

SPST612

STUDENT WARNING: This course syllabus is from a previous semester archive and serves only as a preparatory reference. Please use this syllabus as a reference only until the professor opens the classroom and you have access to the updated course syllabus. Please do NOT purchase any books or start any work based on this syllabus; this syllabus may NOT be the one that your individual instructor uses for a course that has not yet started. If you need to verify course textbooks, please refer to the online course description through your student portal. This syllabus is proprietary material of APUS.

Course Summary

Description

Course Description: Even though the Chinese introduced rockets about 800 years ago, most of the important rocket development has taken place in the 20th Century. This course introduces rocket theory including specific impulse, thrust chamber design, nozzle design, heat transfer, and propellant composition and places particular emphasis on the development and use of liquid and solid rockets. The course concludes with a discussion of the future of rocketry including hybrid rockets, thrust vector control, and electric rockets. The material in this course is applicable and essential for any military or civilian Space Operator, Manager, or Designer who wants to achieve a better understanding of how rockets are designed and how they operate. IT IS HIGHLY RECOMMENDED THAT YOU HAVE COMPLETED COLLEGE ALGEBRA PRIOR TO TAKING THIS COURSE

Course Scope:

For students with minimal backgrounds in propulsion, Rocket Propulsion presents the basic principles required to determine how to launch a rocket from Earth's surface and the propulsion requirements necessary to operate a satellite in space. The course begins with basic definitions and elementary principles such as total impulse, mass flow, specific impulse, the *ideal rocket equation*, thrust chamber design, nozzle theory, heat transfer, flight performance, propellant chemistry, and propulsion operation in space. A detailed investigation of rocket fundamentals is necessary to acquaint the student with 21st century technology. This course includes a very detailed investigation of liquid propellant rockets. The material in this course is applicable and essential for any military or civilian space operator, manager, or designer who wants to achieve a very basic understanding of how rocket propulsion works.

Objectives

Upon completion of this course, the student will be able to:

- Explain the fundamental principles of rocketry and key measures of rocket performance.
- Examine liquid rocket design parameters, including types of propellants, engine nozzle shapes and the use of turbopumps.
- Examine chemical rocket design parameters, including types of solid propellants and grain configuration.
- Calculate engine-produced thrust, specific and total impulse, propellant mass flow rate, combustion chamber and tank pressures, propellant mixture ratios, and combustion chamber and nozzle design parameters.

Outline

Week 1:

Readings:

Sutton, Chapter 1: Classification (all)

Sutton, Chapter 2: Definitions and Fundamentals (all)

Sutton, Chapter 3: Nozzle Theory and Thermodynamic Relations (all)

Assignments:

- Week 1 Forum (class introductions) (available commencement of class)
- Homework #1 (available Week 1; due end of Week 2)

Week 2:

Readings:

Sutton, Chapter 4: Flight Performance (all)

Assignments:

- Week 2 Forum (due the end of Week 2)
- Homework #1 (due end of Week 2)

Week 3:

Readings:

Sutton, Chapter 5: Chemical Rocket Propellant Performance Analysis (all)

Sutton, Chapter 6: Liquid Propellant Rocket Engine Fundamentals (all)

Assignments:

- Week 3 Forum (due end of Week 3)
- Homework #2 (due end of Week 3)

Week 4:

Readings:

Sutton, Chapter 7: Liquid Propellants (all)

Sutton, Chapter 8: Thrust Chambers (all)

Assignments:

- Week 4 Forum (due end of Week 4)
- Homework #3 (due end of Week 4)

Week 5:

Readings:

Sutton, Chapter 9: Liquid Propellants Combustion and Its Stability (all)

Sutton, Chapter 10: Turbopumps, and Their Gas Supplies (all)

Assignments:

- Week 5 Forum (due end of Week 5)
- Homework #4 (due end of Week 5)

Week 6:

Readings:

Sutton, Chapter 11: Engine Systems, Controls, and Integration (all)

Sutton, Chapter 12: Solid Propellants Rocket Fundamentals (all)

Sutton, Chapter 13: Solid Combustion (all)

Assignments:

- Week 6 Forum (due end of Week 6)
- Homework #5 (due end of Week 6)

Week 7:

Readings:

Sutton, Chapter 14: Solid Propellant Combustion and its Stability (all)

Sutton, Chapter 15: Solid Rocket Components and Motor Design (all)

Sutton, Chapter 16: Hybrid Propellant Rockets (all)

Assignments:

- Week 7 Forum (due the end of Week 7)
- Week 8 Forum (due the end of Week 8)
- Homework #6 (due end of Week 7)
- Homework #7 (due end of Week 8)

Week 8:

Readings:

Sutton, Chapter 14: Solid Propellant Combustion and its Stability (all)

Sutton, Chapter 15: Solid Rocket Components and Motor Design (all)

Sutton, Chapter 16: Hybrid Propellant Rockets (all)

Assignments:

- Week 7 Forum (due the end of Week 7)
 - Week 8 Forum (due the end of Week 8)

 - Homework #6 (due end of Week 7)
 - Homework #7 (due end of Week 8)
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Evaluation

Homework Assignments

There are a total of seven (7) homework assignments for this course, covering in detail all assigned readings -- your answers will clearly indicate whether or not you have kept up with the course schedule. Be sure to take your time with all homework assignments, show all mathematical work, and to double-check all answers before uploading your completed homework.

Forum Postings

Not counting the introductions forum, seven (7) times throughout the course, discussion items will be posted within the classroom. Your responses must be between 100-300 words, be in YOUR OWN WORDS (no quotes), well written and grammatically correct. Opinions are always welcome . . . however, postings providing only opinions will be graded accordingly! ***For the Weeks 2-8 forums, you must also comment on one other student's posting.***

The purpose of the forums is for you to engage your fellow students and learn from them. For this to occur, your interactions in the forums need to be timely. Therefore, all of your postings must be completed by the forum's due date, unless you make a previous arrangement with me for a new due date for the forum. Additionally, postings more than one week after the due date for a forum will NOT be accepted (with the exception of approved course extensions).

Due Dates

All assignments in this course are given to you prior to the due date. The "due date" for all assignments is the week in which the assignment is due. For the purposes of this course, a "**week**" is defined as the time period between Monday – Sunday. The **first week** begins on the first day of the session and ends on 11:55 p.m. (Eastern time zone) the following **Sunday**. As a general rule, I will grade an assignment once everyone has submitted it. ***If you need additional time to complete an assignment, please contact me before the due date so we can discuss your situation and determine an acceptable resolution. If you submit an assignment after the due date without making prior arrangements with me, you will lose points from your final grade for the assignment.***

Maintaining Contact

During this course, we can maintain contact in several ways. **The first and best way is to send me a message using the classroom message system**; the next way is via e-mail; and the last way is by phone. Please don't get me wrong – I don't mind phone calls. But since we are all on different schedules, I ask that you send me a message first to arrange a time to talk. However, most questions are best answered in writing. That way, the information can be referred to again in the future. ***And questions about the course are best discussed in the classroom, so I ask that you send me a message in the classroom to do this.***

Grading:

Name	Grade %
Forum Participation	30.00 %

Week 1 (Introductions) Forum	3.75 %
Week 2 Forum	3.75 %
Week 3 Forum	3.75 %
Week 4 Forum	3.75 %
Week 5 Forum	3.75 %
Week 6 Forum	3.75 %
Week 7 Forum	3.75 %
Week 8 Forum	3.75 %
Homework Assignments	70.00 %
Homework #1	10.00 %
Homework #2	10.00 %
Homework #3	10.00 %
Homework #4	10.00 %
Homework #5	10.00 %
Homework #6	10.00 %
Homework #7	10.00 %

Materials

Book Title: Rocket Propulsion Elements, 8th ed

Author: Sutton, George P

Publication Info: John Wiley & Sons, Inc

ISBN: 9780470080245

Supporting Documents

If/when required, such documents will be posted in the Announcements and/or Lessons area of the classroom as the course progresses.

Supporting Websites

Be sure to use the APUS Online Library Research Center, as well as the APUS Space Studies Program Guide (http://apus.campusguides.com/space_studies) in support of your research efforts.

Selected Bibliography

There are numerous online sources to help you in better understanding the objectives outlined in this course. Please see the APUS Space Studies Program Guide (http://apus.campusguides.com/space_studies) for more information.

Course Guidelines

Citation and Reference Style

- Attention Please: Students will follow the APA Format as the sole citation and reference style used in written work submitted as part of coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the APA Format.

Tutoring

- [Tutor.com](https://www.tutor.com) offers online homework help and learning resources by connecting students to certified tutors for one-on-one help. AMU and APU students are eligible for 10 free hours* of tutoring provided by APUS. Tutors are available 24/7 unless otherwise noted. Tutor.com also has a SkillCenter Resource Library offering educational resources, worksheets, videos, websites and career help. Accessing these resources does not count against tutoring hours and is also available 24/7. Please visit the APUS Library and search for 'Tutor' to create an account.

Late Assignments

- Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. The due date for each assignment is listed under each Assignment.
- Generally speaking, late work may result in a deduction up to 20% of the grade for each day late, not to exceed 5 days.
- As a working adult I know your time is limited and often out of your control. Faculty may be more flexible if they know ahead of time of any potential late assignments.

Turn It In

- Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. This is automatically processed through the Assignments area of the course.

Academic Dishonesty

- Academic Dishonesty incorporates more than plagiarism, which is using the work of others without citation. Academic dishonesty includes any use of content purchased or retrieved from web services such as CourseHero.com. Additionally, allowing your work to be placed on such web services is academic dishonesty, as it is enabling the dishonesty of others. The copy and pasting of content from any web page, without citation as a direct quote, is academic dishonesty. When in doubt, do not copy/paste, and always cite.

Submission Guidelines

- Some assignments may have very specific requirements for formatting (such as font, margins, etc) and submission file type (such as .docx, .pdf, etc) See the assignment instructions for details. In general, standard file types such as those associated with Microsoft Office are preferred, unless otherwise specified.

Disclaimer Statement

- Course content may vary from the outline to meet the needs of this particular group.

Communicating on the Forum

- Forums are the heart of the interaction in this course. The more engaged and lively the exchanges, the more interesting and fun the course will be. Only substantive comments will receive credit. Although there is a final posting time after which the instructor will grade comments, it is not sufficient to wait until the last day to contribute your comments/questions on the forum. The purpose of the forums is to actively participate in an on-going discussion about the assigned content.
- "Substantive" means comments that contribute something new and hopefully important to the discussion. Thus a message that simply says "I agree" is not substantive. A substantive comment contributes a new idea or perspective, a good follow-up question to a point made, offers a response to a question, provides an example or illustration of a key point, points out an inconsistency in an argument, etc.
- As a class, if we run into conflicting view points, we must respect each individual's own opinion. Hateful and hurtful comments towards other individuals, students, groups, peoples, and/or societies will not be tolerated.

University Policies

[Student Handbook](#)

- [Drop/Withdrawal policy](#)
- [Extension Requests](#)
- [Academic Probation](#)
- [Appeals](#)
- [Disability Accommodations](#)

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