

ASEN 5053

ROCKET AND SPACECRAFT PROPULSION

Tuesdays and Thursdays 11:40 AM – 12:55 PM

Course Description:

This course is designed to teach you the theory, analysis and design of modern rocket and spacecraft propulsion systems. We start from the basics of rocket propulsion, including some orbital mechanics to delineate the requirements. We will then discuss thermodynamics of rocket propulsion and nozzle flow theory, followed by in-depth study of various types of rocket and spacecraft propulsion: cold gas, monopropellant and bipropellant liquid rockets, solid and hybrid rockets, electric propulsion, nuclear rockets, and solar sails. If time permits, other exotic propulsion technologies will be dealt with. The goal is to provide you with a broad overview of this fast-changing field, including latest developments at NASA, ULA and SpaceX, as well as in-depth knowledge of rocket and spacecraft propulsion systems. The course is designed to be self-sufficient so that students who may not have taken the prerequisite undergraduate course on propulsion can successfully navigate it, albeit with some more effort, and benefit from it. ULA-sponsored graduate projects in the department, such as HySOR (Hybrid Sounding Rocket) and currently on-going AMARCS (Additively Manufactured Aerospike Reaction Control System), have built upon the knowledge my students gain in this course. Many of my students have ended up working for major corporations such as ULA, SpaceX, Orbital ATK, Boeing and Lockheed Martin.

Instructor:

Dr. Lakshmi Kantha

Professor, Department of Smead Aerospace Engineering Sciences

Office: Aerospace Building Room 463. Cell phone: 720-891-1775 (Please note that because of Covid-19 impact, I will be teaching from home. So it is best to e-mail me. Call me only if you need to contact me on an urgent matter).

E-mail: kantha@colorado.edu.

Office Hours: Tuesdays 3:00 PM to 5:00 PM

In addition, you can e-mail me any time for an appointment at a mutually convenient time. You are also welcome to call me to chat about latest events in the field or on any relevant issue or topic of your interest, but first notify me by e-mail to make sure I am free and available.

Office hours will be conducted remotely and not in the office as per CU regulations. The same applies to office hours with the TA.

Course Assistant (Teaching Fellow):

TBD

Email: TBD

Grading: Homework (8) – 40%, Quizzes (5) – 10%, Mid-Term Exam (1) – 20%, Final Project (or Exam) – 30%

Course Outline:

1. Introduction – History, Classification – Chemical, Electric, Nuclear. Examples
- 2.

8. ***Introduction to Rocket Science and Engineering*** by T. S. Taylor, CRC Press, 2009 (ISBN 978-1-4200-7528-1) Call # TL782.T395 2009 (Rather elementary book but has a good chapter on

