San José State University
Aerospace Engineering Department
AE 166, Rocketry, Spring 2018

Course & Contact Information

Instructor: Jay Westerwelle
Office Location: Engr. 272F
Email: Jay11west11@gmail.com
Class Days / Time: F 13:30 – 16:15
Classroom: TBA
Prerequisite: AE 165
Credit: 3 units
Text: Instructor Notes

Course Description

Introduction to rocketry through theory, computer simulations, and development / launch of an amateur level rocket. Topics include basic principles of aerodynamics, vehicle structures, rocket propulsion, flight mechanics, avionics, as well as past and current launch vehicle technologies.

Course Learning Objectives

1. Explain the history and current purpose of launch vehicles in industry.
2. Explain Newton’s Laws and how they apply to launch vehicles.
3. Define and estimate the aerodynamic forces of a launch vehicle.
4. Define and calculate the center of gravity and the center of pressure of a launch vehicle.
5. Explain the in-flight dynamics and safety hazards of launch vehicles.
6. Determine the flight stability of a launch vehicle.
7. Define the chemical components of a solid and liquid rocket motor.
8. Describe average thrust vs. impulse and thrust plots.
9. Explain the solid rocket motor naming convention.
10. Explain how rocket altimeters and accelerometers work.
11. Define the components of a launch vehicle and explain their purpose.
12 Use a simulation tool to approximate the flight trajectory of a rocket.
13 Present, launch, and recover a fully developed amateur level rocket.

Course Requirements & Grading

Assignments & Exams

<table>
<thead>
<tr>
<th></th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Quizzes x 100 points each</td>
<td>200</td>
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<tr>
<td>Tripoli Level 2 Practice Exam</td>
<td>150</td>
</tr>
<tr>
<td>College Tutorial &amp; Pass Quiz for Hazardous Materials</td>
<td>50</td>
</tr>
<tr>
<td>Open Rocket Report</td>
<td>200</td>
</tr>
<tr>
<td>Amateur Rocket</td>
<td>200</td>
</tr>
<tr>
<td>Launch &amp; Recovery: Level 1</td>
<td>200</td>
</tr>
<tr>
<td>Total Points</td>
<td>1,000</td>
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</tbody>
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Extra Credit

Tripoli Level 2 Achieved (successful launch & recovery) 150
Launch Date: TBA

OR

Future Rocket Technology Assignment 150

Quizzes
There will be 2 quizzes, each with 50 multiple-choice questions. Questions are derived from the lectures and TRA Certification Rules.

Tripoli Level 2 Practice Exam
50 multiple choice questions (25 Technical & 25 on Safety) worth 3 points each and derived from the Tripoli Level 2 Certification Study Guide.

Open Rocket Report
A complete report consisting of:
- Title Page
- Table of Contents
- Dimensionally accurate plot of your rocket showing the center of gravity and the center of pressure with a brief explanation of the stability status
- A plot of the simulated flight with a brief description
- A brief explanation of any changes recommended to improve launch vehicle performance
Amateur Rocket
Develop and present a complete amateur rocket, ready for launch:

- Motor mount assembly
- Avionics demonstration
- Flight plan
- Recovery assembly
- Trajectory and tracking plan

Launch & Recovery – Level 1
Launch Date: TBA.
100 points for a successful launch
100 points for successful recovery.

Grading Scale
90% + A
80 to 89% B
70 to 79% C
60 to 69% D
59% and below F

Approximate Weekly Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Syllabus, Project Costs &amp; Resources, &amp; Engineering</td>
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<tr>
<td>2</td>
<td>A Brief History of Rocketry</td>
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<tr>
<td>3</td>
<td>Definitions, Components, Certification Rules, and Safety</td>
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<tr>
<td>4</td>
<td>Newton’s laws, calculation of aerodynamic forces on rockets</td>
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<tr>
<td>5 Quiz 1</td>
<td></td>
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<tr>
<td>6</td>
<td>Center of gravity and center of pressure, in-flight dynamics of rockets; equation of motion</td>
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<tr>
<td>7</td>
<td>Avionics and recovery</td>
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<tr>
<td>8</td>
<td>Rocket propulsion; rocket thrust equation</td>
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<tr>
<td>9 Quiz 2</td>
<td></td>
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<tr>
<td>10</td>
<td>Open Rocket and RAS Aero Simulators</td>
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<tr>
<td>11</td>
<td>Open Forum: Tripoli Level 2 Practice Exam &amp; Simulators</td>
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<tr>
<td>12</td>
<td>Open Rocket Report Due</td>
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<tr>
<td>13</td>
<td>Tripoli Level 2 Practice Exam</td>
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<tr>
<td>14</td>
<td>Review exam and amateur rocket due</td>
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<tr>
<td>15</td>
<td>Launch Day &amp; launch day review</td>
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<tr>
<td>16</td>
<td>Current &amp; future rocket technologies (E.C. assignment)</td>
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<tr>
<td></td>
<td>Future technology assignment due</td>
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</tbody>
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University Policies
Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/

AE Department Policies may be found at: http://www.sjsu.edu/ae/programs/policies/

Faculty Web Page and MySJSU Messaging
Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on my faculty web page at http://www.sjsu.edu/people/firstname.lastname and/or on Canvas Leaning Management System course login website at http://sjsu.instructure.com. You are responsible for regularly checking with the messaging system through MySJSU at http://my.sjsu.edu (or other communication system as indicated by the instructor) to learn of any updates.

Associations & Clubs

Tripoli Rocketry Association (TRA)
Membership, certification, motor classifications, and records
www.tripoli.org

Tripoli Central California
Launch schedule, launch site location, and technical info
www.tccrockets.com

SJSU Rocket Club
Membership, projects, events, vids, pics, etc
Studentorgs.sjsu.edu/rocketclub