# Aero 335: Aircraft and Spacecraft Propulsion

<table>
<thead>
<tr>
<th>COURSE #</th>
<th>AE 335</th>
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<tbody>
<tr>
<td>COURSE TITLE:</td>
<td>AIRCRAFT AND SPACECRAFT PROPULSION</td>
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<td>TERMS OFFERED:</td>
<td>Fall/Winter</td>
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<td>INSTRUCTOR(S):</td>
<td>Dahm, Gallimore, Driscoll</td>
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<tr>
<td>PREREQUISITES:</td>
<td>Aero 225 and Math 216</td>
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<tr>
<td>SCIENCE/DESIGN CREDITS:</td>
<td>3/1 (required course)</td>
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### CATALOG DESCRIPTION:
Airbreathing propulsion, rocket propulsion, and an introduction to modern advanced propulsion concepts. Includes thermodynamic cycles as related to propulsion and the chemistry and thermodynamics of combustion. Students analyze turbojets, turbofans and other air-breathing propulsion systems. Introduces liquid- and solid-propellant rockets and advanced propulsion concepts such as Hall thrusters and pulsed plasma thrusters. Students also learn about the environmental impact of propulsion systems and work in teams to design a jet engine.

### COURSE TOPICS:
1. Fundamentals of thermodynamics.
2. Combustion processes.
3. Air-Breathing Propulsion.
4. Rocket Propulsion.
5. Advanced Propulsion

### COURSE OBJECTIVES
1. To provide students with an overview of various aerospace propulsion systems. [j,l]
2. To provide students with a sound foundation in the fundamentals of thermodynamics [q]
3. To teach students the elementary principles of thermodynamic cycles as applied to propulsion analysis. [a,k,l]
4. To provide students with an introduction to combustion. [a]
5. To provide students with an introduction to gas kinetic theory. [a]
6. To provide students with a working knowledge of and the tools to analyze various flight propulsion systems such as turbojets, turbofans, ramjets, rockets, air turborockets and nuclear/electric propulsion systems. [a,k,m]

To provide students with the opportunity to form teams which design aerospace propulsion system. [c,d,e,g,h,j,m]

### COURSE OUTCOMES

**On completion of Aero 335, students can:**
- Recognize when the ideal gas law may be applied. (Assessed by: 1,2,3,4)
- Determine the efficiency, indicated mean effective pressure (where applicable), and net work of the OTTO, DIESEL, STERLING, and BRAYTON cycles, and to make connections between these cycles and aerospace propulsion systems. (Assessed by: 1,2,3,4)
- Determine the equilibrium species concentrations of a simple chemical reaction. (Assessed by: 1,2,3)
- Calculation the adiabatic flame temperature of a simple combustion reaction. (Assessed by: 1,2,3,4)
- Calculate the key fluid properties (total pressure, enthalpy, etc.) at each component of an air-breathing and rocket engine. (Assessed by: 1,2,3,4)
- Perform an analysis to match the power output of the turbine to the required power of the compressor. (Assessed by: 1,2,3,4)
- Calculate $\Delta V$‘s required for space missions and relate these to total propellant consumption using the rocket equation. (Assessed by: 1,2,3)
- Calculate the specific impulse, thrust, throat and exit areas, and nozzle profile of a rocket engine. (Assessed by: 1,3)
- Calculate the thrust, thrust profile, and specific impulse of a solid propellant and hybrid rocket engine. (Assessed by: 1,3)
- Calculate the specific impulse and thrust of a nuclear thermal rocket engine. (Assessed by: 1,3)
- Calculate the specific impulse, thrust, maximum thrust density, and thrust efficiency of electric propulsion engines. (Assessed by: 1,3)

### ASSESSMENT TOOLS
1. Individual homework.
2. Hourly exams.
3. Final exam.
4. Design project.

Updated: May 2005