



# AE 3450: Introduction/Overview

- Class web page
  - [seitzman.gatech.edu/classes/ae3450](http://seitzman.gatech.edu/classes/ae3450)
- Course title “Thermodynamics and Compressible Flow”
  - we will focus on thermodynamics
    - energy and its relationships to the properties of matter (gases, liquids, solids, plasmas)
    - application of thermodynamics to energy devices and flows



# Thermodynamics Overview

- Useful for
  - finding how **substance properties** like pressure, density, temperature, energy, chemical composition are related to each other
    - state relations
  - how to model and understand **devices** that use/produce energy
 

• jet engines	• rockets	⇒ thrust
• power plants	• fuel cells	⇒ fuel consumption
• nozzles	• heat pumps	⇒ efficiency
• pumps/compressors	• artificial kidneys	⇒ power requirements
• turbines	• .....	



## Thermodynamics Overview

- Based on just a few fundamental principles
- **The State Postulate**
  - how many properties are “independent”
- **The 1<sup>st</sup> Law of Thermodynamics**
  - energy is conserved
  - you can move it around, but not create or destroy it
  - need to identify types of energy and ways of transferring it
    - work
    - heat transfer



## Thermodynamics Overview

- **The 2<sup>nd</sup> Law of Thermodynamics**
  - entropy can be produced but not destroyed; it can also be transferred (exchanged)
  - tells us what processes are possible and impossible
    - a process that destroys entropy is an impossible process
  - “ideal” processes create no entropy and require (produce) the least (most) useful work (are most “efficient”)



## Thermodynamics Overview

- **The 2<sup>nd</sup> Law of Thermodynamics**
  - it also tells us which way a process can happen, and what will happen to a system if left on its own (achieves equilibrium)
  - for example when you push a box along the floor, it doesn't push itself back when you let go
    - example of an **irreversible process**
  - compressing a perfect spring, you do get the same energy back that you put it
    - example of a **reversible process**



## Units

- Review basic units
  - mass, kg ( $lb_m$ )
  - length, m (ft)
  - time, s
- Other units
  - energy, J (BTU, hp, cal, ...)
  - pressure, Pa (bar, atm, psi, ...)
  - temperature, K (C, R F)