

## Contact Information

**Name:** Prof. James Nabity

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## Instructor Bio

My current research supports human spaceflight. In the past, I developed advanced propulsion technologies and systems while employed by the Naval Air Warfare Center Weapons Division (1983-1999) and working for a small business (1999-2013). These include airbreathing systems (ramjets, scramjets, ducted rockets, expendable turbines, augmentors, advanced fuels and catalysts), solid composite rocket motors, bipropellant motors (ask me about Harley Davidson some time) and electro spray thrusters.

## Communication Policies

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1. Preferred method of contact: email
  2. Additional contact options:
    1. Canvas Discussions
    2. 303-492-3243 (office; limited availability)
  3. I strive to respond to emails the same day, however it may be the next business day if after hours or weekends
  4. Please follow up if no response within 24 hrs
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## Course Description

Describes aerothermodynamics and design of rocket engines. Includes cold gas, liquid, and nuclear thermal rockets as well as electric thrusters and solar sails.

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## Course Objectives

This course teaches the theory, analysis and design of modern rocket and spacecraft propulsion systems. Specific emphasis will be placed on fundamental cycle analyses,

component and propulsion system level understanding, and challenges with propulsion integration. Students will apply thermodynamics, fluid mechanics and/or aerodynamics, heat transfer, and chemistry.

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## Course Outline

1.
    1. Introduction & Overview – Chemical, Electric, Nuclear. Examples.
    2. Fundamentals - Principles of Rocket Propulsion, Ideal Rocket Equation, Single and Multi-Stage Rockets.
    3. Thermodynamics of Rocket Propulsion, Nozzle Theory, Over and Under-expanded Nozzles.
    4. Heat Transfer, Regenerative and Radiative Cooling.
    5. Flight Performance - Basics of Orbital Mechanics, Space Flight, Orbit Perturbations, Orbit Maneuvers.
    6. Non-reacting Rockets – Cold gas & warm gas thrusters. Nuclear Propulsion.
    7. Liquid Propellant Rockets - Monopropellant and Bipropellant. Combustion Thermodynamics. Pressure-fed and Pump-fed Systems. Design and Analysis. Examples.
    8. Electric Propulsion Systems, Electrothermal, Electrostatic and Electromagnetic. Design and Analysis.
    9. Emerging and Exotic Systems, Solar Sails, Directed Laser, Rail Launch.
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## Required Texts

George P. Sutton and Oscar Biblarz (2016), Rocket Propulsion Elements 9th Edition, ISBN-13 978-1118753651

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## Method of Instruction

This course will be taught in person (Section 001) and asynchronously via Lecture Capture (Section 002). The Library course is asynchronous.

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## Student Responsibilities and Class Expectations

Students are responsible for completing assignments, readings, quizzes, exams, discussions, and projects by the posted due date and time. These are expected to take about 9 hours a week—or 135 hours for the semester.

## **Assignments**

- Readings
- Lectures
- Homework
- Quizzes
- Exams
- Project

## **Evaluated Outcomes**

The Department of Aerospace Engineering Sciences has adopted a policy of assigning grades according to “evaluated outcomes” in each course:

- O1 Professional context and expectations (ethics, economics, business environment, etc.)
- O2 Current and historical perspective
- O3 Multidisciplinary, systems perspective
- O4 Written, oral, graphical communication ability
- O5 Knowledge of key scientific/engineering concepts
- O6 Ability to define and conduct experiments, use instrumentation
- O7 Ability to learn independently, find information
- O8 Ability to work in teams
- O9 Ability to design
- O10 Ability to formulate and solve problems
- O11 Ability to use and program computers

Evaluation of these outcomes allows an assessment of your performance and provides a major portion of the process we (the Faculty) use for continuous assessment and improvement of the entire AES curriculum. The model for these outcomes derives from several sources including the “Desired Attributes of an Engineer” as defined by The Boeing Company, and “curriculum reviews” from major aerospace corporations including The Boeing Co., Lockheed Martin Corp., and Ball Aerospace Corp. These inputs were combined with the AES faculty vision of the desired attributes of an

aerospace engineer and the requirements of the Accreditation Board for Engineering and Technology (ABET) to produce this list of evaluated outcomes. Each assignment designed and graded to assess some combination of several or a few of the outcomes.

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## Submission Policies

All homework and exams must be completed on 8.5×11-inch paper and submitted electronically via Canvas unless otherwise specified. Grades and feedback will generally be provided within one week of the due date.

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## Grading Criteria and Points Breakdown

Assignments are graded to an absolute standard designed to indicate your level of competency in the course material. Minor adjustments may be made in the assignment of final grades, yet grading on a “curve” will be limited. The final grade indicates your readiness to continue to the next level in the curriculum. The AES faculty have set these standards based on our education, experience, interactions with industry, government laboratories, others in academe, and according to the criteria established by the ABET accreditation board.

