I. INTRODUCTION

A. A comprehensive consolidated course to prepare experienced aircraft mechanics for successful completion of the Airframe & Powerplant-General written examination. This course will include maintenance publications, FAA Regulations, weight and balance determination, blueprints, diagrams, corrosion control, basic electricity, aircraft materials and hardware, basic math and physics, basic aerodynamics and aircraft inspection fundamentals.

B. This is a not 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 all required general (G) aviation maintenance course. Meet experience requirements specified in Code of Federal Regulations 15 Part 65.

II. LEARNING OUTCOMES

Upon successful completion of this course, Airframe & Powerplant Mechanic General Course, the student will:

A. Demonstrate and practice skill in the application of FAA Regulations, use of maintenance publications, weight and balance calculations, blueprints and diagrams, corrosion control, basic electricity, aircraft materials and hardware, physics, basic aerodynamics, inspection fundamentals, and basic math. (C18,F1-F6,F10)

B. Successfully complete the Federal Aviation Administration (FAA) written examination for Aviation Mechanic - General. (F1-F5,F10)

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

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: There will be no graded projects; however, there will be many confidence building, hands on tasks assigned by the instructor providing exposure to a large variety of tools, techniques and procedures common to general aviation maintenance.

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 four written examinations for this course covering all lecture notes and reading material:
Examination 1- chapter 4
Examination 2- chapter 5,6,7 & 9
Examination 3- chapter 8 & 10
Examination 4- chapter 2,3,11,12 & 13

B. Practicum: None graded.

VI. SEMESTER GRADE COMPUTATION

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<tr>
<th>EXAMINATIONS</th>
<th>POINTS</th>
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<td>300</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 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 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: (Basic Electricity) Intro to Electricity

1. Learning Outcomes: upon successful completion of this module, the Student will:
   a. Explain electron flow, conductors, semiconductors and insulators.
   b. Explain useful work capabilities associated with electron flow and direction of electron flow.
   c. Differentiate between static and current electricity.
   d. Explain the production of electricity from heat, chemical action, pressure, light and magnetism.
   e. Explain Ohm’s law and the multiple applications of this useful formula.
   f. Explain direct current, multiple types of (DC) circuits and the use of Kirchhoff’s laws; used to calculate voltage drops within these circuits.

2. Learning Activities:

   Successfully complete examination 1 covering material presented in module 1. (F1,F4,F5,F10,F12)

3. Module Outline One: (Basic Electricity) Introduction to Electricity

   a. Introduction to Electricity
      1. Electron Flow
      2. Valence Electrons
      3. Conductors
      4. Insulators
      5. Semiconductors
      6. Ions
      7. Useful Work
8. Direction of the Flow of Electricity
   b. Types of Electricity
      1. Static Electricity
      2. Current Electricity
   c. Production of Electricity
      1. Electricity from Heat
      2. Electricity from Chemical Action
      3. Electricity from Pressure
      4. Electricity from Light
      5. Electricity from Magnetism
   d. Electrical Relationships
      1. Ohm’s Law
         a. Examine principles of Ohm’s Law Problems
      2. Metric Prefixes
   e. Direct Current Electricity
      1. Direct Current Circuits
         a) Series Circuits
         b) Analysis of a Series Circuit
         c) Parallel Circuits
         d) Analysis of a parallel Circuit
         e) Series-Parallel Circuits
         f) Kirchhoff’s Law
         g) Circuits with Two Power Sources
         h) Bridge Circuits
            1) Finding the Equivalent Resistance of a Bridge Circuit

B. Module Two: (Basic Electricity) Alternating Current Electricity

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

   a. Explain the production of Alternating Current and typical use of Alternating Current.

   b. Discuss Amplitude, Phase and Power

   c. Explain the effects of Capacitance in an AC Circuit and the use of Ohm’s law in determining values in both series and parallel circuits.

   d. Explain the effects of Inductance in AC Circuits and the use of Ohm’s law in series and parallel inductive reactance circuits.
e. Explain circuits utilizing Capacitive Reactance and Inductive Reactance and Resonance in both Series and Parallel AC Circuits.

f. Explain Three-Phase Alternating Current Electricity.

