday, February 8**, 2:30-3:45 pm (104 Thaw Hall)
_ Exam 2: **Thursday, March 15**, 2:30-3:45 pm (104 Thaw Hall)
_ Exam 3: **Thursday, April 12**, 2:30-3:45 pm (104 Thaw Hall)
_ Cumulative Final Exam: **Thursday, April 19**, 2:30-3:45 pm (104 Thaw Hall)

**N.B. – The Final Exam will *only* be administered on the last regularly scheduled class date as listed above.**

**Attendance Policy:** Recitation attendance is not required, as stated above. Lecture attendance will be taken intermittently. Students will be allowed two unexcused absences. Thereafter, each absence will result in a deduction of **5 points** from the grade point total. **Students are responsible for all material discussed in the lectures**. If you miss a class, ask a fellow student for the notes!

**There are no classes on March 6th and 8th due to Spring Break.**

**Course Grading Policy:** The final course grade will be determined in accordance with the School of Arts & Sciences Policies, and the PHYAST departmental guidelines. The final grade will be based on total point scores at the end of the course. The distribution of total points for the purpose of grading is: Three Best Exams, **150 maximum points**. Letter Grades will be assigned by percentage average as follows:

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|---|---|---|---|---|
| **A+** | 4.00 | **Superior** | 97-100% | 145-150 points |
| **A** | 4.00 | | 93-96% | **139-144 points** |
| **A-** | 3.75 | | 90-92% | 135-138 points |
| **B+** | 3.25 | **Meritous** | 87-89% | 130-134 points |
| **B** | 3.00 | | 83-86% | **124-129 points** |
| **B-** | 2.75 | | 80-82% | 120-123 points |
| **C+** | 2.25 | **Adequate** | 77-79% | 115-119 points |
| **C** | 2.00 | | 73-76% | **109-114 points** |
| **C-** | 1.75 | | 70-72% | 105-108 points |
| **D+** | 1.25 | **Minimal** | 67-69% | 100-104 points |
| **D** | 1.00 | | 63-66% | **94-99 points** |
| **D-** | 0.75 | | 60-62% | 90-93 points |
| **F** | 0.0 | **Failure** | 59% and Below | **89 points or less** |

**ACADEMIC INTEGRITY:**
All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process , initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity http://www.pitt.edu/~provost/ail.html. This may include, but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

**DISABILITY SERVICES:**
Disability Statement - If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 140 William Pitt Union,

(412) 648-7890, drsrecep@pitt.edu, (412)228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

**STATEMENT ON CLASSROOM RECORDING:**

This course will adhere to the University's Senate Educational Policy Committee recommendation on classroom recording of May 4, 2010:

*To ensure the free and open discussion of ideas, students may not record classroom lectures, discussions, recitations, and/or other activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.*

**INTELLECTUAL PROPERTY POLICY:**

Per the University's policies regarding copyright and intellectual property, http://www.library.pitt.edu/copyright-pitt, the instructor retains the rights to all original course materials – including, but not limited to, lectures, lecture notes, Power Point or other presentations, assignments, exams, papers, diagrams, etc. – and none of this material may be used, shared, or reproduced in any way, for other than a student's own private educational use.

In addition, all legal rights for any and all third-party materials, whether used by direct permission or under the Fair Use educational rules, is fully retained by the original authors. None of this material may be used, shared, or reproduced, in any way, for other than a student's own private educational use unless granted by the original authors or sources.