EAS 4939/5938 – ROCKET PROPULSION :: FALL 2020

Instructor Dr. Thomas L Jackson

Office	205B, Particle Science and Technology Building
Credit	Three hours
Location	All classes are online
Email	tlj@ufl.edu
Location	Particle Science Building, Room 205B
TA:	Ms. Jianhui Cheng; chengjianhui@ufl.edu
Office Hours:	TBA

Office Hours: The instructor and TA are available to meet with students via zoom. Students should email instructor questions or to arrange Zoom meetings during office hours or at other times.

It may become necessary to modify this syllabus during the semester. In this event, students will be notified, and the revised syllabus will be posted on the course web site.

Lectures: All lectures have been pre-taped and are available on canvas. The pdf file "LessonSchedule_Fall_2020_RocketPropulsion" gives a week by week guide to the lectures. Homework will be assigned according to the schedule.

Description Basic principles of chemical rocket propulsion and performance, propellants and their influence on design of rockets, combustion processes, design of components, and flight performance.

Necessary Background Vector calculus, differential equations through partial differential equations, incompressible flow theory, compressible flow theory, thermodynamics, MATLAB.

Textbook: **Required:** Heister, Anderson, Pourpoint, Cassady, Rocket Propulsion, 2019
Suggested: Sutton, G.P. and O. Biblarz, Rocket Propulsion Elements, 8th edition.
Class notes are essential!

Grading		
	Homework (assigned regularly)	70%
	Final Exam	20%
	Project (see below)	10%

Homework and Final Exam must be submitted through Canvas.

Homework Policy: If you get a poor grade, redo and resubmit. All resubmissions due by December 9.

The Final Exam will be take home and due the last day of classes Wednesday December 9.

Project

For the class project, you will need to write a review paper on some aspect (nozzle, propellant, design, instability, etc) of a chemical rocket engine (solid, liquid, hybrid) from an archival peer-reviewed article (examples: Journal of Fluid Mechanics, Physics of Fluids, Journal of Computational Physics, any of the AIAA journals, AIAA meeting or conference papers, etc.)

1. Your name
2. Title, authors, journal, year
3. Problem introduction,
4. Solution method,
5. Outcome, and
6. How it relates to class.

EAS 4939 – For undergraduates taking the course as EAS 4939, the project should be between 3-4 pages. The problem and solution method should be short and only descriptive.

EAS 5938 – For graduate students taking the course as EAS 5938, the project should be between 8-10 pages, and must include a rigorous analysis and discussion appropriate for graduate student work.

Honor Code It is assumed that the UF Student Code will be followed at all times, including during completion of homework and during exams.

Course Outline (subject to change by Instructor):

1. Introduction
2. Derivation of conservation equations
    a. Reynolds Transport Theorem
    b. Material control volume
    c. Arbitrary control volume
3. General rocket analysis (Heister, Chapters 2-3; Sutton, Chapters 1, 2, and 4)
    a. fundamental rocket equation
    b. ideal rocket (Tsiolkovsky equation)
    c. Staging
    d. Staging optimization
    e. Trajectories
    f. Numerical methods for trajectories
    g. Control
    h. Derivation of thrust
    i. Impulse and effective exhaust velocity, c
    j. characteristics velocity, c*
    k. specific impulse
    l. chamber pressure
    m. chamber pressure drop
    n. performance parameters
    o. space flight
4. Combustion (Heister, Chapter 5; Sutton, Chapter 5)
5. Nozzles (Heister Chapter 4; Sutton, Chapters 3 & 18)

6. Solids (Heister Chapter 7; Sutton, Chapters 11-15)
7. Liquids (Heister, Chapter 8-10; Sutton, Chapters 6-10)
8. Hybrid (Heister, Chapter 11; Sutton, Chapter 15)

Note: Section 2 and 3(a-i) are contained in my handout notes.

Homework policy and format

Policy Homework will be assigned regularly. Students should make every effort to turn problems in on time. Problems must be submitted in neat, professional form. You are encouraged to discuss problem sets with your classmates, but *you must submit your own work*.

Problems are to be submitted through CANVAS.

University Honesty Policy
UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

COVID-19 related issues:

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.