Ö. Savaş
6113 Etcheverry Hall
Office Hours : TuTh 14:30-16:00

August 30, 2018
Lectures in 240 Mulford
Lecture Hours TuTh 9:40-11:00

ME 163
ENGINEERING AERODYNAMICS
Fall 2018

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 4)	20%
Projects (3×10)	30%
Final Project (Dec 6)	30%
TOTAL	100%

LETTER GRADE BOUNDARIES

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

ONE EXCEPTION:

[A] for term grade if scored ≥95.0% in the final exam regardless of the in-term class performance.

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 as well as on DECF computers. Learn it. The page limit is 4, including figures.

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. Etkin, B. 1995 *Dynamics of Flight*, 3rd edition. Wiley.
6. Hale, F. 1984 *Introduction to Aircraft Performance, Selection, and Design*, Wiley.
7. Kuethe, A. M. & Chow, C-Y. 1998 *Foundations of aerodynamics,* 5th edition. Wiley. .....**TEXT BOOK**
8. Milne-Thomson, L. M. 1973 *Theoretical aerodynamics.* Dover.
9. Lanchester, F. W. 1908 *Aerodynamics.* D. Van Nostrand Company.
10. Von Karman, T. 1963 *Aerodynamics.* Mcgraw-Hill

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

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#	*date*		*Topic*	*K & C*	*Homework & Projects*
1.	Aug	23	Introduction, Thermodynamics, The Atmosphere	Ch. 1 & 8	
2.	Aug	28	Kinematics of flow field	Ch. 2	
3.	Aug	30	Stream/Path/Streak Lines	Ch. 2	
4.	Sep	4	Continuity, Stream function	Ch. 2	
5.	Sep	6	Deformation, vorticity, circulation	Ch. 2	
6.	Sep	11	Irrotational flow, Helmholtz' vortex theorems	Ch. 2	
7.	Sep	13	Dynamics of flow fields - Momentum equation	Ch. 3	Project 1
8.	Sep	18	Dynamics of flow fields - Bernoulli's equation	Ch. 3	
9.	Sep	20	Flow about a body - Source, Sink, Doublet	Ch. 4	
10.	Sep	25	Flow about a body - Vortices	Ch. 4	
11.	Sep	28	Flow about a body - Lifting bodies	Ch. 4	1.4.1, SP2. 8.4.1, 8.4.4, 8.8.1
12.	Oct	2	Vortex sheet, Vortex panel method		
13.	Oct	4	MID-TERM EXAM, CLOSED BOOK		
14.	Oct	9	Two-Dimensional airfoils - vortex sheet	Ch. 5	3.2.2, 3.3.4, 3.4.1, SP: 6,8,9,10,11
15.	Oct	11	Symmetric airfoil	Ch. 5	
16.	Oct	16	Cambered airfoil	Ch. 5	Project 2
17.	Oct	18	Cambered airfoil	Ch. 5	
18.	Oct	23	Finite wing	Ch. 6	
19.	Oct	25	Finite wing	Ch. 6	
20.	Oct	30	Boundary layer theory	Ch. 15	
21.	Nov	1	Boundary layer theory	Ch. 15	Project 3
22.	Nov	6	Airfoil design - Low Reynolds number		
23.	Nov	8	Airfoil design - High Reynolds number		
24.	Nov	13	High speed aerodynamics	Ch. 7,8,9	
25.	Nov	15	High speed aerodynamics	Ch. 10, 11, 12	SP: 14, 15, 16, 19
	Nov	20	*APS/DFD meeting*		
	Nov	22	*Thanksgiving*		
26.	Nov	27	Aircraft vortex wake, Helicopter aerodynamics		
27.	Nov	29	Aircraft vortex wake, Helicopter aerodynamics		
	Nov	30	*CLASSES END*		
	Dec	3	*RRR week*		
	Dec	6	*Final Project Due: 5pm*		
	Dec	7	*INSTRUCTION ENDS*		
	Dec	14	*FALL SEMESTER ENDS*		