I. INTRODUCTION

A. The purpose of this course is to study aerodynamics and to develop an increased awareness of the theory and application of specific problems of flying to include basic aerodynamics, slow speed flight, and supersonic flight

B. This course is required to meet curriculum requirements for the Central Texas College program(s) associate degree in aviation science

C. This course is occupationally related and serves as preparation for jobs in aviation

II. OVERALL OR GENERAL OBJECTIVES OF THE COURSE

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

A. Demonstrate, through written tests and discussions, an increased awareness of aerodynamic principles (F2; F3; F5)

B. Recognize hazardous aerodynamic flight conditions and avoid them (C5)

C. Explain factors involved with high speed, high altitude flight conditions (C19; F12)

III. INSTRUCTIONAL MATERIALS

The instructional materials identified for this course are viewable through www.ctcd.edu/books

IV. COURSE REQUIREMENTS

A. To attend class regularly.

B. To be prepared to participate in classroom discussions and to take unannounced quizzes relating to lecture material presented and text assignments.

February 2007
C. To be present for all examinations.

V. EXAMINATIONS

A. There will be a minimum of three major examinations:
   1. Exam 1
   2. Mid-term exam
   3. Final exam

B. A student must be present for all examinations. No make-up examinations will be given. Students who know in advance will be absent from an examination due to valid reasons, must arrange to take an early examination. Unexpected absences due to illness or extenuating circumstances will require the student to see the instructor about individual make-up work in lieu of the missed examination.

C. Students without excused absences will be given a zero for the examination missed.

VI. SEMESTER GRADE COMPUTATIONS

<table>
<thead>
<tr>
<th>Exams 1</th>
<th>100 points</th>
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<tbody>
<tr>
<td>Mid-Term Exam</td>
<td>100 points</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100 points</td>
</tr>
<tr>
<td>Quizzes/Instructor Evaluation</td>
<td>100 points</td>
</tr>
</tbody>
</table>

TOTAL 400 points

A student must take the final examination to receive a grade for the course.

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM COURSE INSTRUCTOR

A. **Withdrawal from course:** It is the student’s responsibility to officially drop a class if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file an Application for Withdrawal or an Application for Refund. The withdrawal form must be signed by the students.

Application for Withdrawal will be accepted at any time prior to Friday of the 12th week of classes during the 16 week fall and spring semesters. The deadline for sessions of other lengths is as follows.

- 11 week session: Friday of the 8th week
- 8 week session: Friday of the 6th week
- 5 ½ week session: Friday of the 4th week
The equivalent date (75% of the semester) will be used for session of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

Students who officially withdraw will be awarded the grade of “W”, provided the students’ attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the college before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F” or “FN” for nonattendance.

B. **Administrative withdrawal**: An administrative withdrawal may be initiated when the student fails to meet College attendance requirements. The instructor will assign the appropriate grade on the Administrative Withdrawal Form for submission to the registrar.

C. **An Incomplete Grade**: The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the course work but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course...” Prior approval from the instructor is required before the grade of “I” is recorded. A student who merely fails to show for the final examination will receive a zero for the final and an “F” for the course.

D. **ADA Statement**: Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

(College policy-procedures statements)
BLOCK ONE

OBJECTIVES: To establish common ground for the study of aerodynamics while introducing basic aerodynamic principles

CONTENT: This block will be used to introduce the student to the history of flight, people who helped develop aircraft, and to discuss basic aerodynamic principles

COMPLETION STANDARDS: This block will be completed when the student demonstrates through quizzing, an understanding of basic aerodynamic principles and a background of aerodynamics

LESSON ONE: History of flight

OBJECTIVES: To develop common ground and to introduce the student to the history of flight

CONTENT:

1. Flight as recorded in mythology
2. Introduction to Aerostatics
3. Development of lighter-than-air aircraft

COMPLETION STANDARDS: This lesson will be complete when the student can explain the role of mythology in the study of flight and, through oral quizzing, explain the principles of aerostatics and lighter-than-air

LESSON TWO: Continuation of history of flight with the introduction of the background of heavier-than-air aircraft development

OBJECTIVES: To develop an understanding of how the invention of the airplane was a process carried out over hundreds of years

CONTENT:

1. Dreams and drawings of Leonardo DaVinci
2. Sir George Cayley
3. Gliding flight

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates through oral quizzing an increased knowledge of the innovations and ideas that led to powered flight

LESSON THREE: Powered flight
OBJECTIVES: This lesson will be used to discuss the development of the airplane and the study of aerodynamics

CONTENT:

1. Wright Brothers and others
2. The study of aerodynamics
3. Early airplane development

COMPLETION STANDARDS: This lesson is complete when, through oral quizzing and discussion, the student shows increased knowledge of airplane development

