

*University of Michigan*  
**SPACE 101: Introduction to Rocket Science**  
**Fall 2020**

**Instructor:**

Prof. Chris Ruf, Department of Climate and Space Sciences and Engineering  
Email: cruf@umich.edu

**Lectures:**

11:00 am to noon, Monday-Wednesday-Friday

Remote synchronous: zoom link: <https://us02web.zoom.us/j/87062373467>; passcode: Rocket Sci

Remote asynchronous: All lectures will be recorded and posted on the course Canvas site

**Instructor Office Hours:**

Wednesdays at noon – 1:00 pm, M-W (right after class)

Also: By appointment (set up after class or by email)

**Text:**

No textbook for this class. Just lecture notes and lectures.

**Grading Apportionment:**

Midterm Exam #1     25%

Midterm Exam #2     25%

Midterm Exam #3     25%

Final Exam            25% (drop lowest of 4 exam scores)

Homework             25% (9 ~weekly assignments, drop lowest homework score)

All homework and exam problems are multiple choice. Homework sets will be ~15 problems and exams will be ~30 problems.

**Major Topics:**

History of rocketry (from pre-WWII beginnings to the post-shuttle era)

Some basic physics (forces, thrust, orbits, even some relativity)

Engines (most rocket engines, but engines of all kinds for comparison)

Orbit types (LEO, MEO, GEO, and HEO/Molniya, to name a few)

Space environment (the natural hazards that space missions encounter)

Manned space missions

Scientific satellite missions

**Milestone Dates:**

Midterm Test #1: October 2 (Friday)

Midterm Test #2: October 30 (Friday)

Thanksgiving Break: November 23-27 (no classes)

Midterm Test #3: December 7 (Monday)

Final Exam: Wednesday, December 16 @ 1:30-3:30 pm (2-hour exam)

Homework: assigned almost every Wednesday, due the following Wednesday by 11 am

**Homework and Exams**

The exams will be very similar to the homework sets in terms of level of difficulty. It's okay to talk to others in the class when attempting the homework sets, but do the work yourself. The exams are take on-line; referring to the class presentations is okay, a calculator is okay (off-line phones can be used as a calculator), but don't access the rest of the internet or other referece

material. I will have a review session before each exam and a recap of the answers after each exam. Questions or concerns about specific problems can be raised during the recap or later.

### **Religious Absence**

Students who expect to miss classes as a consequence of their religious observance will be provided with a reasonable alternative opportunity to make up any missed academic work. It is the obligation of students to provide the instructor with reasonable notice of the dates on which they will be absent. We will determine a mutually agreeable make up opportunity within the boundaries of the class.

### **School-Function-Related Absence**

If you are traveling with a U-M sports team or attending a research conference or other school-related activity, we will make arrangements to accommodate missed academic work. It is the obligation of students to provide the instructor with reasonable notice of the dates on which they will be absent. We will determine a mutually agreeable make up opportunity within the boundaries of the class.

### **Disability Access**

If you think you may need an accommodation for a disability, then please inform the instructor early in the term. You should contact the Services for Students with Disabilities (SSD) office to be issued a Verified Individual Services Accommodation (VISA) form, to be given to the instructor. We will do everything we possibly can to accommodate all such requests.

### **Student Sexual Misconduct Policy**

Title IX prohibits discrimination on the basis of sex, which includes sexual misconduct – including harassment, domestic and dating violence, sexual assault, and stalking. We understand that sexual violence can undermine students' academic success and we encourage anyone dealing with sexual misconduct to talk to someone about their experience, so that they can get the support they need. Confidential support and academic advocacy can be found with the Sexual Assault Prevention and Awareness Center (SAPAC) on their 24-hour crisis line 734-936-3333 and at <https://sapac.umich.edu>. Alleged violations can be reported to the Office for Institutional Equity (OIE) at [insitutional.equity@umich.edu](mailto:insitutional.equity@umich.edu)

### **Student Mental Health and Wellbeing**

If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, then services are available. For help, please contact Counseling and Psychological Services (CAPS) at 734-764-8312 or online at <https://caps.umich.edu>. You may also consult University Health Service (UHS) at 734-764-8320 and at <https://www.uhs.umich.edu/mentalhealthsvcs>, or for alcohol or drug concerns, see [www.uhs.umich.edu/aodresources](http://www.uhs.umich.edu/aodresources). For a listing of other mental health resources available on and off campus, visit <http://umich.edu/~mhealth/>

