The University of Texas at El Paso
College of Engineering
Department of Aerospace and Mechanical Engineering

Course number	**Title of Course**	**Semester/year**
15457 (MECH5305)	Comp. Fluid Dynamics	Fall 2024

Time: Tuesday & Thursday 3:00 – 4:20 PM

Location: Chemistry Computer Sci Bldg 1.0202

Instructor: Dr. Jaeyoung Cho (he, his, him)
Assistant Professor
Department of Aerospace and Mechanical Engineering
College of Engineering
The University of Texas at El Paso
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Office: Engineering Building, Room A-105

Office hours: With appointment via email, Tuesday & Thursday & Friday 10:30 – 11:30 AM

Course Description: This course will provide the physical basis of computational fluid dynamics (CFD), particularly those of unsteady gas-phase flow. The course content includes a review of fundamental gas dynamics and various numerical schemes (e.g., finite-volume method, upwind stencils, flux-averaging, flux-splitting, etc.). The students are expected to apply the knowledge gained to build their own CFD codes in Python, based on which they will solve three exemplary equations: the linear advection equation, Burger's equation, and Euler equations.

Method of Evaluation: The final grade will be evaluated as below.

Grading Components		*Grading Scale*	
HW-physics	400pts	A	721 – 800 pts
HW-computation	400pts	B	641 – 720 pts
Total	800pts	C	561 – 640 pts
		D	481 – 560 pts
		F	0 – 480 pts

Homework: As shown in the *Method of Evaluation*, homework (HW) is the key component of the class's final evaluation. There will be two different types of HW: physics and computation. Physics HW will be on mathematical problems related to fluid dynamics, and the computation HW will be about developing a CFD code in a Python environment. A course instructor strictly regulates the format of HW submitted, while any HW not following the provided format will be returned immediately without review. The correctly formatted HW should be printed out and

submitted in person at the classroom within a given deadline. Any delays in submission are subject to a penalty in the final grade.

Blackboard: The instructor will communicate with students via Blackboard.

Course Content

1. **Theory of Computational Fluid Dynamics**
    a. Review of fundamental gas dynamics
    b. Finite volume methods
    c. CFL condition and upwind scheme
    d. Wave interpretation of advection equations
    e. Riemann problem
    f. Flux averaging and flux splitting
2. **Python Programming**
    a. Basic Python programming
    b. Applying the finite volume methods in CFD
    c. Applying the upwind schemes in CFD
    d. Applying flux averaging and flux splitting in CFD
    e. Treatment of the boundary conditions

Recommended Texts: Lecture notes will be based on the following references.

[1] Laney, Culbert B. Computational Gasdynamics. Cambridge University Press, 1998.

Attendance: Attendance is not directly accounted for in the final grading. Still, for a record purpose, the instructor will keep track of each student's attendance throughout the semester. The instructor strongly encourages the students to attend the class as most of the important physics will be provided through handwriting on a whiteboard in class. It should be noted that the instructor can provide additional hints on the HW during the lecture, which may benefit the students physically attending to get higher final grades.

Accommodations Policy: The University is committed to providing reasonable accommodations to students with documented disabilities. Students who become pregnant may also request reasonable accommodations, in accordance with state and federal laws and regulations and University policy. Accommodations that constitute undue hardship are not reasonable. To make a request, please register with the UTEP Center for Accommodations and Support Services (CASS). Contact CASS at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

Scholastic Integrity: Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit

any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) for possible disciplinary action. To learn more, please visit HOOP: Student Conduct and Discipline.

Guidance on Artificial Intelligence: Use of AI technologies or automated tools, particularly generative AI such as ChatGPT or DALL-E, is not allowed for assignments in this class. Each student is expected to use critical and creative thinking skills to complete tasks and not rely on computer-generated ideas. Any direct use of AI-generated materials submitted as your own work will be treated as plagiarism and reported to the Office of Student Conduct and Conflict Resolution (OSCCR).