## Principles of Flight Vehicle Propulsion

**AEROENG 4550**

### Description / Conditions

**Transcript Abbreviation:**
Prin of Propulsion

**Course Description:**
Fundamentals of aerospace propulsion, engine cycles and analysis of various air-breathing and rocket engines.

**Course Levels:**
Undergraduate (1000-5000 level)

**Designation:**
Required

**General Education Course:**
(N/A)

**Cross-Listings:**
(N/A)

### Course Detail

**Credit Hours (Minimum if “Range”selected):**
3.00

**Max Credit Hours:**
(N/A)

**Select if Repeatable:**
Off
Maximum Repeatable Credits:
(N/A)

Total Completions Allowed:
(N/A)

Allow Multiple Enrollments in Term:
No

Course Length:
14 weeks (autumn or spring)
12 weeks (summer only)

Off Campus:
Never

Campus Location:
Columbus

Instruction Modes:
In Person (75-100% campus; 0-24% online)

Prerequisites and Co-requisites:
Prereq: 3570.

Electronically Enforced:
No

Exclusions:
Not open to students with credit for 550.

Course Goals and Learning Objectives

Course Goals / Objectives:
Educate students in the physical principles, concepts, and mathematical analysis that are unique to airbreathing and rocket propulsion
Enable students to analyze, develop models for, and to compute solutions for propulsion-related problems encountered in aerospace applications

Check if concurrence sought:
No

Contact Hours
## Contact Hours:

<table>
<thead>
<tr>
<th>Topic</th>
<th>LEC</th>
<th>REC out-of-class</th>
<th>REC in-class</th>
<th>Weekly LAB out-of-class</th>
<th>Weekly LAB in-class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro to aero/space propulsion systems, basic fluid mechanics/thermodynamics, 1-D flow basics, area rule, normal/oblique shock, boundary layer basics</td>
<td>8.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Intro to air-breathing engines, actuate disk, performance of ramjet</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Performance of turbojet, dimension analysis, engine-aircraft matching</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Turbojet inlet, combustor, and nozzle</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Axial compressor analysis, performance &amp; limitations</td>
<td>7.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Degree of Reaction, axial turbine analysis, disc stress and blade cooling</td>
<td>7.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Rocket fundamentals</td>
<td>6.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Solid and liquid propellants, performance, nozzles, rocket heat transfer</td>
<td>8.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Electrical rocket</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Exams and review</td>
<td>0.0</td>
<td>4.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>52</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

## Grading and Texts

### Grading Plan:
Letter Grade

### Course Components:
Lecture
Grade Roster Component:
Lecture

Credit by Exam (EM):
No

Grades Breakdown:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>homework</td>
<td>20%</td>
</tr>
<tr>
<td>class participation</td>
<td>5%</td>
</tr>
<tr>
<td>midterms I &amp; II</td>
<td>50%</td>
</tr>
<tr>
<td>final exam</td>
<td>25%</td>
</tr>
</tbody>
</table>

Representative Textbooks and Other Course Materials:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanics and Thermodynamics of Propulsion</td>
<td>Hill, P and Peterson, C.</td>
<td></td>
</tr>
</tbody>
</table>

ABET Student Learning Outcomes

ABET-CAC Criterion 3 Outcomes:
(N/A)

ABET-ETAC Criterion 3 Outcomes:
(N/A)
## ABET-EAC Criterion 3 Outcomes:

<table>
<thead>
<tr>
<th>Significant contribution (7+ hours)</th>
<th>1</th>
<th>an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>2</td>
<td>an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors</td>
</tr>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>3</td>
<td>an ability to communicate effectively with a range of audiences - pre-2019 EAC SLO (g)</td>
</tr>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>4</td>
<td>an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts</td>
</tr>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>5</td>
<td>an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives</td>
</tr>
<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>6</td>
<td>an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</td>
</tr>
<tr>
<td>Substantial contribution (3-6 hours)</td>
<td>7</td>
<td>an ability to acquire and apply new knowledge as needed, using appropriate learning strategies</td>
</tr>
</tbody>
</table>

### Embedded Literacies (UG courses only)

**Embedded Literacies Info:**

**Attachments / Additional Notes or Comments**

**Attachments:**
(N/A)

**Additional Notes or Comments:**
(N/A)