Note:

Course content may be changed, term to term, without notice. The information below is provided as a guide for course selection and is not binding in any form, and should <u>not</u> be used to purchase course materials.

LIBERTY UNIVERSITY

COURSE SYLLABUS

AVIA 305
AIRPLANE AERODYNAMICS

COURSE DESCRIPTION

This course will provide the student a study of the physical principles of airplane aerodynamics, thereby fostering an appreciation of the factors affecting aircraft performance, stability and control, and special flight conditions often experienced by commercial pilots of the fixed-wing aircraft.

RATIONALE

This course will prepare the student to understand and apply aerodynamic concepts, such as incompressible flow airfoil theory and wing theory, to enhance safe execution of more complex flight conditions and parameters. Topics discussed will center on calculation of stall speed, drag and basic performance criteria, configuration changes, high and low speed conditions, special flight conditions, and an introduction to compressible flow.

I. PREREQUISITE

For information regarding prerequisites for this course, please refer to the Academic Course Catalog.

II. REQUIRED RESOURCE PURCHASES

Click on the following link to view the required resource(s) for the term in which you are registered: http://bookstore.mbsdirect.net/liberty.htm

III. ADDITIONAL MATERIALS FOR LEARNING

A. Computer with basic audio/video output equipment

B. Internet access (broadband recommended)

C. Microsoft Word
(Microsoft Office is available at a special discount to Liberty University students.)

IV. MEASURABLE LEARNING OUTCOMES

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

A. Describe lift, drag, and pitching moment curves versus angle of attack with differing wing shapes and high coefficient of lift devices.

B. Explain characteristics of boundary layer composition caused by changes in friction and wing airfoil shape.

C. Examine the effects of velocity, density, area, and lift coefficient on lift and drag and compute stall speed and changes to stall speed due to variables such as weight-load factor, altitude, and lift coefficient.

D. Determine maximum range, endurance speeds, and rate of climb airspeeds from plots of power, thrust and drag versus airspeed.

E. Diagram wing stall patterns and explain the aerodynamic characteristics of spins and spin recovery.

F. Discuss the effects of wake turbulence, ground effect, and induced drag on aircraft performance and flying qualities.

G. Explain factors affecting the maneuvering envelope.

H. Solve problems involving the turn equations.

I. Explain the cause and effects of compressibility and how the effects can be minimized.

J. Describe aerodynamic design features for high-speed transonic and supersonic flight.

K. Define types of stability and control with respect to axis, static, or dynamic, and the primary contributors to each type.

V. COURSE REQUIREMENTS AND ASSIGNMENTS

A. Textbook readings, presentations, and National Transportation Safety Board (NTSB) documents

B. Course Requirements Checklist

After reading the Syllabus and Student Expectations, the student will complete the related checklist found in Module/Week 1.

C. Discussion Board Forums (2)

The student is required to create a thread in response to the provided prompt for each forum. Each thread must be 250–300 words in length and demonstrate course-related knowledge. The student is required to reply to 2 other classmates' threads. Each reply must be 150–200 words in length. The textbook must be the primary resource.

D. Essays (5)

The student will write five 300-word essays, each in response to questions presented by the instructor. The student must use his/her textbook as a reference; no other resources are required. Each essay will be submitted in a Word document and include a citation page.

E. Research Paper

The student will submit a 4–6-page research paper on the unique aerodynamic characteristics of his/her favorite aircraft. The paper must adhere to current APA format. The 4–6-page length requirement does not include the title page, abstract, or bibliography. A minimum of 3 sources will be submitted in an Annotated Bibliography. An outline of the paper is also to be submitted.

F. Tests (4)

The student will take 4 tests in this course. Tests will be open-book/open-notes, and contain multiple-choice and true/false questions, covering information from the assigned textbook readings. Test are timed. If you exceed the allotted time limit, you may still finish the test, but your instructor will be alerted to your total completion time and your grade will be deducted 10% for every 10 minutes you exceed the allotted time limit.

