I. INTRODUCTION

A. An aircraft is propelled by thrust produced by the powerplant increasing the momentum of a mass of air. The basic principle of propellers has changed very little since the first successful Wright Brothers flight, but technology has undergone many advances in aerodynamics. This course will provide a basic foundation in propeller theory necessary for the understanding of propeller design, function, and construction and general principles of propeller inspection, servicing and repair of fixed-pitch, constant-speed, and feathering propellers and governing systems. Instruction includes propeller removal, balancing, installation and basic safety.

B. This is a required course of study for the Associate Degree of Applied Science in Aviation Maintenance Technology.

C. This course is occupationally related and serves as preparation for a career in the field of Aviation Maintenance.

D. Prerequisite: successful completion of all required (G) general aviation maintenance courses.

II. LEARNING OUTCOMES

Upon successful completion of this course, Aircraft Propellers, the student will:

Inspect, check, service and repair propeller synchronizing and ice control systems, fixed-pitch, constant-speed and feathering propellers and propeller governing systems; identify and select propeller lubricants; balance propeller control system components; install, troubleshoot, and remove propellers; repair aluminum alloy propeller blades; and demonstrate proper safety procedures. (C18,F1,F3,F5,F10)

III. INSTRUCTIONAL MATERIALS

January 2007
A. The instructional materials identified for this course are viewable through www.ctcd.edu/books

B. Supplemental Reading: None


IV. COURSE REQUIREMENTS

The following will be required of each student for successful completion of this course:

A. Reading Assignment: Students are required to complete all reading assignments prior to the class in which the materials will be discussed. Students are subject to announced and unannounced written and oral examinations on assigned reading material.

B. Projects: No individual projects.

C. Class performance: Students are required to attend all classes and to be in the classroom on time. The instructor can lower a student’s grade because of excessive tardiness. When absent from class for any reason, it is the student’s responsibility to arrange for and make up assignments missed during the absence.

D. Class Participation: Students will earn a satisfactory grade in the course by attending and regularly participating in class, giving complete attention to class activities, completion of all assigned work and successfully completing the examinations. Students are required to maintain a minimum GPA of 2.0 to receive a passing grade for the class and are encouraged to compute and monitor their GPA as the class progresses.

V. EXAMINATIONS

A. There will be two written examinations for this course covering all the lecture notes and reading material with a weight of 100 points each totaling 200 points.
B. Practicum:
None

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>EXAMINATIONS</th>
<th>POINTS</th>
<th>POINT TO GRADE RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXAM 1</td>
<td>100</td>
<td>180- 200 = A</td>
</tr>
<tr>
<td>EXAM 2</td>
<td>100</td>
<td>160- 179 = B</td>
</tr>
<tr>
<td>TOTAL 200</td>
<td></td>
<td>140- 159 = C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120- 139 = D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0- 119 = F</td>
</tr>
</tbody>
</table>

VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM COURSE INSTRUCTOR

A. Course Withdrawal: It is the student’s responsibility to officially drop a class if circumstances prevent attendance. In order to be officially withdrawn from the course, a student must obtain, complete and file an Application for Withdrawal form with the College. The student’s transcript will show “W” or “F”, depending on whether the student was passing or failing at the time of withdrawal.

B. Administrative Withdrawal: Students not meeting course objectives or making satisfactory progress may be withdrawn from the course at the discretion of the instructor.

C. Cellular Phones and Beepers: Cellular phones and beepers will be turned off while the student is in the classroom or laboratory.

D. American’s with Disabilities Act (ADA 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 for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

E. Instructor Discretion: The instructor reserves the right of final decision in course requirements.
F. Civility: Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

VIII. COURSE OUTLINE

A. Module One: Introduction to Aircraft Propellers

1. Learning Outcomes: upon successful completion of this module, the Student will:

   Explain the multiple forces acting on a propeller, propeller efficiency, typical materials used to manufacture propellers and pitch change mechanisms.

