Course Number:	**MNE490**
Course Title:	**Fundamentals of Flight**
Instructors:	Dr. Geoff Cowles
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Class Location:	SENG 215
Class Time:	9:30 - 10:45, Tuesday/Thursday
Office Hours:	10:45-12:00 Tuesday/Thursday (SENG 116D)
Website:	UMD blackboard/mycourses
Textbook:	Introduction to Flight, J. Anderson, 2011, ISBN978-0073380247

Course Description:
This course will provide a technical introduction to the mechanics of flight. Units will include: a review of fluid mechanics in the context of aerodynamics, two-dimensional and finite-span wing theories, flow compressibility effects, airplane performance, stability and control, and propulsion. The course will emphasize computation in both homework and team-oriented projects.

Course Objectives:

1. Provide an introduction to aeronautical engineering with a technical perspective
2. Help the students gain a critical understanding of the aerodynamics of lifting bodies
3. Instruct the students on how to calculate fluid forces on a body in flight
4. Demonstrate how aerodynamics, stability, and purpose drive configuration design
5. Provide experience in the computational modeling of aerodynamic flows.

Topics:

- Properties of the Atmosphere
- Basic Aerodynamics
- Incompressible Flow – Speed Measurement
- Compressible Flow – Isentropic Mach Relations
- Viscous Flow – Boundary Layers and Skin Friction
- Pressure Coefficient – Definitions Aerodynamic Coefficients
- 2D Airfoils
- 3D Wings
- Airplane Performance
- Stability and Control
- Propulsion

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Grading:

Quizzes:	5%
Homeworks:	20%
Computing Project:	10%
Midterm Exam:	20%
Final Project:	20%
Comprehensive Final Exam:	25%

Homeworks (8, lowest grade dropped):

- Turn in your work on time at the beginning of class
- Write neatly and box your answers
- I encourage you to work with others but you must write up the solutions on your own. Explanations must be in your own words.

Projects:
This course will include two group projects. You will have approximately 4 weeks to complete each project.

- Computing Project (Teams of 2): [3 separate tutorials]
  - Compute supersonic flow through converging/diverging nozzle with COMSOL
  - Compute flow over 2D airfoil section using XFOIL
  - Compute forces on 2D airfoil using COMSOL
- Design Project (Teams of 4). Design a low-speed aircraft given some simple constraints.

Quizzes (12):
There will be weekly blackboard quizzes. These quizzes must be completed prior to class (generally Tuesdays) and are based largely on the reading for the week. The quizzes will be quite simple and should not take more than 10 minutes to complete.

Approach:
My approach to this course is to use, to the extent possible, Blackboard / MyCourses as an aid to providing content electronically through reading assignments, instructional videos, and other online content. My strategy in doing this is to enable you, the student, to gain a basic level of understand of the material *before* you come to class so that *during* class we can discuss the material at a higher level and delve deeper into applications of the concepts (as opposed to introducing the information for the first time). With this model, your "homework" time outside of class will be a mix of reading and viewing online content in MyCourses plus traditional problem sets.

I have organized the course content into weekly units that will contain two modules for each week (Tuesday and Thursday class times). In a typical week, Tuesday will be focused on in-class lecture/review with some sample problems and on Thursdays we will split up into two or three groups in the library and work through problems. Not all

weeks will use this structure. Weeks that have one class due to an exam or holiday as well as the first week will not follow this structure.

A typical week will look like:

Before Tuesday Class:
- Work through the associated learning module in MyCourses, including any reading assignments and online content
- Take the associated learning assessment Quiz in MyCourses

During Tuesday Class:
- We will recap the main topics for the current unit and answer questions from the reading and/or online content
- We will work through sample problems, provide further examples & demonstrations to illustrate principles

During Thursday Class:
- We will work (in groups) on quantitative problems, putting into practice the material from the week. These will be similar to homework problems.

Time Management:
As per the syllabus, homeworks will be due on Tuesdays at the beginning of lecture, and new assignments given at the end of lecture on Tuesday, due the following Tuesday. Also as per the syllabus, I cannot stress enough the importance of good time management. I expect all students to come to class prepared – that is, having completed the associated learning module (readings, online content, etc.) and learning assessment quiz *before* class. The success of the "flipped" classroom style depends on students coming prepared to class so that we can discuss relevant topics at a higher (as opposed to introductory) level. Come to class prepared!

Incomplete Policy:
Incomplete may be given only in exceptional circumstances at the instructor's discretion. The student must be passing at the time of the request or be sufficiently close to passing. If the work is not completed within one year of the recording of the incomplete grade, the grade will become an F(I). The incomplete policy for this course is that at least 70% of the course must be already completed and an exceptional circumstance (i.e. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

Academic Integrity:
University policy applies: see link here.

Electronic Gadgets:
Usage of electronic devices (tablets, Surfaces) for taking notes or problem solving is permitted. Any other use of devices is not permitted. Phones must be off or on vibrate. No texting, tweeting, surfing, etc. during class time.

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Week	Date	Topic
1	T, Jan 27	Units and Concepts
	R, Jan 29	Standard Atmosphere
2	T, Feb 3	Continuity, Momentum, Bernoulli
	R, Feb 5	
3	T, Feb 10	Energy Equation, Isentropic Flow, Speed of Sound
	R, Feb 12	
4	T, Feb 17	NO CLASS
	R, Feb 19	Incompressible Flow: Low-Speed Wind Tunnels and Airspeed Measurement
5	T, Feb 24	Compressible Flow: Area-Velocity Relations, Airspeed Measurement and Supersonic Wind Tunnels
	R, Feb 26	
6	T, Mar 3	Viscous Flow, Boundary Layers, Skin Friction Calculation
	R, Mar 5	
7	T, Mar 10	IN CLASS MIDTERM EXAM
	R, Mar 12	Aerodynamic Nomenclature
8	T, Mar 17	NO CLASS SPRING BREAK
	R, Mar 19	
9	T, Mar 24	Pressure Coefficient, Critical Mach Number, Wave Drag
	R, Mar 26	
10	T, Mar 31	Finite wings, concept, induced drag, efficiency factor, aspect ratio changes to lift curve slope, swept wings, Flaps, high lift
	R, Apr 2	
11	T, Apr 7	Flight Performance
	R, Apr 9	
12	T, Apr 14	Stability and Control
	R, Apr 16	
13	T, Apr 21	Propulsion
	R, Apr 23	
14	T, Apr 28	Design Process
	R, Apr 30	Project Presentations
15	T, May 5	Review Session
	R, May 7 (8-11)	Final Exam