2. Learning Activities: Alternating Current Electricity

Successfully complete examination 2 covering material presented in module 2. (F1,F4,F5,F10,F12)

3. Module Outline Two: (Basic Electricity) Alternating Current Electricity

a. Production and Use of Alternating Current Electricity
b. Alternating Current Terms and Values
   1. Amplitude
   2. Phase
   3. Power
c. Effects of Capacitance in an AC Circuit
   1. Capacitance in an AC Circuit
   2. Ohm’s Law for Capacitive Circuits
   3. Series R-C Circuits
      Power in a Series R-C Circuit
   4. Parallel R-C Circuits
d. Effects of Inductance in AC Circuits
   1. Self Induction
   2. Inductive Reactance
   3. Phase Shift in an Inductive Circuit
   4. Ohm’s Law for Inductive Circuits
   5. Series R-L Circuits
      Power in a Series R-L Circuit
   6. Parallel R-L Circuits
e. Circuits with Resistance, Inductance and Capacitance
   1. Series R-L-C Circuits
   2. Parallel R-L-C Circuits
   3. Resonance
      a) Series Resonance
      b) Parallel Resonance
      c) L-C Filters
   4. Three-Phase Alternating Current Electricity

C. Module Three: (Basic Electricity) Electrical Circuit Components

1. Learning Outcomes: upon successful completion of this module, the Student will:
a. Demonstrate correct use of Electrical Measuring Instruments.

b. Explain the function of Conductors, Resistors, Switches, Circuit Protection Devices, Capacitors, Inductors, Transformers, Rectifiers and Terminal Strips.

c. Explain the function and use of Solid-State Devices.

d. Discuss the typical types of Integrated Circuits.

2. Learning Activities:

   Successfully complete examination 3 covering material presented in module 3. (F1,F4,F5,F10,F12)

3. Equipment and Materials:

   Multimeters, bread boards, Variable DC/AC power supplies, 22 gage single strand insulated copper wire, an assortment of 1/8 watt resistors, capacitors, transformers, large assortment of solid-state devices for exhibit, testing and identification.

4. Module Outline Three: (Basic Electricity) Electrical Circuit Components

   a. Electrical Measuring Instruments
      1. Voltmeters
      2. Ammeters
      3. Ohmmeters

   b. Conductors

   c. Resistors
      1. Composition Resistors Color Code
      2. Wire-wound Resistors
      3. Variable Resistors

   d. Switches
      Relays and Solenoids

   e. Circuit Protection Devices
      1. Fuses
      2. Circuit Breakers

   f. Capacitors
      1. Energy Stored in Capacitors
      2. Series and Parallel Capacitors
      3. Capacitive Time Constant

   g. Inductors
      1. Self Induction
2. Mutual Induction
3. Series and Parallel Inductances
4. Inductive Time Constant

h. Transformers
   1. Types of Transformers
   2. Transformer Ratios
   3. Transformer Phase
   4. Transformer Losses

i. Rectifiers
j. Terminal Strips
k. Solid-State Devices
l. Semiconductor Theory
m. Semiconductor Diodes
n. Zener Diodes
o. Silicon Controlled Rectifiers
p. Triacs
q. Transistors
   1. Bipolar Transistors
   2. Field Effect Transistors
   3. Unijunction Transistors

r. Optoelectronics Devices
   1. Light Emitting Diodes
   2. Semiconductor-Light Sensors
      a) Photodiodes
      b) Phototransistor
      c) Photofets
      d) Light-Activated Silicon Controlled Rectifier
      e) Photoresistors
      f) Solar Cells

s. Integrated Circuits
t. Digital Integrated Circuits
   1. Buffer
   2. Inverter
   3. Three-State Buffer
   4. Three-State Inverter
   5. AND Gate
   6. NAND Gate
   7. OR Gate
      a) INCLUSIVE OR Gate
      b) EXCLUSIVE OR Gate
   8. NOR Gate

u. Linear (Analog) Integrated Circuits
   Operational Amplifiers
D. **Module Four**: (Basic Electricity) Chemical Energy, Aircraft Batteries, Magnetism, Electrical Motors and Generators and Aircraft Electrical Circuits

1. **Learning Outcomes**: upon successful completion of this module, the Student will:
   a. Explain multiple types of Simple, Primary, and Secondary Chemical cells comprised of different chemical elements.
   b. Describe Lead-Acid Batteries, Charging and Installation.
   d. Describe Magnetism; Permanent and Electromagnets.
   e. Describe different types of Direct Current and Alternating Current Electric Motors.
   f. Describe Electrical Generators
   g. Explain typical Aircraft Electrical Circuits.