2. Learning Activities:

   Successfully complete examination 1 covering material presented in Module 1. (F1,F5,F10,F12)

3. Module Outline One: Introduction to Aircraft Propellers

   a. Propeller Theory
      1. Propeller Pitch
      2. Angle of Attack
      3. Tip Speed
      4. Propeller Efficiency
      5. Forces Acting on Propellers
         a) Centrifugal Force
         b) Thrust Bending Force
         c) Torque Bending Force
         d) Aerodynamic Twisting Force
         e) Centrifugal Twisting Force
      6. Asymmetrical Loading

   b. Classifications of Propellers
      1. Materials
      2. Number of Blades
      3. Pitch Change Methods

B. Module Two: Propellers for Reciprocation Engines

1. Learning Outcomes: upon successful completion of this module, the Student will:
a. Identify and explain the types of wood and metallic propellers used on reciprocating engine aircraft.

b. Explain the various types of pitch control, counter balance, propeller feathering and speed control devices used.

2. Learning Activities:

Successfully complete examination 1 covering material presented in Module 2. (F1,F5,F10)

3. Module Outline Two: Propellers for Reciprocating Engines

a. Fixed Pitch Propellers
   1. Wood Propellers
   2. Metal Propellers
b. Ground Adjustable Propellers
c. Controllable-Pitch Propellers
   Two Position Propellers
d. Automatic Propellers
e. Constant-Speed Propellers
   1. Principles of Operation
      a) Counterweight Propellers
      b) Noncounterweight Propellers
   2. Propeller Governor
f. Feathering Constant-Speed Propellers
   1. Hamilton Standard Hydromatic Feathering Propeller
   2. Hartzell Steel Hub Feathering Propeller
   3. McCauley Constant-Speed Feathering Propeller
g. Reversible Constant-Speed Feathering Propeller

C. Module Three: Propellers for Turbine Engines

1. Learning Outcomes: upon successful completion of this module, the Student will:
   a. Explain the operation of typical turbine engines and how power and condition lever controls affect thrust.
   d. Explain the function of different instruments used to monitor turbine engine operation.
   c. Discuss turbine engine propellers and power management.

2. Learning Activities:
Successfully complete examination 3 covering material presented in Module 3. (F1,F5,F10)

3. **Module Outline Three: Propellers for Turbine Engines**
   
   a. **Turboprop Engines**
      
      1. Garrett TPE331 Engine
         a) Propeller
         b) Power Management
      2. Pratt & Whitney of Canada PT6 Engine
         a) Propeller
         b) Engine Controls
            a) Governor
            b) Beta Operation
            c) Overspeed Governor
            d) Autofeather System
   
   b. **Composite Propeller Blades**
   
   c. **UHB (Ultrahigh Bypass Ratio) Engines**

D. **Module Four: Propeller Installation, Inspection and Maintenance**

1. **Learning Outcomes:** upon successful completion of this module, the Student will:

   a. Perform installation of various types of propellers.
   
   b. Perform balance and track procedures on propellers.
   
   c. Inspect for reparability, perform minor repairs and properly store propellers.

2. **Learning Activities:**

   Successfully complete examination 2 covering material presented in Module 4. (C18,F1,F3,F5,F10)

3. **Equipment and Materials:**

   a. Condemned propellers of different material to serve as examples to be inspected by students. An airframe with engine and propeller for hands on removal and installation.
   
   b. Tools and ground support equipment necessary to perform propeller removal and installation.
c. Serviceable airframe with maintenance manual and compatible track and balance equipment.

d. 4X, 6X magnifying glasses, explosion proof flashlights, dial indicating depth gages, metal files, file cards, sanding cloth of various grits 100-600 grit, alodine, mixing cups, acid brushes and vinyl or latex gloves.

4. **Module Outline Four:** Propeller Installation, Inspection and Maintenance

   a. Installation on a Flanged Shaft
      Propeller Spinners
   b. Installation on a Splined Shaft
   c. Installation on a Tapered Shaft
   d. Propeller Vibration
   e. Propeller Track
   f. Propeller Balance
   g. Propeller Inspection
      1. Wood Propellers
      2. Metal Propellers
   h. Propeller Storage
   i. Composite Propeller Blades
   j. Propeller Repairs and Alterations
   k. Determining Propeller Reparability

E. **Module Five:** Propeller Auxiliary Systems

1. **Learning Outcomes:** upon successful completion of this module, the Student will:

   Describe and explain the function of synchronizer systems, synchrophasing systems and ice control systems.

2. **Learning Activities:**

   Successfully complete examination 2 covering material presented in Module 5. (F1,F5,F10)

3. **Module Outline Five:** Propeller Auxiliary Systems

   a. Synchronizer Systems
   b. Synchrophasing Systems
c. Ice Control Systems