

**North Dakota State University**  
**ME 488/688 - Introduction to Aerodynamics**  
Syllabus - 2023 Fall Semester  
MWF 1:00pm-1:50pm; Dolve 204

**Instructor:** Dr. Y. Bora Suzen  
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Office Hours: Monday & Friday 2:00pm-3:00pm or by appointment

**Course Prerequisites:** ME 352 and admission to professional program or graduate standing.

**Course Catalog:**

Introductory aerodynamics, aerodynamic characteristics of airfoils, and other components subjected to inviscid-incompressible flows; dynamics of compressible fluids; shock waves, one-dimensional flow, expansion waves in two-dimensional flow, and compressible flow over aerodynamic bodies.

**Course Objective:**

This course aims to provide an overall introduction to vast area of aerodynamics. At the end of this course students will understand and apply aerodynamic concepts and principles to inviscid incompressible and compressible flows.

**Text:**

Anderson, J. D., 2017, *Fundamentals of Aerodynamics*, 6<sup>th</sup> ed., McGraw-Hill, New York, NY.

**Anticipated Course Outcomes:**

The anticipated course outcomes are listed below. A list of NDSU ME program objectives and outcomes are listed at the end of the syllabus. Upon successful completion of this course, students will be able to:

1. Explain basic concepts, terms, and general principles in aerodynamics.
2. Identify differences between aerodynamics and general fluid dynamics, inviscid and viscous flows, incompressible and compressible flows.
3. Explain the basic governing equations regarding inviscid incompressible flow and compressible flow.
4. Apply aerodynamic principles to calculate lift, drag, moment coefficients of basic two-dimensional airfoils and other simple geometries.
5. Apply incompressible aerodynamics in conceptual low-speed wind tunnel design.
6. Understand high-speed flow characteristics, shock waves, and expansion waves.
7. Identify the design parameters and solve problems associated with supersonic nozzles, diffusers, and wind tunnels.
8. Use aerodynamic tools to design, analyze, model, and interpret aerodynamics challenges and provide solutions.

**Communication:**

- The primary method by which course-related information will be communicated is during class. Reminders, notification of any assignments or schedule changes will be communicated through NDSU email and posted on Blackboard announcements page.
- Your NDSU email address is the official route for information.

**Assessment:**

- Your level of success in attaining the anticipated course outcomes will be assessed during the semester by homework assignments, quizzes, exams and the final examination. ***The format of your solutions in homework assignments and exams should be in acceptable engineering form.***

**(a) Homework Assignments:**

- Homework assignments may consist of both "hand-solution" of problems and computer assignments. Assignments will typically be assigned on a weekly basis and will be collected in class on the due date at the beginning of the class.

**(b) Quizzes/Class Participation:**

- During the semester quizzes will be given periodically. Quizzes are typically in forms of multiple\_choices covering topics that have been covered in previous classes and study assignments.
- Students are expected to actively participate in class group activities.

**(c) Projects for Graduate Students (ME 688 only):**

- Each graduate student taking the class will be assigned an individual project by mid-October. The students will provide biweekly progress report to the instructor on their projects. The students will prepare a project report and present their projects at the end of the semester. The format of the project report and presentation will be provided during the semester.

**(d) Exams:**

- During the semester there will be two 50-minute exams. Each exam will carry 25% of the overall point value. The tentative dates for these exams are given in the tentative course schedule at the end of the syllabus.
- The two-hour final exam will be given on the date and time specified by the University Finals Schedule. The final exam is 25% of the overall grade for the course.
- Students who fall ill, or who know they will be missing an exam for a valid reason (e.g. family emergency) are encouraged to notify the instructor by phone or e-mail prior to the exam, if at all possible. Students missing the exam without a valid excuse will receive a grade of zero for that exam.

**Grading Policy:**

**ME 488**

Homework + Quizzes +	
Class Participation	25%
2 Exams	25% each
Final Exam	25%

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Total 100%

Final course grades will be assigned according to the following scale:

A	90-100
B	80-89
C	70-79
D	60-69
F	below 60

**ME 688**

Homework + Quizzes +	
Class Participation	15%
Project	10%
2 Exams	25% each
Final Exam	25%

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Total 100%

The final grades will NOT be curved

### **Additional Information:**

- Unless specifically stated otherwise, **all assigned work is assumed to be performed individually.**
- You are expected to work on all assignments.
- You are expected to read, study, and work on the study materials before class.

### **Attendance/Participation Policy:**

- According to NDSU Policy 333 ([www.ndsu.edu/fileadmin/policy/333.pdf](http://www.ndsu.edu/fileadmin/policy/333.pdf)), attendance and participation in classes are required.
- Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

### **Academic Honesty Statement**

The academic community is operated on the basis of honesty, integrity, and fair play. All work in this course must be completed in a manner consistent with Code of Academic Responsibility and Conduct, NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at [www.ndsu.edu/academichonesty](http://www.ndsu.edu/academichonesty).

### **Americans with Disabilities Act for Students with Special Needs**

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office ([www.ndsu.edu/disabilityservices](http://www.ndsu.edu/disabilityservices)) as soon as possible.

### **Tentative Course Topics and Schedule:**

- **August 23-October 9**
  - Chapter 1: Introduction
  - Chapter 2: Aerodynamics: Some Fundamental Principles and Equations
  - Chapter 3: Fundamentals of Inviscid, Incompressible Flow
  - Chapter 4: Incompressible Flow over Airfoils
  - **Exam 1: Monday, October 9**
- **October 11-November 20**
  - Chapter 5: Incompressible Flow over Wings
  - Chapter 7: Compressible Flow: Some Preliminary Aspects
  - Chapter 8: Normal Shock Waves and Related Topics
  - Chapter 9: Oblique Shock and Expansion Waves
  - **Exam 2: Monday, November 20**
- **November 27-December 8**
  - Chapter 10: Compressible Flow through Nozzles, Diffusers, and Wind Tunnels
- **Final Exam: Monday, December 11, 1:00pm-3:00pm**

**Department of Mechanical Engineering  
North Dakota State University**

**Vision**

To become nationally recognized and respected for excellence in engineering education, research, and service to local and regional industries.

**Mission**

The Department of Mechanical Engineering at NDSU will contribute to the aspirations of a land-grant university in the three primary components of education, research, and service. In support of these endeavors, the mission of the department is to:

- Educate undergraduate and graduate students in the fundamentals of the discipline, prepare graduates (BS, MS, or PhD) to effectively function in society in the field of their choice, and provide the learning skills to adapt to evolving personal and professional goals.
- Develop and maintain high quality research programs in traditional and emerging areas that build on the diverse strengths of the faculty, foster interdisciplinary collaborations, and address national and global needs.
- Serve the needs of the profession, the state of North Dakota, and regional industries to promote and enhance economic development opportunities.

**Educational Objectives**

In support of the mission of the ME Department, the educational objectives of the program are to produce engineering graduates who:

1. Are well educated in the fundamentals of the discipline, and possess the ability and willingness to adapt to emerging technologies through continued professional development.
2. Will contribute in a competent manner to the engineering profession in the field of their choice.
3. Demonstrate a commitment to uphold high ethical and professional standards in the practice of engineering.
4. Can effectively function in a team environment and interact with people of diverse backgrounds.
5. Understand the context in which their designs will be implemented and the corresponding impact of their activities on society.

**Program Outcomes**

To foster attainment of the program educational objectives, the ME Department has developed a curriculum that insures students will achieve the following outcomes (1) through (7). Attainment of these outcomes prepares graduates to enter the professional practice of engineering.

1. an 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
3. an ability to communicate effectively with a range of audiences
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, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