2. **Learning Activities**: Successfully complete examination 4. (F1,F4,F5,F10,F12)

3. **Equipment and Materials**:
   a. Multimeters, bread boards, Variable DC/AC power supplies, 22 gage single strand insulated copper wire, an assortment of 1/8 watt resistors, capacitors, transformers, large assortment of solid-state devices for exhibit, testing and identification; electrical schematic diagrams.
   b. Lead-Acid aircraft battery, Nickel Cadmium aircraft Battery, charging/discharging equipment, goggles, chemical resistant gloves, Chemical resistant Aprons, multimeter and distilled water. *Note: lead-acid and nickel cadmium batteries must not be stored or serviced in the close proximity.*

4. **Module Outline Four**: (Basic Electricity) Chemical Energy, Aircraft Batteries, Magnetism, Electrical Motors and Generators and Aircraft Electrical Circuits
a. Chemical Energy into Electricity
   1. Simple Chemical Cell
   2. Primary Cells
      a) Carbon-Zinc Cells
      b) Alkaline-Manganese Cells
      c) Mercury Cells
      d) Silver Oxide Cells
      e) Lithium Cells
   3. Secondary Cells
      a) Lead-Acid Cells
         1) Chemical Changes During Discharge
         2) Chemical Changes During Charge
      b) Sintered-Plate Nickel-Cadmium Cells
         1) Thermal Runaway
         2) Cell Memory
         3) Cell Voltage Changes During Discharge
b. Aircraft Batteries
   1. Lead-Acid Batteries
      a) Battery Charging
      b) Battery Installation
   c. Nickel-Cadmium Batteries
      1. Battery Construction
      2. Chemical Changes During Discharge
      3. Chemical Changes During Charge
      4. Battery Servicing
      5. Capacity Reconditioning
      6. Thermal Runaway
d. Magnetism
   1. Permanent Magnetism
   2. Electromagnets
e. Electrical Motors
   1. Direct Current Motors
      a) Permanent Magnet DC Motors
      b) Shunt-Wound DC Motors
      c) Series-Wound DC Motors
      e) Compound-Wound DC Motors
   2. Alternating Current Motors
      a) Universal Motors
      b) Induction Motors
         1) Single-Phase Induction Motors
         2) Split-Phase Induction Motors
         3) Capacitor-Start Induction Motors
         4) Shaded-Pole Induction Motor
      e) Repulsion Motors
      d) Three-Phase Induction Motors
f. Electrical Generators
1. Direct Current Generators
g. Aircraft Electrical Circuits
   1. Electrically Retractable Landing Gear
   2. Electrically Operated Fuel Valves

E. Module Five: Aircraft Drawings

1. Learning Outcomes: upon successful completion of this module, the Student will:
   a. Demonstrate competence in the application of the many different types of drawings, diagrams and charts used in aviation maintenance manuals and bulletins to identify locations and components.
   b. Utilize standard drawing symbols and line types, weights and dimensions to determine whether parts fall within allowable tolerances upon inspection.

2. Learning Activities: Aircraft Drawings

   Successfully complete examination 2 covering material presented in this module. (F1-F6,F10)

3. Module Outline Five: Aircraft Drawings

   a. Types of Aircraft Drawings
      1. Detail Drawing
      2. Assembly Drawing
      3. Installation Drawing
      4. Sectional Drawing
      5. Half-Sectional Drawing
      6. Cutaway Drawing
      7. Exploded-View Drawing
      8. Schematic Diagram
      9. Block Diagram
      10. Repair Drawing
      11. Wiring Drawing
      12. Pictorial Diagrams
      13. Sketches

   b. Drawing Views
      1. Perspective Views
      2. Isometric Views
      3. Orthographic Views
      4. Auxiliary Views

   c. Drawing Practices
1. Line types and Weights
2. Notes
3. Dimensions and Tolerances
4. Location Identification on an aircraft
5. Drawing Sizes
6. Zones
d. Charts
1. Brake Horsepower—Brake Mean Effective pressure chart
2. Electric Wire Chart
3. Control Cable Tension Chart
4. Specific Fuel Consumption—Brake Horsepower Curve

F. **Module Six**: Weight and Balance

1. **Learning Outcomes**: upon successful completion of this module, the Student will:
   a. Demonstrate confidence in the different methods of accurately calculating aircraft weight and balance; checking center of gravity limits for light single and multi-engine aircraft and large aircraft.
   b. Recognize and document weight and balance calculations on FAA or manufacture furnished documents.
   c. Explain correct procedures for weighing aircraft to determine center of gravity.

