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SPST 615

Course Summary

Course: SPST615
Length of Course: 8
Prerequisites: N/A

Title: Aerodynamics
Faculty:
Credit Hours: 3

Description

Course Description:

This course introduces the student to core concepts of aerodynamics, including fundamentals of inviscid, incompressible flow; compressible flow; shock waves/properties; compressible flow through nozzles, diffusers, and wind tunnels; subsonic compressible flow over airfoils; linear theory; elements of hypersonic flow, and boundary layers. IT IS HIGHLY RECOMMENDED THAT YOU HAVE PREVIOUSLY COMPLETED COLLEGE ALGEBRA AND CALCULUS I BEFORE TAKING THIS COURSE.

Course Scope:

This course fulfills a portion of the concentration requirements for the Master of Science in Space Studies – Capstone Option. At the end of this course the student will have a fundamental understanding of the aerodynamic forces and properties as they relate to aircraft and selected spacecraft.

Objectives

Upon completion of this course, you will be able to:

- **CO-1** Describe the concepts and applications of aerodynamics
- **CO-2** Apply critical thinking skill to the analysis of aerodynamic theory
- **CO-3** Apply aerodynamic theory and equations to real-world scenarios
- **CO-4** Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- **CO-5** Judge aerodynamic effectiveness of various aeronautical designs
- **CO-6** Demonstrate graduate-level critical thinking and writing

Outline

Week 1: Introductory Aerodynamic Concepts and Fundamental Principles/Equations

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).

Chapter 1, Aerodynamics: Some Introductory Thoughts

Omit Sections 1.7 and 1.9

Chapter 2, Aerodynamics: Some Fundamental Principles and Equations

Omit Sections 2.7 thru 2.10

Deliverables:

Discussion: Introductions / Aircraft of Interest

Assignments: Week 1 Short Paper

Tests/Quizzes: None

Week 2: Fundamentals of Incompressible Flows

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).

Chapter 3, Fundamentals of Inviscid, Incompressible Flow

Omit Sections 3.15 thru 3.18

Deliverables:

Discussion: Lift per Unit Span

Assignments: Week 2 Homework Assignment

Tests/Quizzes: None

Week 3: Incompressible Flows over Airfoils

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Chapter 4, Incompressible Flow over Airfoils

Deliverables:

Discussion: Bernoulli and Pitot Tubes

Assignments: Week 3 Homework Assignment

Tests/Quizzes: Week 3 Quiz (Covers all material from Weeks 1-3)

Week 4: Incompressible Flows over Finite Wings

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Chapter 5, Incompressible Flow over Finite Wings

Deliverables:

Discussion: Airfoil Calculations

Assignments: Week 4 Homework Assignment

Tests/Quizzes: None

Week 5: Compressible Flows and the Normal Shock Wave

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Chapter 7, Compressible Flow: Some Preliminary Aspects
Chapter 8, Normal Shock Waves and Related Topics

Deliverables:

Discussion: Velocity Measurements in Compressible Flows

Assignments: Week 5 Homework Assignment

Tests/Quizzes: Week 5 Quiz (Covers all material from Weeks 4-5)

Week 6: Oblique/Expansion Shock Waves and Compressible Flows through Nozzles

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Chapter 9, Oblique Shock and Expansions Waves
Omit Sections 9.6 thru 9.14
Chapter 10, Compressible Flow Through Nozzles, Diffusers, and Wind Tunnels

Deliverables:

Discussion: Oblique Shock Waves / Educational Goals

Assignments: Week 6 Homework Assignment

Tests/Quizzes: None

Week 7: Linear Theory and Boundary Layers

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Chapter 11, Subsonic Compressible Flow over Airfoils: Linear Theory
Omit Sections 11.7 thru 11.16
Chapter 17, Introduction to Boundary Layers

Deliverables:

Discussion: Critical Mach

Assignments: Week 7 Homework Assignment

Tests/Quizzes: Week 7 Quiz 3 (Covers all material from Weeks 6-7)

Week 8: Aircraft Design Ideas

Objectives

- CO-1: Describe the concepts and applications of aerodynamics
- CO-2: Apply critical thinking skill to the analysis of aerodynamic theory Description
- CO-3: Apply aerodynamic theory and equations to real-world scenarios
- CO-4: Evaluate aerodynamic issues associated with subsonic, transonic and supersonic flight
- CO-5: Judge aerodynamic effectiveness of various aeronautical designs
- CO-6: Demonstrate graduate-level critical thinking and writing

Reading Requirements:

Lesson Readings

Textbook Readings: Anderson, J.D. (2011). *Fundamentals of aerodynamics* (6th ed.).
Sections covered from Chapters 1-4, 5-11, and 17 (Preparation for the Final Exam)

Deliverables:

Discussion: Aircraft Design

Assignments: Week 8 Homework Assignment

Tests/Quizzes: Final Exam (Covers all material from Weeks 1-8)

Evaluation

Grades for this course will be based upon four grading instruments. You must complete all assigned tasks in order to pass the course.

