COURSE OUTLINE

Course Number	Course Title	Credits
AVI 215	Aerodynamics	3
Hours:	**Prerequisite:**	**Implementation**
2 Lecture / 2 Lab	MAT 115	Fall 2023

Catalog description:
Analysis of the fundamental theory and elements of applied aerodynamics. It provides the knowledge and background for safe and effective flying. Lab explores the basic concepts of airfoil angle of attack and lift/drag characteristics.

General Education Category:
Not GenEd

Course coordinator:
Deanna Lawson
(609) 570-3487
lawsond@mccc.edu

Required texts & Other materials:

1. Flight Theory and Aerodynamics – A Practical Guide for Operational Safety by Dole, Lewis, Badick, and Johnson (ISBN 1119233402)
   Information Resources
1. FOILSIM, NASA's interactive web-based teaching aide
2. Videos, guest speakers, additional texts which complement the information presented in class

Other learning resources: The labs provide activities which illustrate concepts discussed in the lectures. Wind tunnel experiments will be utilized in the labs. Additional challenges are provided to allow students to explore topics in greater depth. Small group activities are also an integral component of the learning process.

Course Student Learning Outcomes (SLO):

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

1. Describe the aerodynamic forces acting on an aircraft in flight and the variables affecting each one. **(PLO 1,4) (ILG 1,3,11)**
2. Calculate the amount of lift being produced by an airfoil by utilizing the lift formula. **(PLO 1,4) (ILG 1,2,3,4)**
3. Compare aircraft to measure the effects of drag and then be able to determine potential methods of reducing these effects. **(PLO 1,4) (ILG 1,3,4,10,11)**
4. Explain the effects of planform design on flight and provide the rationale for specific planform selection. **(PLO 1,4) (ILG 1,3,11)**
5. Evaluate and calculate aircraft performance data for the various flight regimes. **(PLO 1,4) (ILG 1,2,3,4,11)**
6. Identify the types of aircraft stability and the impact on aircraft control and maneuverability. **(PLO 1,4) (ILG 1,3,4,11)**
7. Trace the development of high-speed flight and understand the latest technological advances in aircraft design. (**PLO1,4) (ILG 1,3,11)**

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.
Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Aviation Technology (PLO)

1. Demonstrate the knowledge and skills required to obtain the private and commercial certificates and instrument rating, including aeronautical technical skills and decision-making, while demonstrating safety as their primary focus

4. Demonstrate effective and correct written and verbal communication

Units of study in detail – Unit Student Learning Outcomes:

Unit I **WING AND AIRFOIL FORCES** [Supports Course SLO #1]

The student will be able to…

- Identify the properties of the atmosphere and determine their aerodynamic effects
- Describe Bernoulli's Principle and Newton's Laws as they relate to incompressible airflow
- Define airfoil terminology and explain aerodynamic forces
- Illustrate Magnus Effect and the importance of circulation to lift

Unit II **PLANFORM EFFECTS** [Supports Course SLOs #2 and #3]

The student will be able to...

- Describe the aerodynamic effects of planform
- Compare lift and stall patterns of various wing types
- Explain the effects of flaps and other high lift devices

Unit III **AIRCRAFT DRAG** [Supports Course SLOs #3 and #4]

The student will be able to…

- *Differentiate between parasite and induced drag*
- *Explain drag characteristics including L/D max*
- *Describe the effects of speed, altitude, aspect ratio on drag*
- *Calculate Reynolds Number and understand its significance*

Unit IV **AIRCRAFT PERFORMANCE** [Supports Course SLO #5]

The student will be able to…

- Explain the various aspects of aircraft performance
- Predict takeoff, climb, maneuvering, range, endurance, and landing performance
- Determine how the various performance calculations are derived
- Compare the effects of variables such as power and weight on performance

Unit V **STABILITY** [Supports Course SLO #6]

The student will be able to…

- Differentiate between static and dynamic stability in aircraft
- Describe positive, neutral, and negative stability about the aircraft axes
- Determine design and loading factors and how they affect stability

Unit VI **HIGH SPEED FLIGHT** [Supports Course SLO #7]

The student will be able to…

- Trace the history of the breaking of the sound barrier
- Explain the problems associated with high speed flight
- Discuss unique flight characteristics of supersonic flight
- Investigate recent technological advancements in supersonic and hypersonic
- flight Hypothesize about future developments in aerodynamics and flight

Evaluation of student learning:

Tests, quizzes, labs, assignments, attendance, and class participation will be considered for the final grading. The breakdown of grading is:

Participation	15 %
Glider Project	10 %
Labs	45 %
Tests	30 %