2. **Learning Activities**: Weight and Balance
   Successfully complete examination 2 covering material presented in this module. (F1-F6,F10,F11)

3. **Equipment and Materials**:

   Mechanical or electronic weight scale, aircraft jacks, FAA furnished weight and balance data or manufacture weight and balance data and airframe with maintenance manual.

4. **Module Outline Six**: Weight and Balance
   a. Weight and Balance Theory
      1. Locating the Balance Point, or Center of Gravity (CG)
      2. Shifting the CG
         a) Solution by Chart
         b) Solution by Formula
b. Weight and Balance Documentation
   1. FAA-Furnished Information
   2. Manufacture-Furnished Information

c. Weighing the Aircraft
   1. Equipment for Weighing
   2. Preparation for Weighing

d. Locating the Center of Gravity
   1. Location with Respect to the Datum
      a) Tail Wheel Airplane with the Datum Ahead of the Main Wheels
      b) Tail Wheel Airplane with the Datum Behind the Main Wheels
      c) Nosewheel Airplane with the Datum Ahead of the Main Wheels
      d) Nosewheel Airplane with the Datum Behind the Main Wheels
   2. Location with Respect to the Mean Aerodynamic Chord

e. Single-Engine Aircraft Weight and Balance Computations
   1. The Loading Graph
   2. CG Moment Index Envelope

f. Twin-Engine Airplane Weight and Balance Computations
   1. Finding the Empty Weight Center of Gravity
      a) The Chart Method
      b) The Formula Method
   2. Finding the Operational CG
      a) The Chart Method
      b) CG in Percent of MAC

g. Adverse-Loaded CG Checks
   1. Forward CG Check
   2. Aft CG Check

h. Center of Gravity Change After Repair or Alteration

i. Determination of Needed Ballast

j. Large Aircraft Weight and Balance Computations
   1. Finding the Maximum Payload
   2. Determining Minutes of Fuel Dump Time

k. Weight and Balance Computations with an Electronic Computer

G. Module Seven: Fluid Lines and Fittings

1. Learning Outcomes: upon successful completion of this module, the Student will:
a. Identify the many types of rigid lines and fittings used in aircraft; demonstrate correct use of cutting, bending flaring and beading tube tools and correctly install rigid fluid lines.

b. Demonstrate correct assembly and selection of flexible fluid lines and explain correct installation of these lines.

c. Identify the many different types of aviation line fittings.

2. Learning Activities: Fluid Lines and Fittings

Successfully complete examination 2 covering material presented in this module. (F1-F6,F10,F11)

3. Equipment and Materials:

Tubing wheel cutter, tubing bender, tubing flare and double flare tool, samples of MS Flareless fittings, AN and AC flared fittings for exhibit and samples of flexible hose, bench vise and basic hand tools.

4. Module Outline Seven: Fluid Lines and Fittings

a. Fluid Lines

1. Rigid Fluid Lines
   a) Tube Cutting
   b) Tube Bending
   c) Tubing Beading
   d) Tubing Flaring
      1) Double Flare
      2) Single Flare
      3) Flared Tube End Fittings
   e) MS Flareless Fittings
   f) Swaged Tube Fittings
   g) Installation of Rigid Fluid Lines
   h) Identification of fluid lines

b. Flexible Fluid Lines

1. Low-Pressure Hose
2. Medium-Pressure Hose
3. High-Pressure Hose
4. Extra-High-Pressure Hose
5. Teflon Hose
6. Installation of Flexible Hoses
7. Flexible Hose End Fittings

c. Fluid Line Fittings

1. Pipe Fittings
H. Module Eight: Materials and Processes

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   
a. Discuss the many types of materials used in aircraft structures from ferrous and nonferrous metals, woods, fabric, plastics, resins and composite materials.
   
b. Explain the heat treatment process of hardening, tempering, normalizing, annealing and case hardening of metals.
   
c. Explain the different methods of nondestructive inspections used in aircraft inspections.
   
d. Recognize the many different types of nuts, bolts, washers, screws, cowling fasteners, control cables and rivets and the proper application of hardware to include the importance of correct torque of threaded fasteners.
   
e. Demonstrate correct use of measuring devices commonly used in aircraft maintenance.

2. **Learning Activities:** Materials and Processes
   
Successfully complete examination 2 covering material presented in this module. (F1-F6,F10,F11)

3. **Equipment and Materials:**
   
Dial indicators, micrometer calipers, vernier calipers, small hole and telescoping gages, dividers and calipers, thickness gages, combination set, valve-stretch gage, connecting rod twist fixture, safety wire, basic hand tools and a torque wrench.

