San José State University
College of Engineering / Aerospace Engineering
AE 265, Boundary Layers, Section 01, Fall 2022

Course and Contact Information

Instructor(s):	Xuanhong An
Office Location:	272E
Email:	xuanhong.an@sjsu.edu
Office Hours:	Monday and Wednesday, 1400-1500
Class Days/Time:	Monday and Wednesday, 1630-1745
Classroom:	Engineering Building 339
Prerequisites:	Graduate standing or instructor consent

Course Description

This course focuses on both theory and applications of boundary layers. The topics will cover continuity equation, Naiver-Stokes equations and some exact solutions, boundary layer analysis including Blasius solution and Falkner-Skan flows, momentum integral equations, flow instability and transition from laminar flow to turbulence, turbulence modeling, boundary layer separation and control. The first half of this course focuses on theoretical analysis and introduce analytical tools to the students. The second half of this course focuses on engineering application studies, which include literature studies and project assignments.

Course Goals

Introduce students to:

A. Fundamentals of fluid mechanics and boundary layers.
B. Boundary layer analysis in engineering applications.

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Understand the fundamentals of fluid mechanics.
2. Solve the Navier-Stokes equations using similarity method including Blasius solution and Falkner-Skan flows.
3. Solve the Navier-Stokes equations using separation of variables.
4. Calculate the laminar boundary layer using integral methods: boundary layer thickness, displacement thickness, momentum thickness, skin friction coefficient.

5. Calculate boundary layers using iterative methods.
6. Have a basic understanding of turbulence transition, modeling.
7. Have a basic understanding of boundary layer separation and boundary layer control.
8. Have a basic understanding of experimental and numerical approaches to boundary layer problems.

Recommended Texts/Readings

Textbook

Ronald L. Panton's Incompressible Flow (4th Edition)

John D. Anderson, Jr.'s Fundamentals of Aerodynamics (5th Edition) is RECOMMENDED but not mandatory
ISBN: 978-0-07-339810-5

Other Readings

Course slides (available on Canvas shortly after the respective lecture)

Course Requirements and Assignments

This course shall have a midterm exam, assignments and a final project contribute to the final overall grade.

The midterm shall be open book and open note, given synchronously during a normally schedule course time.

Assignments shall be completed individually (though collaboration is encouraged) and submitted per the schedule on Canvas.

The final project is TBD

Grading Information

Grade Categories and contribution to total grade:

Homework	30%
Midterm exam	30%
Final project	40%

Grade	*Percentage*
A plus	*95 to 100%*
A	*90 to 95%*
A minus	*85 to 90%*
B plus	*80 to 85 %*
B	*75 to 80%*
B minus	*70 to 75%*
C plus	*67 to 70%*
C	*65 to 67%*
D	*60 to 65%*
F	*59.9% or lower*

Late work shall at the discretion of the instructor be penalized by up to 20%. No late work shall be accepted after two weeks from the original due date. Absence during a quiz or final shall result in a zero for the score unless a suitable makeup can be mutually determined between the instructor and student.

Classroom Protocol

In class discussion is encouraged but respect for others is required and expected.

University Policies

Per [University Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf) *(http://www.sjsu.edu/senate/docs/S16-9.pdf)*, relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo) (http://www.sjsu.edu/gup/syllabusinfo), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

AE256/ Boundary Layers, Fall 2022, MW 1630-1745

Course Schedule

Week	Date	Topics
1	08/23	Introduction to boundary layers
1	08/25	Vector & Tensor Calculus, introduce group project
2	08/30	Continuity equation and Navier-Stokes equations
2	09/01	Solutions of N-S equations and boundary layer characteristics
3	09/06	“
4	09/08	Blasius solution
4	09/13	“
5	09/15	Falkner-Skan solution
5	09/20	“
6	09/22	momentum integral equations
6	09/27	“
7	09/29	Iterative calculation of boundary layer development
7	10/04	“
8	10/06	**Midterm Exam:** Date TBD
8	10/11	“
9	10/13	Stability analysis and transition from laminar flow to turbulence
9	10/18	“
10	10/20	In-class presentation (TBD)
10	10/25	“
11	10/27	Introduction to turbulence modeling
11	11/01	“
12	11/03	In-class presentation (TBD)
12	11/08	“

Week	Date	Topics
13	11/10	Basics of boundary layer separation and control
13	11/15	“
14	11/17	In-class presentation (TBD)
14	11/22	“
15	11/24	Introduction to numerical and experimental methods
15	11/30	“ industry
16	12/01	In-class presentation (TBD)
16	12/06	“

This schedule is subject to change as circumstances develop and notice of any change shall be delivered via Canvas announcement. Changes regarding the topic schedule or assignments will generally be made by canvas announcement but may be communicated during normally scheduled lecture for minor changes.