

# SPST310

**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.

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## Course Summary

**Course :** AW690 **Title :** Rocket Propulsion

**Length of Course :** 8 Professors Various

**Prerequisites :** **Credit Hours :** 3

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## Description

**Course Description:** This is a survey course of rocket propulsion that covers the history of rockets, the basic science of rocket propulsion including Newton's Third Law, basic fluid mechanics, the ideal rocket equation, nozzle design and impulse, types of rockets including thermodynamic and electrodynamic, and exotic propulsion methods such as solar sails, tethers and the future of antimatter propulsion. As an introductory survey course, the objectives of this class are geared towards gaining a conceptual understanding of these topics and how rocket propulsion works, rather than memorizing a lot of facts.

### Course Scope:

This is a survey course of rocket propulsion that covers the history of rockets, the basic science of rocket propulsion including Newton's Third Law, basic fluid mechanics, the ideal rocket equation, nozzle design and impulse, types of rockets including thermodynamic and electrodynamic, and exotic propulsion methods such as solar sails, tethers and the future of antimatter propulsion.

As an introductory survey course, the objectives of this class are geared towards gaining a conceptual understanding of these topics and how rocket propulsion works, rather than memorizing a lot of facts.

We will be using some mathematics, although all of the math in the class will be at the level of college algebra or below. Each student should have a scientific calculator.

As noted in the course outline, there will be eight graded forums, four quizzes, a midterm exam, a final exam, and one research paper.

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## Objectives

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

1. Summarize the contributions of early rocket pioneers
2. Apply Newton's Third Law to the basic principles of rocket propulsion
3. Compute the propellant mass fraction of a given rocket system
4. Describe the principles of thermodynamic rockets

5. Analyze different types of thermodynamic rocket systems and their operating principles
  6. Describe electrodynamic rocket principles
  7. Use operating principles of electrodynamic rocket systems to distinguish structures and operations of electrodynamic rockets
  8. Examine exotic or future rocket technologies
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## Outline

### Week 1: History of Rockets and Pioneers of Rocketry

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#### Course Objectives

CO-1: Summarize the contributions of early rocket pioneers

#### Readings

##### eBook pages

16 - 20,

41

#### Assignment

Forum Post #1: two parts: (1) personal introduction; and

(2) choose one rocket pioneer and discuss his contributions to rocketry

### Week 2: Basic Principles of Rocket Propulsion

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#### Course Objectives

CO-2: Apply Newton's Third Law to the basic principles of rocket propulsion

#### Readings

##### eBook pages

43 - 51,

73 - 77,

152 - 159

#### Assignment

Forum Post #2: choose one topic: (1) explain the connection between rocket thrust and Newton's Third Law, or (2) discuss the connection between thrust and momentum

Assignment: Research paper - subject approval

#### Quiz #1

### Week 3: The Ideal Rocket Equation

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#### Course Objectives

CO-3 Compute the propellant mass fraction of a given rocket system

Readings

eBook pages

54,

77 - 81

Assignment

Forum Post #3: Discuss each term in the Ideal Rocket Equation. What is the importance of the equation? Why is it called "Ideal"?

Quiz #2

## **Week 4: Types of Rockets and Thermodynamic Expansion (nozzles)**

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Course Objectives

CO-4: Describe the principles of thermodynamic rockets

Readings

eBook pages

83 - 94,

159 - 161

Assignment

Forum Post #4: Discuss the purpose of nozzles in thermodynamic rockets

Assignment: Research paper - outline and draft bibliography

Quiz #3

## **Week 5: Thermodynamic Rockets**

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Course Objectives

CO-4: Describe the principle of thermodynamic rockets

CO-5: Analyze different types of thermodynamic rocket systems and their operating principles

Readings

eBook pages

106 - 114,

172 - 185

Assignment

Forum Post #5: Choose one specific thermodynamic rocket; describe how it works and how it's been used in actual systems or proposed for future systems

## Midterm Exam

### **Week 6: Electric Rockets**

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#### Course Objectives

CO-6: Describe electrodynamic rocket principles

CO-7: Use operating principles of electrodynamic rocket systems to distinguish structures and operations of electrodynamic rockets

#### Readings

eBook pages

114 - 120,

163 - 166,

185 - 190

#### Assignment

Forum Post #6: Choose one of the following topics:

- What is the difference between an ion thruster and a plasma thruster?

or

- Describe the Hall Effect thruster; what spacecraft have used this system, and why was it chosen over a different technology ?