LESSON FOUR: Physics of Lift

OBJECTIVES: To study principles of lift and to increase the student’s knowledge of principles defining lift

CONTENT:

1. Daniel Bernoulli
2. Continuity equation
3. Airfoils

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates knowledge of basic principles that are applied to aerodynamics

LESSON FIVE: Airfoils

OBJECTIVES: This lesson will be used to introduce airfoil terminology and the various types of airfoils

CONTENT:

1. Airfoil terminology
2. Lift on cambered airfoils
3. Symmetrical and inverted airfoils

COMPLETION STANDARDS: This lesson will be completed when the student can explain parts of the airfoil, describe lift along the airfoil, and differentiate between cambered and symmetrical airfoils

LESSON SIX: Pressure distribution

OBJECTIVES: to develop knowledge of the pressures along an airfoil

CONTENT:
1. Pressure distribution
2. Pitching moments
3. Symmetrical airfoils and pitching moments

COMPLETION STANDARDS: This lesson is complete when the student can explain pressure distribution and pitching moments on an airfoil

LESSON SEVEN: Stalls

OBJECTIVES: To increase the student’s knowledge of stalls and factors affecting them

CONTENT:

1. Factors involved with stalls
2. Stagnation point and unfavorable pressure gradient
3. Stall devices

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates, through discussion or oral quizzing, increased knowledge of stalls

LESSON EIGHT: Airfoil types and effects on stalls

OBJECTIVES: To develop an understanding of how airfoils are classified, and how various devices are used to enhance lift characteristics

CONTENT:

1. Airfoil designation
2. Wing lift and span effects
3. Span wise lift and stall sequence

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates a thorough knowledge of how airfoils are designated and how lift and stall characteristics are enhanced

LESSON NINE: Lift coefficient and lift quality

OBJECTIVES: To develop knowledge of factors involved with lift developed by an airfoil

CONTENT:

1. Exerted pressure
2. Coefficient of lift
3. Momentum

COMPLETION STANDARDS: This lesson is completed when the student demonstrates through oral and written quizzing the knowledge of forces effecting lift

AIRP 1343
LESSON TEN: Lift Controllers

OBJECTIVES: To demonstrate complete knowledge of aircraft devices used to enhance lift

CONTENT:

1. Flaps
2. Slots and Slats
3. Spoilers

COMPLETION STANDARDS: This lesson is complete when the student can discuss the effects of aircraft devices used to control lift and demonstrates an increased knowledge of those effects

LESSON ELEVEN: Concepts of aerodynamic drag

OBJECTIVES: To develop increased knowledge of factors effecting aerodynamic drag

CONTENT:

1. Components of drag
2. Drag coefficient
3. Ground effect

COMPLETION STANDARDS: This lesson is complete when the student, through oral and written quizzing, demonstrates a working knowledge of aerodynamic drag

LESSON TWELVE: Concepts of thrust

OBJECTIVES: To become more familiar with the concepts of thrust and the different types of engines

CONTENT:

1. Principles of propulsion
2. Jet engines
3. Reciprocating engines

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates, through oral quizzing and discussion, a greater knowledge of thrust concepts and the engines that produce thrust

LESSON THIRTEEN: Thrust enhancers

OBJECTIVES: This lesson will be used to develop a greater knowledge of those devices
designed to enhance thrust

CONTENT:

1. Superchargers and turbochargers
2. Propellers
3. Power plant performance

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates knowledge of devices used to increase power plant performance
BLOCK TWO

OBJECTIVES: This block of instruction will serve to increase the student’s knowledge of basic aircraft performance and elements of aircraft stability

COMPLETION STANDARDS: This block will be complete when the student demonstrates through written quizzing a thorough knowledge of aircraft performance and properties of stability

LESSON 14: Aircraft performance

OBJECTIVES: This lesson will be used to address various elements of aircraft performance

CONTENT:

1. Definition of performance
2. Items of A/C performance
   a. Straight and level
   b. Climb and descent
3. Take-off and landing performance

COMPLETION STANDARDS: This lesson will be complete when the student can discuss elements of A/C performance

LESSON FIFTEEN: Concepts of range, endurance and maneuvering

OBJECTIVES: This lesson is to be used to allow the student to increase his/her knowledge of factors effecting and aircraft’s range and/or endurance as well as the elements involved with aircraft maneuvering

CONTENT:

1. Aircraft range vs. aircraft endurance
2. Maneuvering flight

COMPLETION STANDARDS: This lesson is complete when the student demonstrates through oral or written quizzing, greater knowledge of aircraft range and endurance as well as how maneuvering effects aircraft performance

LESSON SIXTEEN: Stability and Control

OBJECTIVES: To develop knowledge of stability as the term applies to aerodynamics

CONTENT:
1. Concepts of stability
2. Types and properties of stability
3. Aircraft Axis

**COMPLETION STANDARDS:** This lesson is complete when the student, through oral
discussion and quizzing, demonstrates operational knowledge of factors involved with aircraft
stability.