Forums/Class Participation

24 percent of your course grade is earned through participation in the Forum area of the classroom and interaction with your classmates. Your knowledge of assigned readings will be reflected in your ability to actively participate and discuss key course concepts. Postings will occur every week throughout the course. Your initial response to each forum must be at least 250 words and be well written. In addition, you must comment substantively on two other student postings to receive full credit for the forum.

Short Paper

There is a short paper that provides an analysis of a given reading and represent 6 percent of your overall course grade. Each should be approximately 5 - 6 pages (3 full pages of narrative) summarizing what the points noted in the assignment details and your supporting argument or rationale. The paper expands on your readings and shows a better understanding of the topics. Details are provided in the Assignments Tab.

Homework Assignments

Homework assignments make up 30 percent of your overall course grade. Questions will require you to have previously read the chapter(s) assigned in order to comprehend and correctly respond. Each homework assignment will be posted in the Assignments area of the classroom at the end of the Week listed in the Course Outline. Be sure to review the examples provided in the book before working on your homework problems! Details are provided in the Assignments Tab.

Quizzes

There are 3 non-cumulative quizzes in Weeks 3, 5, and 7. All Quizzes are open book/open note. The Quizzes make up 24 percent of your overall course grade and will test your understanding of aerodynamic concepts and theory covered during segments of the course. The Quizzes have 10 to 15 multiple choice questions each.

Final Exam

The Final Exam is an open book/open note, comprehensive exam. The exams are worth a total of 16 percent of your overall course grade and will test your knowledge of the terms and concepts covered during the course. The exams consist of 25 multiple choice questions. You will have 24 hours to complete each exam once first accessed. You can leave and return, but only submit one time.

All assignments in this course are given to you at least 1 Week prior to the due date. The “due date” for all assignments is the end of the Week in which the assignment is due. For the purposes of this course, a “**Week**” is defined as the time period between Monday to Sunday. The **first Week** begins on the first day of the semester and ends on midnight (your local time) the following **Sunday**.

During this course, we can maintain contact in several ways. The best will be through the classroom messaging system; next will be email; last will be phone. Don't get me wrong - I don't mind phone calls, however most questions are best answered in writing so that the information can be referred to again in the future.

Grading

Name	Grade %
Forums	24.00%
Forum 1	3%
Forum 2	3%
Forum 3	3%
Forum 4	3%
Forum 5	3%
Forum 6	3%
Forum 7	3%
Forum 8	3%
Short Paper	6.00%
Short Paper	6%
Homework Assignments	30.00%
Week 2 Homework Assignment	5%
Week 3 Homework Assignment	5%
Week 4 Homework Assignment	5%
Week 5 Homework Assignment	5%
Week 6 Homework Assignment	5%
Week 7 Homework Assignment	5%
Quizzes	24.00%
Quiz 1	8%
Quiz 2	8%
Quiz 3	8%
Exams	16.00%
Final Exam	16%

Materials

Required Text:

Title: Fundamentals of Aerodynamics, 6th Edition
Author: Anderson, J. D., Jr.
Publication Info: McGraw-Hill Education
ISBN: 9781259129919

Recommended Text:

Title: *Publication manual of the American Psychological Association* (7th ed.)
Author: American Psychological Association
Publication Info: American Psychological Association
ISBN: 978-1-4338-3217-8 (Spiral Bound)

Software Requirements:

Microsoft Word
 Adobe Acrobat Reader

Course Guidelines

Citation and Reference Style

- You will follow the APA 7th Edition Style and Formatting Rules as the sole citation and reference style guide for the Written Assignment and Discussions submitted as part of your coursework to the University. Assignments completed in a narrative essay or composition format must follow the citation style cited in the 7th Edition of the APA Publication Manual.

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

- You 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 10% of the grade for each day late, not to exceed 7 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

- Short Papers and your Research Paper will 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 in the Forums

- 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 viewpoints, 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.

Identify Verification & Live Proctoring

- Faculty may require students to provide proof of identity when submitting assignments or completing assessments in this course. Verification may be in the form of a photograph and/or video of the student's face together with a valid photo ID, depending on the assignment format.
- Faculty may require live proctoring when completing assessments in this course. Proctoring may include identity verification and continuous monitoring of the student by webcam and microphone during testing.

University Policies

Student Handbook

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

The mission of American Public University System is to provide high quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.