## SPACE 101 Course Outline (Fall 2020)

Date	#	Topic	HW due date
M Aug 31	1	Course administrative overview	
W Sep 2	2	Course content overview	
F Sep 4	3	Space program in the USA, satellite of the week (SotW)	
M Sep 7	4	History: rocketry before WW II	
W Sep 9	5	Rocket science: force, acceleration, velocity, and position	
F Sep 11	6	Science Application of the Week	
M Sep 14	7	History: rocketry during WW II	
W Sep 16	8	Rocket science: forces, vectors, and drag	HW #1
F Sep 18	9	Satellite Application of the Week	
M Sep 21	10	History: the Space Race begins	
W Sep 23	11	Rocket science: thrust	HW#2
F Sep 25	12	Science Application of the Week	
M Sep 28	13	History: Space Race successes and failures	
W Sep 30	14	Review for midterm exam #1	HW#3
F Oct 2		<b>Midterm Test #1 (in class)</b>	Exam #1
M Oct 5	15	History: Going to the Moon	
W Oct 7	16	Rocket science: Orbital mechanics	
F Oct 9	17	Satellite Application of the Week; recap of exam #1	
M Oct 12	18	The Earth as a Planet	
W Oct 14	19	Rocket science: engine physics	HW#4
F Oct 16	20	Toy Rockets	
M Oct 19	21	History: Life after Apollo (Soyuz, Skylab, Shuttles)	
W Oct 21	22	Rocket science: Orbits	HW#5
F Oct 23	23	Science Application of the Week	
M Oct 26	24	History: modern NASA spaceflight	
W Oct 28	25	Review for midterm exam #2	HW#6
F Oct 30		<b>Midterm Test #2 (in class)</b>	Exam #2
M Nov 2	26	History: modern commercial spaceflight	
W Nov 4	27	Rocket engines, pt 1: solid v liquid rocket engines	
F Nov 6	28	Satellite Application of the Week; recap of exam #2	
M Nov 9	29	Rocket engines, pt 2: basics of engine and nozzle design	
W Nov 11	30	Rocket science: ion engines	HW#7
F Nov 13	31	Science Application of the Week	
M Nov 16	32	Rocket science: advanced propulsion techniques	
W Nov 18	33	Rocket science: guidance and control	HW #8
F Nov 20	34	Satellite Application of the Week	
		<b>Thanksgiving Break, no class</b>	
M Nov 30	35	Space weather effects: near-Earth space considerations	
W Dec 2	36	Asteroids and near-Earth objects; Planetary space environments	HW #9
F Dec 4	37	Review for midterm exam #3	
M Dec 7		<b>Midterm Test #3 (in class)</b>	Exam #3
W Dec 16		<b>Final Exam, 1:30 – 3:30 pm (per schedule)</b>	Final Exam

## **SPACE 101: Introduction to Rocket Science Course Conduct Statement**

Prof. Chris Ruf      cruf@umich.edu

---

The College of Engineering has an honor code. This is taken seriously. See the website:  
<http://www.engin.umich.edu/students/honorcode/code/>

### **Policy on Homework**

You are encouraged to form study groups to work on homework problems and to study in other ways. You are allowed to consult with other students during the conceptualization of a problem. However, all written work, whether in scrap or final form, is to be generated by you alone. You are not allowed to possess, look at, use, or in anyway derive advantage from the existence of solutions prepared in prior years, whether these solutions were former students' work product or copies of solutions that had been made available by others.

Unless arrangements are made with me beforehand, no late homework will be accepted.

### **Policy on Exams**

You are to complete all examinations on your own, with only benefit of the allowed aids (lecture notes only), and without looking at or talking about the examination work of others. If you see a violation of the Honor Code, then you are obligated to report it.

For those needing special accommodations, please provide me with the proper form well in advance of the first exam so that arrangements can be made.

All of the exam dates are set. If you know that you will miss one (due to athletic travel, religious observances, etc.), then please let me know well in advance so that we can make arrangements. If you miss one due to a medical emergency, then you need a doctor's note explaining the situation.

During an exam, the instructor will be online in the zoom meeting and monitoring the chat room to answer questions. If an answer to a question is relevant to everyone, then it will be broadcast via the chat room.

### **Violations**

Violation of this policy is grounds for the initiation of a report filed with the Dean's office and the case would come before the Honor Council of the College of Engineering. If you have any questions about this policy, please do not hesitate to contact me.