Syllabus

ME 0075 (312046030-01) – Introduction to Fluid Mechanics

Fall Semester 2025

Lecture Time:	Wed. 08:15 – 11:00	**Classroom:**	Scupi New Bldg. S501
Instructor:	Dr. John Pien	**Office:**	Scupi New Bldg. N503
Office Hours:	Thu. 08:30 – 11:30 Thu. 16:30 – 17:30 Fri. 08:30 – 12:00	**Email:**	john.pien@scupi.cn

Course Description

This 3-credit course is an introduction into the study of fluid statics and dynamics to provide an understanding of the basic concepts that relate to fluid mechanics and fluid systems. Topics covered will include hydrostatics, flow kinematics, control volume analysis, Navier-Stokes equations, inviscid flow and incompressible viscous flow.

Prerequisites

PHYS 0174 Physics for Science and Engineering, ENGR 0145 Statics, and MATH 0290 Differential Equations.

Textbook

Pritchard and Mitchell, *Fox and McDonald's Introduction to Fluid Mechanics*, 9th Edition, Wiley.

Course Objectives

- Develop an understanding for fluids at rest and apply them to engineering applications.
- Apply the conservation of momentum to fluids in motion.
- Apply the conservation of energy for fluids in motion.
- Define and describe Reynold's number and how to calculate it.
- Apply differential equation solutions to fluid in motion applications.
- Define and understand laminar and turbulent flow conditions and how to apply relation to solve engineering applications.

Applicable ABET Student Outcomes

1. Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, environmental and economic contexts.
7. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Outline

- Introduction (Ch. 1)
- Fundamental Concepts (Ch. 2)
- Fluid Statics (Ch. 3)
- Basic Equations in Integral Form for a Control Volume (Ch. 4)
- Introduction to Differential Analysis of Fluid Motion (Ch. 5)
- Incompressible Inviscid Flow (Ch. 6)
- Dimensional Analysis and Similitude (Ch. 7)
- Internal Incompressible Viscous Flow (Ch. 8)

Course Schedule

Week	Date	Chapter	Topics
1	09/10	1.1-1.2 1.3-1.4	Introduction, Basic Equations Analysis Methods, Dimensions and Units
2	09/17	2.1 2.2-2.3	Fluid as Continuum Velocity and Stress Fields
3	09/24	2.4-2.6 3.1-3.2	Viscosity, Surface Tension, Fluid Classifications Equation of Fluid Statics, Standard Atmosphere
4	10/01		Holiday
5	10/08		Holiday
	10/11	3.3 3.4 3.5	Pressure Variation in a Static Fluid Hydrostatic Force on Submerged Surfaces Buoyancy and Stability
6	10/15	3.6 4.1	Fluids in Rigid-Body Motion Basic Laws for a System
7	10/22	4.2 4.3 4.4	System Derivatives to the Control Volume (C.V.) Formulation Conservation of Mass Momentum Equation for C.V. (General)
8	10/29		Midterm Exam I
9	11/05	4.4 4.5 4.8 5.1	Momentum Equation for C.V. (Along Streamline + Constant Velocity) Momentum Equation for C.V. (Rectilinear Acceleration) The first Law of Thermodynamics Conservation of Mass
10	11/12	4.5 4.8	Momentum Equation for C.V. (Rectilinear Acceleration) The first Law of Thermodynamics

		5.1 5.3-5.4	Conservation of Mass Motion of a Fluid Particle, Momentum Equation (Cartesian)
11	11/19	5.2 5.3 5.4	Stream Function for Two-Dimensional Incompressible Flow Motion of a Fluid Particle Momentum Equation (Cartesian)
12	11/26	5.4 6.1-6.2	Momentum Equation (Cylindrical) Momentum Equation for Frictionless Flow, Bernoulli Equation
13	12/03		Midterm Exam II
14	12/10	7.1 7.2-7.3 8.1-8.2	Nondimensionalizing the Basic Differential Equations Nature of Dimensional Analysis, Buckingham Pi Theorem Internal Flow, Fully Developed Laminar Flow
15	12/17	8.3-8.6	Flow in Pipes and Ducts (Head Loss)
16	12/24	8.7 8.8	Flow in Pipes and Ducts (Calculation in Head Loss) Solution of Pipe Flow Problems
17	12/31		Final Exam