4. **Module Outline Eight:** Materials and Processes
   
a. Materials
      1. Metals
         a) Ferrous Metals
         b) NonFerrous Metals
            1) Aluminum Alloys
            2) Magnesium Alloys
3) Titanium
4) Monel

2. Nonmetal Materials
   a) Aircraft Wood
   b) Aircraft Fabrics
   c) Composite Materials
      1) plastic Resins
         (a) Thermoplastic Resins
         (b) Thermosetting Resins
            (1) Polyester Resin
            (2) Epoxy Resin
   2) Reinforcing Materials
      (a) Glass fibers
      (b) Kevlar
      (c) Graphite

b. Metal Heat Treatment
   1. Ferrous Metal Heat Treatment
      a) Hardening
      b) Normalizing
      c) Annealing
      d) Tempering
      e) Case Hardening
   2. Nonferrous Metal Heat Treatment
      Aluminum and Magnesium Alloys
      1) Solution Heat Treatment
      2) Precipitation Heat Treatment
      3) Annealing
      4) Heat Treatment of Rivets
      5) Aluminum Alloy Temper Designations
   3. Titanium Alloys
      a) Stress Relieving
      b) Annealing
      c) Thermal Hardening
      d) Case Hardening
   4. Hardness Testing
      a) Rockwell Hardness Testing
      b) Brinell Hardness Testing

c. Nondestructive Inspection
   1. Radiographic Inspection
      a) X-Rays
      b) Gamma Rays
   2. Magnetic Particle Inspection
   3. Eddy Current Inspection
   4. Ultrasonic Inspection
   5. Penetrant Inspection
   6. Bonded Structure Inspection
7. Welding Inspection
   d. Aircraft Hardware
      1. Threaded Fasteners
         a) Thread Fit
         b) The Importance of Torque
         c) Aircraft Bolts
         d) Clevis Bolts
         e) Aircraft Nuts
         f) Washers
         g) Aircraft Screws
         h) Cowling Fasteners
         i) Aircraft Control Cable
            1) Nonflexible Cable
            2) Flexible Control Cable
            3) Extraflexible Control Cable
            4) Control Cable Terminals
            5) Turnbuckles
         j. Aircraft Rivets
            1) Rivet Material Specifications
            2) Rivet Head Style
            3) Rivet Identification
            4) Special Rivets
               (a) Friction-Lock Self-Plugging Rivets
               (b) Pop Rivets
               (c) Mechanical-Lock Self-Plugging Rivets
               (d) Rivnuts
               (e) Hi-Shear Pin Rivets
      2. Measuring Devices
         a. Dial Indicators
         b. Micrometer Calipers
         c. Vernier Calipers
         d. Small-Hole Gages and Telescoping Gages
         e. Dividers and Calipers
         f. Thickness Gages
         g. Combination Set
         h. Valve-Stretch Gage
         i. Connecting Rod Twist Fixture

I. Module Nine: (Ground Operation and Servicing) Fire Protection

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

   a. Demonstrate correct selection and employ fire extinguishing agents on all classes of fire.
b. Comply with safety measures associated with compressed gas cylinders, employ hearing, eye and respiratory safety equipment in the shop and on the flight line.

c. Identify aviation fuels by color and explain correct refueling and Defueling operations.

d. Perform hand and arm signals and demonstrate correct use of aircraft ground handling equipment while moving aircraft.

e. Demonstrate correct procedures for aircraft tie-down during normal and severe weather conditions.

f. Employ jacks and hoists to support aircraft and subcomponents during maintenance and inspections.

g. Apply anti-icing and deicing measures to aircraft.

h. Explain correct engine starting procedures for multiple types of reciprocating and turbine engines.

i. Perform aircraft washes and practice corrosion control measures.

2. Learning Activities:

   Successfully complete examination 3 covering material presented in this module. (F1-F6,F10,F11)

3. Equipment and Materials:

   Water fire extinguisher, carbon dioxide and dry-powder fire extinguishers.

4. Module Outline Nine: (Ground Operation and Servicing) Fire Protection

   a. Nature of fire
   b. Classification of fires
   c. Extinguishing agents
   d. Fire Extinguishers
      1. Water fire extinguishers
      2. Halon 1211 and 1301 fire extinguishers
      3. Carbon Dioxide fire extinguishers
      4. Dry-powder fire extinguishers
J. Module Ten: (Ground Operation and Servicing) