

## EAS4101 Aerodynamics Section#0076 (Class#12579)

**Lecture Location and Time:** Asynchronous Online (access via <https://elearning.ufl.edu/>)  
**Class Periods:** MWF 2 (8:30 am to 9:20 am) (used for exams and synchronous class activities)

**Academic Term:** Spring 2021

*It may become necessary to modify this syllabus during the semester.  
In this event, students will be notified and the revised syllabus will be posted on the course web site.*

### **Instructor:**

Bruce Carroll  
Room 218 MAE-A  
[bfc@ufl.edu](mailto:bfc@ufl.edu)  
352-392-4943 (office)  
352-262-8174 (cell)

Office Hours: The instructor is available to meet with students via zoom MWF 2 period. Students should email instructor questions or to arrange Zoom meetings at other times.

### **Teaching Assistants:**

None

### **Course Description**

Incompressible aerodynamics, integral and differential governing equations, potential flow, boundary layers, airfoils, wings, numerical techniques. Credits: 3

### **Course Pre-Requisites / Co-Requisites**

EAS2011 or EAS3020C or EGN3353C and COP2271; EML3100, MAC2313 and MAP2302 with minimum grades of C

### **Materials and Supply Fees**

A distance learning fee is Spring 2021.

### **Course Objectives**

The objective of the course is to introduce students to incompressible aerodynamics. Students will learn underlying theory derived from fundamental engineering science principles and will apply the theory to solve complex engineering problems using knowledge of mathematics and numerical techniques. In addition, students in this course will develop communication skills and continuing education skills. The objective will be achieved through:

- Class lectures and examples
- Group projects completed with class partners
- Student completion of homework
- Student preparation for and completion of exams and quizzes

### **Professional Component (ABET):**

This course prepares graduates to have a knowledge of aerodynamics and to have design competence that integrates aeronautical topics.

### **Relation to Program Outcomes (ABET):**

Outcome	Coverage*
1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	Low
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	Low
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	Low

\*Coverage is given as high, medium, or low. An empty box indicates outcome not significantly addressed by this course.

### **Required Textbooks and Software**

- *Basic Aerodynamics: Incompressible Flow*, Gary Flandro, Howard McMahon and Robert Roach, Cambridge, 2012. ISBN 0521805821

### **Additional Recommended Materials**

- *Fundamentals of Aerodynamics*, John D. Anderson, Jr., McGraw-Hill, 2017, Sixth Edition,
- *Low Speed Aerodynamics from Wing Theory to Panel Methods*, Katz and Plotkin, McGraw-Hill, 1991.
- *Aerodynamics for Engineers*, John Bertin, Prentice Hall, 2002.

### **Course Schedule**

- See table at end of syllabus.

#### **Online Course Recording**

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

### **Attendance Policy, Class Expectations, and Make-Up Policy**

Regular class attendance is expected. This course is being presented in an online, asynchronous format. In this format, class attendance constitutes watching the recorded video lectures and completing any quizzes or other activities assigned for completion prior to the due date for each lecture.

Late HW and makeup exams are only allowed for students with documented circumstances consistent with UF policy. Students must contact the instructor as soon as possible to provide documentation and request a make-up exam. Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation. For more information on UF policies see <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

### **Evaluation of Grades**

- Homework will be assigned periodically during the semester. Students must submit HW online by the due date to receive credit.
- Each lecture will have an associated quiz. A due data is specified by which students should watch the lecture and complete the quiz.
- Students will be paired in teams of 2 for collaborative group projects. The group projects must be submitted by the due date to receive credit.
- All exams will make use of HonorLock
- During term exams will be given during the regular class period. There are two during term exams.
- The cumulative final exam will be given at the time scheduled by the registrar.

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework	10%
Quizzes	5%
Group Projects	10%
First During Term Exam	25%
Second During Term Exam	25%
Final exam	25%
	100%

### **Grading Policy**

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
94 to 100	A	4.00
<94 to 90	A-	3.67
<90 to 87	B+	3.33
<87 to 84	B	3.00
<84 to 80	B-	2.67
<80 to 77	C+	2.33
<77 to 74	C	2.00
<74 to 70	C-	1.67
<70 to 67	D+	1.33
<67 to 64	D	1.00
<64 to 61	D-	0.67
<61 to 0	E	0.00

More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### **Students Requiring Accommodations**

should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### **Course Evaluation**

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

A violation of the honor code will result in academic sanctions (typically a failing grade of E assigned for the course) and further disciplinary action.

### **Commitment to a Safe and Inclusive Learning Environment**

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### **Software Use and Copyrighted Material**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### ***Campus Resources:***

#### *Health and Wellness*

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### *Academic Resources*

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu).

<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.

<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:** [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.

**EAS4101 Aerodynamics – Tentative Schedule Spring 2021**

*(Subject to revision during semester as needed)*

<b>Week</b>	<b>Monday</b>	<b>Wed</b>	<b>Friday</b>
1	Jan 11 Lecture 1: Basic Concepts, Fluid, Pressure, Viscosity, Continuum, Units	13 Lecture 2: Dimensional Analysis, similarity	15 Lecture 3: Mathematical Descriptions of fluid flow, Lagrangian vs Eulerian, Substantial Derivative. Streamlines
2	18 Holiday – MLK Day	20 Lecture 4: Fluid Statics, standard atmosphere	22 Lecture 5: Conservation laws in Lagrangian form, Reynolds Transport Theorem (RTT)
3	25 Lecture 6: CV form of continuity	27 Lecture 7: CV form of linear momentum	29 Lecture 8: Examples
4	Feb 1 Lecture 9: CV form of energy (1 <sup>st</sup> law)	3 Lecture 10: Differential form of Governing Equations	5 Lecture 11: Fluid Kinematics, Angular Velocity, Strain
5	8 Lesson 12: Circulation, Stream Function, Velocity Potential	10 Lecture 13: Examples	12 Lecture 14: Bernoulli Equation, Manometers
6	15 Lecture 15: Examples	17 Lecture 16: Static and Stagnation Pressure, Gage and Absolute Pressures	19 Review
7	22 <b>Exam 1</b>	24 Lecture 16: Elementary Solutions, Uniform flow, source/sink flow, vortex, doublet	26 Lecture 17: Superposition of elementary flows, non-lifting flow around a cylinder
8	March 1 Lecture 18: lifting flow around a cylinder	3 Lecture 19: Numerical Methods	5 Project 1 Day: Non-Lifting flow around a cylinder.
9	8 Lecture 20: Intro to Airfoils	10 Lecture 21: Thin Airfoil Theory	12 Lecture 22: Moment coefficient, aerodynamic center, center of pressure.
10	15 Lecture 23: Examples	17 Lecture 24: Cambered Airfoils	19 Lecture 25: Examples and Biot-Savat Law
11	22 Lecture 26: Lifting Line Theory	24 Recharge Day (No Class)	26 Lecture 27: Examples
12	29 Lecture 28: General Lift Distribution	31 Lecture 29: Elliptic Wings	April 2 Lecture 30: Panel Methods (xflr5 info)
13	5 Project 2 Day (Wing Design)	7 <b>Exam 2</b>	9 Lecture 31: Viscous Flow Intro
14	12 Lecture 32: Exact Solutions NS Equations	14 Lecture 33: Displacement and momentum thickness	16 Lecture 34: Boundary Layer Equations
15	19 Lecture 35: Blasius solution for laminar boundary layers	21 Review	23 Reading Day (No Class)

**Final Exam is Friday April 30 from 12:30 pm to 2:30 pm (see <https://registrar.ufl.edu/courses/final-exam.html>)**