I. INTRODUCTION

A. This course provides a comprehensive study of aircraft powerplant electrical systems with a focus on theory, operation and maintenance of reciprocating engine ignition, starting, power generation and fire protection systems.

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 careers in the field of Aviation Maintenance.

D. Prerequisite: Successful completion of AERM 1314, Basic Electricity-G course.

II. LEARNING OUTCOMES

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

- Explain the operational cycle of reciprocating engine ignition systems;
- Perform services, inspections, repairs and installation of ignition magnetos on reciprocating engines;
- Troubleshoot and replace electric starters, AC and DC generators;
- Troubleshoot, service and repair fire detection, warning and extinguishing systems. (F1-F5,F10,F12)

III. INSTRUCTIONAL MATERIALS

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

B. This text, Aircraft Inspection, Repair and Alterations: Acceptable Methods, Techniques and Practices is located at the FAA website:

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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: The following ten projects will be completed by students only after coverage of the subjects by course material. Students are required to demonstrate proficiency and knowledge in each area. (Projects are to be assigned based on instructor discretion and availability of resources).

1. Explain the correct method of flashing the field on a DC Generator.

2. Check the diodes in a DC generator for shorts or opens.

3. Explain the correct procedure to parallel the generators installed on a twin-engine aircraft.

4. Select the correct solderless terminal for an electrical wire connection and install using the proper tool.

5. Using a multimeter, check the continuity in an electrical circuit.

6. Using the wire chart in AC 43.13-1B, find the correct wire size needed to carry a specific amount of current for a specified distance without exceeding the allowable current-carrying limits or the allowable voltage drop.

7. Locate and identify the fire protection system components in an aircraft.
8. Demonstrate the correct method to internally time an aircraft magneto.

9. Using the correct test equipment, check the condition of the condenser in an aircraft magneto.

10. Demonstrate the correct method to time a magneto to an aircraft engine.

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. One examination will cover the material from chapters 5 & 8 “Ignition Systems” and “Starting Systems and the second examination from chapter 17 & 18 “Electrical Systems” and “Fire Protection Systems”.

B. Practicum: Ten graded practicum will be administered by the instructor with a point weight of 20 points each.

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 Chapter 5&amp;8</td>
<td>400</td>
<td>900-1000 = A</td>
</tr>
<tr>
<td>EXAM 2 Chapter 17&amp;18</td>
<td>400</td>
<td>800- 899 = B</td>
</tr>
<tr>
<td>Practicum/Projects 1-10</td>
<td>200</td>
<td>700- 799 = C</td>
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<tr>
<td><strong>TOTAL 1000</strong></td>
<td>200</td>
<td><strong>600-699 = D</strong></td>
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<tr>
<td></td>
<td>0-599</td>
<td><strong>0-599 = F</strong></td>
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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 not 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.cted.edu/disability-support](http://www.cted.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:** Ignition Systems

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

   a. Explain principles of reciprocating engine ignition systems

   b. Perform inspections, adjustments, troubleshooting and repairs on magneto ignition systems.
2. **Learning Activities:**
   
a. Successfully complete examination 1 covering material presented in Module 1. (F1,F5,F10,F12)

b. Complete projects: 8-10. (C18,F1,F5,F10)

3. **Equipment and Materials:**
   
a. Ignition magnetos, aircraft spark plugs, ignition harness, and serviceable reciprocating engine airframe with maintenance manual.

b. Basic hand tools, shop towels and hand cleaner, spark plug cleaner, magneto timing light, ignition harness tester, spark plug gapping tools for massive electrode and fine wire electrode spark plugs and multimeters.

4. **Module Outline One: Ignition Systems**
   
a. Introduction to Reciprocating Engine Ignition Systems
   1. Battery Ignition Systems
   2. Magneto Ignition Systems
      a) High-Tension Magneto Systems
      b) Low-Tension Magneto Systems
   
b. Auxiliary Starting Systems
   1. Impulse Coupling
   2. Induction Vibration Systems

c. Special Types of Magnetos
   1. Double Magnetos
   2. Magnetos with Compensated Cams

d. Magneto Installation
   1. Internal Timing
   2. Timing the Magneto to the Engine
      a) Preparing the Engine
      b) Installing Magnetos without Impulse Couplings
      c) Installing Magnetos with Impulse Couplings

e. Magneto Inspection and Servicing
   1. Magneto Overhaul
   2. Magneto Check on Engine Run-up
   3. Magneto Safety Check

f. Ignition Harness
g. Spark Plugs
1. Spark Plug Design
   a) Spark Plug Size
   b) Electrodes
      1) Massive Electrodes
      2) Fine-Wire Electrodes
      3) Projecting Electrodes
c) Insulation
d) Shielding
e) Resistors
f) Reach
g) Hear Range
2. Spark Plug Construction
h. Spark Plug Servicing
   1. Removal
   2. Inspection
   3. Cleaning
   4. Gapping
      a) Massive Electrode Spark Plugs
      b) Fine-Wire Spark plugs
   5. Testing
   6. Installation

B. Module Two: Starting Systems

1. Learning Outcomes: upon successful completion of this module, the Student will:
   a. Discuss the evolution of reciprocating engine starting systems.
   b. Discuss electric starters for large and small engines and starter drive systems.
   c. Demonstrate troubleshooting and maintenance procedures for aircraft starters.