Assignment: Research paper - draft and final bibliography

Quiz #4

### **Week 7: Exotic and Future Propulsion Methods**

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#### Course Objectives

CO-8: Examine exotic or future rocket technologies

#### Readings

eBook pages

120 - 124,

190 - 193

#### Assignment

Forum Post #7: Choose one "exotic" or future propulsion method; discuss the principles and potential uses of the technology

Quiz #5

### **Week 8: Final Exam and Research Paper**

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## Course Objectives

(All Course Objectives)

Readings

None

Assignment

Forum Post #8: Course wrap-up and comments

Final Exam

Research Paper - final

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## Evaluation

**Forums:** For each forum, you are required to post your own response to the given topic and to respond to at least two of your classmates. Your main post must be at least 200 words, and your responses must be substantive (not merely “Good post”).

**Exams and Quizzes:** the quizzes, midterm exam and final exam will be open-book, open-resource. The short-answer questions will require well-researched and detailed answers.

**Research paper subject approval:** the student will select a topic directly related to rocket propulsion and submit the proposal as a written assignment not later than the end of week 2. The proposal will include the topic, the reason the topic was chosen, and a draft abstract (a concise summary that describes the scope of the paper and identifies the objective or intended results).

Research paper - outline and draft bibliography: no later than the end of week 4, the student will provide the following:

- a draft outline of the paper, including the major topic areas to be discussed
- an initial bibliography

Research paper - draft and final bibliography: no later than the end of week 6, the student will submit the following:

- the first draft of the research paper
- final bibliography

**Research paper - final:** not later than the end of the course (week 8), the student will submit the final paper, which must be related to the course subject area. The final paper must not be less than 10 pages in length, not including title page and bibliography/references. There must be a minimum of two published (not web site) references, such as textbooks or papers published in professional journals, and at least five total sources, which may also include magazine or web articles.

Final paper grading: the research paper will be graded on the following criteria:

- Research: did the student conduct important and relevant research in the area?
- Analysis: did the student thoroughly analyze and evaluate the data?
- Conclusions: did the student make original, logical, rational and convincing arguments based on the analysis?
- Was the paper well-written in a clear, logical style using proper grammar, spelling and punctuation?  
Was the paper properly formatted and referenced?

## Grading:

Name	Grade %
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## Materials

**Book Title:** Introduction to Rocket Propulsion - the VitalSource e-book is provided via the APUS Bookstore

**Author:**

**Publication Info:** McGraw-Hill

**ISBN:** 9781308656977

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**Book Title:** You must validate your cart to get access to your VitalSource e-book(s). If needed, instructions are available here - <http://apus.libguides.com/bookstore/undergraduate>

**Author:** N/A

**Publication Info:** N/A

**ISBN:** N/A

The e-book will be provided through VitalSource. The following links provide information on the new bookstore process and a demo video:

<http://apus.campusguides.com/bookstore/undergraduate>

[https://apus.adobeconnect.com/\\_a795569749/ugedmap1/](https://apus.adobeconnect.com/_a795569749/ugedmap1/)

See the Course Materials in the Sakai classroom Lessons area for further instructions on accessing the eBook.

Websites: Must be government or industry sites; e.g. NASA, NOAA, Boeing, etc.

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## 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](http://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.

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## **University Policies**

### [Student Handbook](#)

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

- [Disability Accommodations](#)

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