Ö. Savaş
6113 Etcheverry Hall
Office Hours : TuTh 13:00-14:30

August 21, 2019
Lectures in 60 Barrows Hall
Lecture Hours TuTh 11:10-12:30

ME 163
ENGINEERING AERODYNAMICS
Fall 2019

COURSE

You are expected to be proficient in fundamental fluid dynamics and thermodynamics, such as those topics covered in ME-40 Thermodynamics and ME-106 Fluid Mechanics, and in mathematics inasmuch as it is needed for that proficiency. You are expected to have derived the equations of motion for continuum at least once. Mathematically, you should be comfortable with vector calculus and ordinary differential equations. Computationally, you are expected to be proficient in a high level programming environment of your choice (e.g. Java, C/C++, Fortran, Mathematica, Matlab, IDL) to design algorithms and perform aerodynamics calculations. We will cover the following topics at appropriate levels for this course: flow kinematics, the atmosphere, potential flow, the lift, drag, and moment of two-dimensional airfoils, three-dimensional wings, vortex wake, and high speed aerodynamics. Time permitting, we will look at bioaerodynamics. Also, some analysis of the performance and stability of airplane in subsonic flight.

I urge you to read the assigned material beforehand for most effective use of our classroom time.

GRADING: Original

Homework (∼5)	20%
Midterm exam (Oct 12)	20%
Projects (3×10)	30%
Final Project or Exam (Dec 6)	30%
TOTAL	100%

LETTER GRADE BOUNDARIES

A	85.0%
B	75.0%
C	65.0%
D	55.0%

POLICY

We are all bound by the UC Berkeley honor code.

All assigned material is to be done independently. Unless you have a good reason, no late assignment will be accepted, no makeup will be given. The midterm exam will be *closed book* with no internet access. No electronic communication is allowed. You may bring your hand written notes and printed copies of the posted class notes. You may also bring a calculator. All results must be dimensionally correct. All numerical results must be presented in **SI UNITS**. It is your responsibility to *communicate clearly* your work!

PROJECT REPORTS

Your project reports must be typeset using LaTeX and submitted electronically in pdf format. The software is avaliable freely on the web. Learn it. The page limit is 4, including figures. Fit it.

REFERENCES

1. Abbott I. R. & Von Doenhoff, A. E. 1959 *Theory of wing sections.* Dover.
2. Anderson, J.D. 1999 *Aircraft performance and design.* McGraw-Hill.
3. Anderson, J.D. 1991 *Fundamentals of Aerodynamics*, 2nd edition. McGraw-Hill.
4. Bertin, J.J. 2002 *Aerodynamics for Engineers*, 4th edition. Prentice-Hall.
5. Durand W.F. 1963 *Aerodynamic Theory*, Dover. Six Volumes.
6. Etkin, B. 1995 *Dynamics of Flight*, 3rd edition. Wiley.
7. Hale, F. 1984 *Introduction to Aircraft Performance, Selection, and Design*, Wiley.
8. Kuethe, A. M. & Chow, C-Y. 1998 *Foundations of aerodynamics,* 5th edition. Wiley. .....**TEXT BOOK**
9. Milne-Thomson, L. M. 1973 *Theoretical aerodynamics.* Dover.
10. Lanchester, F. W. 1908 *Aerodynamics.* D. Van Nostrand Company.
11. Von Karman, T. 1963 *Aerodynamics.* Mcgraw-Hill

12. Von Mises, R. 1959 *Theory of flight.* Dover.

13. Culick, F. E. 2003 The Wright Brothers: First Aeronautical Engineers and Test Pilots, *AIAA J.*, **41**(6), 985-1006. https://doi.org/10.2514/2.2046

14. https://dlmf.nist.gov

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#	*date*		*Topic*	*K & C*	*Homework & Projects*
1.	Aug	29	Introduction, Thermodynamics, The Atmosphere	Ch. 1 & 8	
2.	Sep	3	Kinematics of flow field	Ch. 2	
3.	Sep	5	Stream/Path/Streak Lines	Ch. 2	
4.	Sep	10	Continuity, Stream function	Ch. 2	
5.	Sep	12	Deformation, vorticity, circulation	Ch. 2	
6.	Sep	17	Irrotational flow, Helmholtz' vortex theorems	Ch. 2	
7.	Sep	19	Dynamics of flow fields - Momentum equation	Ch. 3	Project 1
8.	Sep	24	Dynamics of flow fields - Bernoulli's equation	Ch. 3	
9.	Sep	26	Flow about a body - Source, Sink, Doublet	Ch. 4	
10.	Oct	1	Flow about a body - Vortices	Ch. 4	
11.	Oct	3	Flow about a body - Lifting bodies	Ch. 4	1.4.1, SP2. 8.4.1, 8.4.4, 8.8.1
12.	Oct	8	MID-TERM EXAM, CLOSED BOOK		
13.	Oct	10	Vortex sheet, Vortex panel method		
14.	Oct	15	Two-Dimensional airfoils - vortex sheet	Ch. 5	3.2.2, 3.3.4, 3.4.1, SP: 6,8,9,10,11
15.	Oct	17	Symmetric airfoil	Ch. 5	
16.	Oct	22	Cambered airfoil	Ch. 5	Project 2
17.	Oct	24	Cambered airfoil	Ch. 5	
18.	Oct	29	Finite wing	Ch. 6	
19.	Oct	31	Finite wing	Ch. 6	
20.	Nov	5	Boundary layer theory	Ch. 15	
21.	Nov	7	Boundary layer theory	Ch. 15	Project 3
22.	Nov	12	Airfoil design - Low Reynolds number		
23.	Nov	14	Airfoil design - High Reynolds number		
24.	Nov	19	High speed aerodynamics	Ch. 7,8,9	
25.	Nov	21	High speed aerodynamics	Ch. 10, 11, 12	SP: 14, 15, 16, 19
	Nov	26	*APS/DFD meeting.* No Class		
	Nov	28	*Thanksgiving*		
26.	Dec	3	Aircraft vortex wake, Helicopter aerodynamics		
27.	Dec	5	Helicopter aerodynamics		
	Dec	6	*FORMAL CLASSES END*		
	Dec	9	*RRR week*		
	Dec	13	*Final Project Due: 5pm*		
	Dec	13	*LAST DAY OF INSTRUCTION*		
	Dec	20	*FALL SEMESTER ENDS*		