The course grade is primarily dependent on individual measures of competency, i.e. exams and quizzes. The other course assignments are designed to enrich the learning experience and to enhance individual performance, not to substitute for sub-standard individual competency. Accordingly, group assignment grades are only incorporated into the final grade when the individual grade is a C or better. **In other words, if your individual average is below a C, the group-based grade fraction will not be averaged in to your final grade, which will then be based solely on your individual score.** This policy makes it important to use the group assignments to enhance your own learning. If the work in the assignment is split up among group members, be sure that the learning is not also split up, but is shared among the whole group. For these purposes, exams and quizzes are considered ‘individual’ grades (60%) while homework assignments (10%) and project (30%) are considered ‘group’ grades.

Grade Breakdown: Your final grade is determined according to the following percentage breakdown (see below for additional information regarding assignments and individual grade assessment).

Table 1. Grade Breakdown

Type	Description	Percentage
Individual	Quizzes	10%
Individual	Term Exams	50% (25% each)
Group	Project	30%
Group	Homework*	10%
<b>Total</b>		<b>100%</b>

\* Although homework must be submitted individually, it can be discussed and therefore, counts as a 'group' grade.

## Grading Scale

Grades will be assigned as follows

Table - Grading Scale

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Percentage Grade	93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	<60

## Specific Course Policies

1. Homework assignments are due at the start of class on the due date! If you must miss class for an excused absence, you may submit your homework early. **Late homework submittals are not accepted.**
2. **In the case of homework, report, or exam conflicts, you must make arrangements with the professor at least two weeks in advance. There are no unexcused make-up assignments or exams.**
3. Group collaboration is permitted on homework, but efforts are individual. **Every student is expected to turn in their own individual assignment for**

***grading!*** This means you may discuss the means and methods for solving problems and even compare answers, but you are not free to copy someone's work or the solutions manual. **The homework you submit must be your own. Copying material from any resource (including solutions manuals) and submitting it as one's own work is considered plagiarism and is an Honor Code violation. Keep in mind that the more you think about the problems yourself, the more you will learn, and the easier it will be to succeed on exams.**

4. **Collaboration on quizzes or exams, using another student's work as your own, or allowing another student to use your work as their own, is considered academic misconduct and will not be tolerated. If you are caught in any of these activities, you may receive a grade of "F" for the course and a report may be made to the Dean's office for further punitive action.**
5. Always have a calculator and your textbook for lecture and office hours.
6. Use of MATLAB is permitted, but not always desirable. MATLAB code will not suffice for homework solutions without prior permission, please write out your work in "human" readable format (we will not try to decipher your code). MATLAB figures should be legible, and have meaningful axes and legends.
7. Expect new material to be presented in lecture/discussion periods. Some of the material covered in class is not in the textbook. **Quizzes and exams can cover any material in the course including information from the textbook, lecture/discussions, homework, and supplemental handouts. Like the exams, there are no unexcused make-ups for missed quizzes.**
8. A cordial atmosphere is expected at all times within the classroom. Respect and be courteous to other students. Maintain a quiet work atmosphere; excessive noise distracts others.
9. Rationale for course assignments:
  - Reading assignments are to be completed *before* the lecture/discussion since this material will be on the quizzes. The lecture/discussions should help to clarify and supplement what you have read.
  - Homework reinforces classroom instruction such that you may become proficient in the field of propulsion. In addition to the assigned homework, I encourage you to work additional problems for practice. Before beginning any homework assignment, you should read the text and review the examples in the text.
  - Exams and quizzes provide a gauge to determine what *you* have learned.
  - Projects and labs help you to learn how to synthesize and communicate the basic concepts, methods, and tools presented in the course curriculum.

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## Course Plagiarism Policy

Submitted work must be your own. *Copying material from any resource (including solutions manuals) and submitting it as one's own work is considered plagiarism and is an Honor Code violation. Keep in mind that the more you think about the problems yourself, the more you will learn, and the easier it will be to succeed on exams.*

Collaboration on quizzes or exams, using another student's work as your own, or allowing another student to use your work as their own, is considered academic misconduct and will not be tolerated. If you are caught in any of these activities, you may receive a grade of "F" for the course and a report may be made to the Dean's office for further punitive action.

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## Inclusivity

Equitable access to instructor support and course materials will be provided to all propulsion students with goal to establish a cordial atmosphere whether online or within the classroom.

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## Netiquette

All students should be aware that their behavior impacts other people, even online. I hope that we will all strive to develop a positive and supportive environment and will be courteous to fellow students and your instructor. Due to the nature of the online environment, there are some things to remember.

1. Always think before you write. In other words, without the use of nonverbals with your message, your message can be misinterpreted. So please think twice before you hit submit.
2. Keep it relevant. There are places to chat and post for fun everyday stuff. Do not stray from the discussion in the assigned questions.
3. Never use all caps. This is the equivalent of yelling in the online world. It is not fun to read. Only use capital letters when appropriate.
4. Make sure that you are using appropriate grammar and structure. In other words, I don't want to see anyone writing "R U" instead of "are you". There are people in the class that may not understand this type of abbreviation, not to mention it does nothing to help expand your writing and vocabulary skills. Emoticons are fine as long as they are appropriate. A smile 😊 is welcome, anything offensive is not.

5. Treat people the same as you would face-to-face. In other words, it is easy to hide behind the computer. In some cases, it empowers people to treat others in ways they would not in person. Remember there is a person behind the name on your screen. Treat all with dignity and respect and you can expect that in return.
6. Respect the time of others. This class is going to require you to work in groups. Learn to respect the time of others in your group and your experience will be much better. Always remember that you are not the only person with a busy schedule, be flexible. Do not procrastinate! You may be one that works best with the pressures of the deadline looming on you, but others may not be that way. The same is true for the reverse. The key to a successful group is organization, communication and a willingness to do what it takes to get it done.

Website: <http://www.albion.com/netiquette/corerules.html> [Links to an external site.](#)

Compiled by Melissa Landin, Instructor, Dept. of Communication, Inver Hills Community College, [mlandin@inverhills.edu](mailto:mlandin@inverhills.edu)

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## **University Policies**

Please see the link below for syllabus statements.

<https://www.colorado.edu/academicaffairs/about/policies-customs-guidelines/required-syllabus-statements>

## **Classroom Behavior**

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, marital status, political affiliation, or political philosophy.

Additional classroom behavior information:

[Student Classroom & Course-Related Behavior | Compliance, Ethics and Policy | University of Colorado Boulder](#)

[Honor Code and Student Code of Conduct | Student Conduct & Conflict Resolution | University of Colorado Boulder](#)

## Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the [Honor Code](#). adhering to the Honor Code. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: [StudentConduct@colorado.edu](mailto:StudentConduct@colorado.edu). Students found responsible for violating the [Honor Code](#) will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit [Honor Code](#) for more information on the academic integrity policy.

## Artificial Intelligence (AI)

Generative artificial intelligence tools—software that reproduces text, images, computer code, audio, video, and other content—have become widely available. Well-known examples include ChatGPT for text and DALL•E for images. This statement governs all such tools, including those released during our semester together. Keep in mind that the goal of gen AI tools is to reproduce content that seems to have been produced by a human, not to produce accurate or reliable content; therefore, relying on a gen AI tool may result in your submission of inaccurate content. It is your responsibility—not the tool's—to assure the quality, integrity, and accuracy of work you submit in any college course. If gen AI tool use is suspected in completing assignments for this course in ways not explicitly authorized, I will follow up with you. I may contact the Office of Student Conduct & Conflict Resolution to report suspected Honor Code violations. In addition, you must be wary of unintentional plagiarism or data fabrication. Please act with integrity, for the sake of both your personal character and your academic record.

Limited Gen AI Use: You may use gen AI tools for specific functions in this course that will augment your learning, but their use is limited to the following particular tasks:

- Grammar checks but not for rewriting text of the assignment.
- Generating key words and phrases or ideas or outlines for a report is acceptable, BUT the final work must be student-generated, summarizing or synthesizing content as outlined for the assignment.

You are not permitted to use Gen AI for problem-solving on your homework or exams, and you are not permitted to use Gen AI to generate text for any written assignment.

Should you use gen AI tools on an assignment in this class, document your usage with the Chicago Manual of Style (link below) or appropriate citation guidelines as specified in the problem assignment.

<https://www.chicagomanualofstyle.org/qanda/data/faq/topics/Documentation/faq0422.html>  
[Links to an external site.](#)

## **Requirements for Infectious Diseases:**

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all public health orders to reduce the risk of spreading infectious diseases.

The CU Boulder campus is currently mask optional. However, if masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class. Students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct & Conflict Resolution. Students who require accommodation because a disability prevents them from fulfilling safety measures related to infectious disease will be asked to follow the steps in the “Accommodation for Disabilities” statement on this syllabus.

For those who feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the [further guidance of the Public Health Office](#). For those who have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home.

## **Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation**

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, please contact the instructor and/or TFs regarding missed work. Also see [Temporary Medical Conditions](#) on the Disability Services website.

# **Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation**

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits [protected-class](#) discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about university policies, [reporting options](#), and [support resources](#) including confidential services can be found on the [OIEC website](#).

Please know that faculty and graduate instructors must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the [Don't Ignore It](#) page.

## **Religious Accommodations**

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, the due dates for completion of assignments and the take home exam will be scheduled to avoid conflict with the observance of religious holidays. Please notify the instructor should a conflict or need arise due to religious observance obligations.

See the [campus policy regarding religious observances](#) for full details.

## **Preferred Student Names and Pronouns**

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the Registrar's website for instructions on how to change your personal information in university systems.

### **Canvas Privacy Policy**

You can find a copy of the Canvas Privacy Policy on the [Instructure Product Privacy Policy](#) page.

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## **Canvas Accessibility Statement**

You can find a copy of the Canvas Accessibility Statement on the [Accessibility within Canvas](#) page.