**LESSON SEVENTEEN:** Longitudinal and yaw control

**OBJECTIVES:** To have the student enhance his/her knowledge of factors involved with
longitudinal stability as well as the controls of the vertical or yaw axis

**CONTENT:**

1. Longitudinal stability
2. Trim control
3. Yaw and roll control

**COMPLETION STANDARDS:** This lesson is complete when the student can demonstrate
through discussion or quizzing a knowledge of longitudinal stability that is greater than necessary
for pilot certification

**LESSON EIGHTEEN:** Directional and lateral stability

**OBJECTIVES:** To reach a greater understanding of the elements involved with directional and
lateral stability

**CONTENT:**

1. Directional stability
2. Lateral stability
3. Turning performance

**COMPLETION STANDARDS:** This lesson is complete when, through oral or written
quizzing, the student can demonstrate practical knowledge of the factors involved with lateral
stability and directional control
BLOCK THREE

AIRCRAFT SPEED REGIMES AND DESIGN CONSIDERATIONS

OBJECTIVES: This block of instruction will serve to educate the student about factors involving aircraft speed to include high speed and low speed areas. In addition, this section will cover design considerations for various aircraft speeds.

COMPLETION STANDARDS: This block of instruction will be complete when the student demonstrates through written quizzes and oral discussions increased knowledge of factors involved with various aircraft speeds.

LESSON NINETEEN: Introduction to high speed flight

OBJECTIVES: To develop knowledge of terms used in supersonic flight and concepts of shock wave formation.

CONTENT:

1. Terms used in supersonic flight
2. Concepts of compressibility
3. The speed of sound and formation of shock waves

COMPLETION STANDARDS: This lesson will be complete when the student, through oral discussion, demonstrates knowledge of the terms used as well as the effects of compressibility and shockwave formation.

LESSON TWENTY: This lesson is to be used to inform the student of the various high-speed flight areas and the aerodynamic effects in each.

CONTENT:

1. Classification of speed regimes
2. Design features for high speed flight

COMPLETION STANDARDS: This lesson is complete when the student exhibits, through discussion and quizzing, increased knowledge of the elements involved with high speed flight.

LESSON TWENTY-ONE: Low speed flight areas

OBJECTIVES: To develop increased awareness of the dangers of low speed flight.

CONTENT:

1. A/C design and how it affects flight in the slow speed regimes.
2. Region of reverse command
3. Low level wind shear

COMPLETION STANDARDS: This lesson will be complete when, through oral and/or written quizzing, the student demonstrates an understanding of design features and their effect in slow speed flight

LESSON TWENTY-TWO: Dangerous conditions for slow speed flight

OBJECTIVES: To develop a greater knowledge of conditions and situations that are particularly hazardous during slow-speed flight

CONTENT:

1. Effects of frost and ice
2. Wake turbulence
3. Low level flight

COMPLETION STANDARDS: This lesson will be complete when the student demonstrates increased knowledge by explaining the hazards that a pilot may encounter during slow speed flight

LESSON TWENTY-THREE: Aircraft development and airworthiness requirements

OBJECTIVE: To familiarize the student with the procedures of aircraft design, this lesson will introduce concepts of aircraft development and airworthiness considerations

CONTENT:

1. Design specifications
2. Airworthiness considerations
3. Design phases

COMPLETION STANDARDS: This lesson is complete when the student demonstrates through discussion and oral quizzing, a greater understanding of requirements necessary during the design phase

LESSON TWENTY-FOUR: The design of light propeller-driven airplanes

OBJECTIVE: To develop knowledge necessary to explain elements involved with designing light propeller-driven airplanes

CONTENT:

1. Designing aircraft components
2. Selecting proper power plants
3. Landing gear configuration

COMPLETION STANDARDS: This lesson is complete when the student can describe, either verbally or in written form, design concepts used in designing light aircraft.

LESSON TWENTY-FIVE: Design features used in light aircraft

OBJECTIVE: This lesson will be used to finish developing the student’s knowledge of light aircraft design.

CONTENT:

1. First estimations for design characteristics
2. The use of computers to aid the design process

COMPLETION STANDARDS: This lesson is complete when the student can demonstrate through oral quizzing an understanding of how designers estimate performance characteristics and how computers help in those estimations.