College of Engineering
School of Environmental, Civil, Agricultural, and Mechanical Engineering

MCHE 4500/6500 Advanced Thermal Fluid Systems
Fall 2026

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Topical Outline:
(1) Review of basic thermodynamics, fluid mechanics, and heat transfer;
(2) Introduction to compressible flow;
(3) Normal shock waves;
(4) Oblique shock waves;
(5) Compressible flow in inlets, nozzles, and diffusers of propulsion systems;
(6) Frictionless flow with heat transfer (Rayleigh flow);
(7) Adiabatic flow with friction (Fanno flow);

Description: The course emphasizes the study and application of advanced concepts in thermodynamics, fluids, and heat and mass transfer beyond initial, introductory courses. This includes application of topics from Thermodynamics (ENGR 3140) and Fluid Mechanics (ENGR 3160) to the analysis of propulsion systems and high-speed aerodynamics, an introduction to compressible flow, shock waves, and non-isentropic flow with friction and heat transfer.

Credit Hours: 3 (lecture)

Prerequisites:
ENGR 3140 – Thermodynamics
ENGR 3160 – Fluid Mechanics

Lecture Times: Tuesday / Thursday, 11:35 A – 12:55 P

Lecture Location: Miller Plant Sciences, Room 1501

Course Website: eLC

Reference Text: *Fundamentals of Fluid Mechanics (8th Edition)*
Author: Philip M Gerhart, Andrew L. Gerhart, and John I. Hochstein
ISBN: 978-1119721970

Grading:	Exam 1	35%
	Exam 2	35%
	Quizzes (4 – 6)	30% (based on top three scores)

The overall grade is based on two topical exams and 4 – 6 quizzes. The grading scale is based on the following ranges: A = 90 – 100%, B = 80 – 89%, C = 70 – 79%, etc. Pluses and minuses (+ / –) are given with discretion.

Homework: Working homework problems is a necessity for practicing and learning the material, and is a tool that leads to developing a deeper understanding beyond the lecture content. Homework is assigned on an approximately bi-weekly basis (approximately 5 – 8 problems) but will not be collected or graded for a homework grade. Discussion of the solutions to selected problems will take place in lecture, time permitting, or during problem-solving sessions. Diligently working through the assignments and presenting the results in an organized, professional format is strongly encouraged. Of particular importance is the rigor of the methodology applied (i.e. application of assumptions, equations), organizational merits, reaching the correct solution, analysis and interpretation of the result(s), as an important component of the solution is also writing comments on the context/meaning of the result.

Academic Honesty: Ethical behavior and academic honesty are expected and required of students and even more so of engineers and scientists. Evidence of cheating during an exam or other assignment for credit may result in failure of the entire course for the student(s) in question. The University of Georgia requires academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. All members of the academic community are responsible for knowing the policy and procedures on academic honesty. The document for academic honesty may be found at the website for The University of Georgia Office of Senior Vice President for Academic Affairs and Provost. All academic work must meet the standards contained in "A Culture of Honesty". Students are responsible for informing themselves about those standards before performing any academic work.

Americans with Disabilities Act (ADA) Policy Statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Resource Center, in Clark Howell Hall, call 706-542-8719, or email at dsinfo@uga.edu. For additional information visit https://drc.uga.edu/.

Course Objectives and Expected Learning Outcomes: By the end of this course, students will (at a minimum) have achieved the following (a) understand and advanced fundamental principles of thermodynamics and fluid dynamics; (b) understand compressibility effects in gas flows; (c) understand how shock waves are formed, the basic shock wave relationships and their applications; (d) understand and apply mathematical equations governing thermal processes in compressible flow and propulsion applications.

Course Schedule: Table 1 presents the overall course schedule. The planned exam dates are subject to change upon prior notice with at least one week in advance of the exam date.

Table 1. Course schedule: August 18 – December 1, 2026.

Week	*Tuesday*	*Thursday*	*Notes*
1	8/18	8/20	
2	8/25	8/27	Problem Set 1 Assigned (Thermodynamics)
3	9/1	9/3	
4	9/8	9/10	Problem Set 2 Assigned (Compressible Flow)
5	9/15	9/17	
6	9/22	9/24	Problem Set 3a Assigned (Shock Waves)
7	9/29	10/1	
8	10/6	10/8	***Exam 1 on 10/8***
9	10/13	10/15	
10	10/20	10/22	Problem Set 3b Assigned (Shock Waves)
11	10/27	10/29	
12	11/3	11/5	Problem Set 4 Assigned (Rayleigh Flow)
13	11/10	11/12	
14	11/17	11/19	Problem Set 5 Assigned (Fanno Flow)
15	11/24	11/26	Thanksgiving / Tofurky Day
17	12/1 (no class)	12/4 (no class)	
18	12/8	–	***Exam 2 on 12/8, 12 P***