VI. COURSE GRADING AND POLICIES

A. Points

Course Requirements Checklist		10
Discussion Board Forums	(2 at 75 pts ea)	150
Essays	(5 at 75 pts ea)	375
Research Paper - Annotated Bibliography		20
Research Paper - Outline		25
Research Paper - Final Submission		130
Tests	(4 at 75 pts ea)	300
	Total	1010

B. Scale

A = 900–1010 B = 800–899 C = 700–799 D = 600–699 F = 0–599

C. Disability Assistance

Students with a documented disability may contact Liberty University Online's Office of Disability Academic Support (ODAS) at LUOODAS@liberty.edu to make arrangements for academic accommodations. Further information can be found at www.liberty.edu/disabilitysupport.

VII. BIBLIOGRAPHY

Anderson, D.F. & Eberhardt, S. (2001). *Understanding flight.* New York, NY: McGraw-Hill Companies. ISBN: 0071363777.

Anderson, J.D. (2005). *Introduction to flight* (5th ed.). New York, NY: McGraw-Hill Companies. ISBN: 0072825693.

Anderson, J.D. (2011). *Fundamentals of aerodynamics* (5th ed.). New York, NY: McGraw-Hill Companies. ISBN: 9780073398105

Brandt, S.A., Stiles, R.J., Bertin, J.J., & Whitford, R. (2004). *Introduction to aeronautics: a design perspective* (2nd Ed.). J.A. Schetz (Ed.). Reston, VA: American Institute of Aeronautics and Astronautics, Inc. ISBN: 1563477017.

Crawford, B. *Flightlab texts on aerodynamics.* Retrieved from http://www.flightlab.net/Flightlab.net/Download_Course_Notes.html.

Dreese, J. *The Dreese airfoil primer.* Retrieved from http://www.dreesecode.com/.

Hurt, H.H., Jr. (1965). *Aerodynamics for naval aviators.* Renton, WA: Aviation Supplies & Academics, Inc. ISBN: 156027140X.

Schmidt, L.V. (1998). *Introduction to aircraft flight dynamics.* J.S. Przemieniecki (Ed.). Reston, VA: American Institute of Aeronautics and Astronautics, Inc. ISBN: 1563472260.

Smith, H.C. (1992). *The illustrated guide to aerodynamics* (2nd ed.). United States: TAB Books; a division of McGraw-Hill, Inc. ISBN: 0830639012.

Stowell, R. (2007). *The light airplane pilot's guide to stall/spin awareness* (1st ed.). Ventura, CA: Rich Stowell Consulting. ISBN: 9781879425439.

Yechout, T.R., Morris, S.L., Bossert, D.E., & Hallgren, W.F. (2003) *Introduction to aircraft flight mechanics.* J.A. Schetz, (Ed.). Reston, VA: American Institute of Aeronautics and Astronautics, Inc. ISBN: 1563475774.

LIBERTY UNIVERSITY

COURSE SCHEDULE

AVIA 305

Textbooks: Dole et al., *Flight Theory and Aerodynamics* (2017).

MODULE/ WEEK	READING & STUDY	ASSIGNMENTS	POINTS
1	Dole et al.: chs. 1–3 2 presentations	Course Requirements Checklist Class Introductions DB Forum 1	10 0 75
2	Dole et al.: chs. 4–5 1 presentation	Essay 1 Test 1	75 75
3	Dole et al.: chs. 6–7 2 presentations	Research Paper - Annotated Bibliography Essay 2	20 75
4	Dole et al.: chs. 8–9 1 presentation	Essay 3 Test 2	75 75
5	Dole et al.: ch. 12 2 presentations NTSB document	Research Paper - Outline Essay 4	25 75
6	Dole et al.: chs. 10–11, 13 1 presentation NTSB document	Essay 5 Test 3	75 75
7	Dole et al.: chs. 14–15 1 presentation	Research Paper - Final Submission	130
8	Dole et al.: ch. 16 2 presentations	DB Forum 2 Test 4	75 75
		TOTAL	**1010**

DB = Discussion Board
NTSB = National Transportation Safety Board

NOTE: Each course week (except Module/Week 1) begins on Tuesday morning at 12:00 a.m. (ET) and ends on Monday night at 11:59 p.m. (ET). The final week ends at 11:59 p.m. (ET) on **Friday**.