2. Learning Activities:

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

3. Equipment and Materials:
   a. Serviceable reciprocating engine aircraft with maintenance manual, large and small electric starters for exhibit.
b. Basic hand tools, multimeter, shop towels and hand cleaner.

4. **Module Outline Two: Starting Systems**
   
a. The Evolution of Reciprocating Engine Starting Systems
b. Electric Starters for Large Engines
c. Electric Starters for Small Engines
   1. Starters with an Overrunning Clutch
   2. Starters with Bendix Drive
   3. Starters with Right-Angle Drive Adapter
d. Electric Starter Troubleshooting and Maintenance

C. **Module Three: Electrical Systems**

1. **Learning Outcomes:** Upon successful completion of this module, the Student will:
   
a. Explain the generation of electrical current produced by magnetism.
   
b. Demonstrate knowledge of AC and DC generator theory.
   
c. Explain the use of AC and DC current and voltage control devices.
   
d. Explain typical AC generator and control devices used in large aircraft.
   
e. Explain the function of inverters.

2. **Learning Activities:**
   
a. Successfully complete examination 2 covering material presented in Module 3. (F1,F4,F5,F10,F12)
   
b. Complete projects: 1-6. (C18,F1,F4,F5,F10,F12)

3. **Equipment and Materials:**
   
a. Serviceable airframe with maintenance manual and electrical schematic diagrams.
   
b. Basic hand tools, multimeter, shop towels and hand cleaner.
5. **Module Outline Three: Electrical Systems**

   a. Generation of Current Electricity
   b. Electricity Produced by Magnetism
      1. AC Generator Principles
      2. DC Generator and Alternators
         a) Field Magnets
         b) Armature
            1) Armature Reaction
            2) Compensating Windings and Interpoles
         c) DC Generator Controls
            1) Current Limiter
            2) Reverse-Current Cutout and Switch
            3) Voltage Regulator
      d) Small Aircraft DC Generator Systems
      e) DC Alternators
         1) DC Alternator Controls
      f) Starter Generators
   c. AC Power for Large Aircraft
      1. AC Generators
      2. AC Generator Controls
   d. Inverters

D. **Module Four: Fire Protection Systems**

   1. **Learning Outcomes:** upon successful completion of this module, the Student will:
      a. Identify the different classes of fire and fire zones within an aircraft structure.
      b. Describe the different types of fire detection and warning systems commonly installed in aircraft.
      c. Describe the different types of fire extinguishing systems and agents used in aircraft.
      d. Demonstrate maintenance and service procedures for fire-detection systems.
      e. Demonstrate maintenance and service procedures for fire-extinguishing systems.

   2. **Learning Activities:**
a. Successfully complete examination 2 covering material presented in Module 4. (F1,F5,F10)

b. Complete project: 7. (F1,F10)

3. **Equipment and Materials:**

   a. Airframe with serviceable fire detection, extinguishing system and maintenance manual with fire detection and extinguishing system schematics.

   b. Basic hand tools, multimeter and safety wire, shop towels and hand cleaner.

4. **Module Outline Four: Fire Protection Systems**

   a. Fire Protection Systems
      1. Types of Fires
      2. Fire Zones

   b. Fire Detection and Warning Systems
      1. Thermoswitch-Type Fire Detection System
      2. Rate-of-Temperature-Rise Detection System
      3. Continuous-Loop Fire and Overheat Detection Systems
         a) Thermistor-Type Continuous-Loop System
         b) Pneumatic-Type Continuous-Loop Systems

   c. Fire-Extinguishing Systems
      1. Fire-Extinguishing Agents
         a) Carbon Dioxide (CO₂)
         b) Liquid Nitrogen (N₂)
         c) Halogenated Hydrocarbons
      2. Powerplant Fire-Extinguishing Systems
         a) Carbon Dioxide Extinguishing Systems
         b) HRD (High-Rate-Discharge) Extinguishing Systems
      3. Complete Fire Protection Systems
      4. Maintenance and Service of Fire-Detection Systems
      5. Maintenance and Service of Fire-Extinguishing Systems