AE 2010 Thermodynamics and Fluid Fundamentals
Summer 2022 @ Georgia Tech – Lorraine

Instructor: Mackenize Lau, PhD
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Prerequisites:
Math 2551 Multivariable Calculus
Physics 2211 Physics 1
Chem 1310 or Chem 1211K

Students will be expected to have or be willing to develop a basic proficiency with a suitable computer coding language, such as MATLAB or Python, for the project.

Course Description:
1) Provide students with a fundmental understanding of the conservation laws and properties used to analyze fluids, flows, and energy conversion devices
2) Enable students to analyze basic compressible flows, including applications to nozzles, diffusers, and simple airfoils

Learning Outcomes:
Students will develop understandings of:

- Properties of fluids
- Thermodynamic properties and equations of state
- Basic concepts of thermodynamics
- The laws of thermodynamics
- Conservation equations and their applications, in both integral and differential form, to fluid phenomena and energy conversion devices
- Static and stagnation properties
- Propagations of and propertiy variations due to flow disturbances
- Quasi-1D analysis of compressible internal flows
- Bernoulli equation, hydrostatics, and streamlines
- Physical characteristics and similarity parameters associated with continuum flow regimes
- Derivation of the basic conservation equations of thermodynamics and fluid mechanics
- Applications of covered material to aerospace systems

Grading:

Attendance:	10%
Homeworks:	20%
Project:	15%
Midterm 1:	15%
Midterm 2:	15%
Final Exam:	25%

Attendance:

Attendance is required. Absences will be permitted for reasonable circumstances, provided adequate notice is provided to the instructor and the academic office. The first unexcused absence will result in a 2% deduction from the final grade, a second will result in a further 3% reduction, and a third will result in a further 5% reduction. Any further unexcused absences will be handled at the discretion of the instructor and academic office.

Textbooks (Optional):

1) Anderson, J. D. (2001). *Fundamentals of aerodynamics.* Boston: McGraw-Hill.
2) Turns, S. R., & Haworth, D. C. (2021). *An introduction to combustion: Concepts and applications.*

Tentative Schedule:

Week	**Monday**	**Topic**
1	10 Jan	Orientation, introduction
2	17 Jan	Matter, systems, and energy
3	24 Jan	Equilibrium and properties, flow fields
4	31 Jan	States: Extensive, intensive, postulate, and equations of
5	7 Feb	Ideal gases
6	14 Feb	Spring Break
7	21 Feb	Incompressible fluids, phases
8	28 Feb	Transport properties, mass conservation
9	7 Mar	Control volumes, Reynolds transport theorem, momentum
10	14 Mar	Bernoulli equation, energy analysis
11	21 Mar	The second law of thermodynamics
12	28 Mar	High speed flows
13	4 Apr	Isentropic flows, normal shocks
14	11 Apr	Oblique shocks, expansion fans
15	18 Apr	Supersonic airfoils, friction and heat transfer
16	25 Apr	Applications to aerospace system design, review, final exams
17	2 May	Final Exams

The class schedule is subject to change based on, among other factors, the pace of in-class discussions and activities.