Course Grading

Attendance/Quiz	10%
Homework	15%
Midterm Exam I	20%
Midterm Exam II	25%
Final Exam	30%

Exam Schedule

Midterm Exam I	9:00 – 11:00, Wed., Oct. 29th (week 8)
Midterm Exam II	9:00 – 11:00, Wed., Dec. 3rd (week 13)
Final Exam	9:00 – 11:00, Wed., Dec. 31st (week 17)

Course Policies

Regular class attendance is essential and expected. Active participation in course activities is encouraged which would generally involve focused thinking as well as engaging with instructor and fellow students. Professional classroom demeanor is required; in particular, all cell phones and personal electronic devices must remain off or silent during the lecture. Do not conduct side conversations during the lecture as it is distracting to the lecturer and other students.

Homework Assignments

- Homework problems are assigned periodically and are due as stated in the assigned paper. All work should be submitted electronically through the Blackboard system. It is students' duty to make sure that submission through Blackboard has been properly processed. All homework scores will be used in your grade computation.

- Late submission WILL NOT be accepted. Exceptions will be made for a valid excuse consistent with University Policy. If you have a compelling emergency that prevents you from turning in the homework on time, please email the instructor to get the approval for late submission.
- Unless otherwise indicated, you can work with your fellow classmates, but you must submit a distinct and independent write-up to receive credit. If plagiarism is caught, the homework will receive a zero score.
- All work must be shown for each solution to receive full credit and present your solution in a logical fashion while showing and explaining all important steps in detail.
- If you believe an error has been made in the grading of an assignment, bring it to the attention of the instructor or TA within one week after the graded materials have been made available to the student.

Exams

- There will be three exams (two midterms and one final), all are closed-book and closed-notes. Essential equations will be provided to students during the exams to help answer exam problems. Exams will emphasize treatment of materials covered in lectures and homework assignments.
- If you cannot attend an exam due to emergencies and health issues, you MUST get the approval from the instructor to make alternative arrangements, consistent with University Policy, before the exam is given. If you miss an exam without prior approval, you will receive a score of "ZERO" for that exam except under extenuating circumstances.
- If you believe an error has been made in the grading of an exam, bring it to the attention of the instructor or TA within one week after the graded materials have been made available to the student.

Make-Up Exam

Students who have not taken either the midterm or the final exam are NOT eligible to take the make-up exam. The make-up exam grading is only to replace students' semester final exam grading. Students who pass the course after the make-up exam will receive only a passing grade (60) as the final grade.

Evaluation Policy

Partial credit will be awarded to recognize that some portion of the work is correct. However, partial credit grading is only practical if the work is clearly developed, with clear and well-marked diagrams when fitting, with the appropriate equations prominently displayed, where the substitutions into the equations are quite clear, and the assumptions used are obvious to the grader. That is, it is the student's responsibility to present her/his work so clearly that the grader can quickly ascertain the location and nature of the error(s)

and can follow the subsequent work through. If this is not clear on the work submitted, credit cannot be given. Partial credit is assigned at the discretion of the grader. It is therefore always in your best interest to practice clarity and completeness in your solutions when working on exam and homework problems.

Copyrights

The handouts used in this course are copyrighted. By "handouts" we mean all materials generated for this class, which include but are not limited to syllabi, in-class materials, videos, slides, and problem sets. Because these materials are copyrighted, you do not have the right to copy or distribute the handouts, unless the author expressly grants permission.

Academic Integrity

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

Remarks

- Modifications to this syllabus may occur. Please stay informed about any revisions announced during class or on the Blackboard website. Lecture materials, homework assignments, homework solutions and class announcements will also be accessible through Blackboard.
- Important dates and information will be announced during class. Students should stay informed about announcements on Blackboard.
- While emailing the instructor or TA, please kindly include “Fluid Mechanics” in the subject line for an efficient communication. Please use your university email account (student_ID_number@stu.scu.edu.cn), as emails from other sources could be caught by the SCU spam filter.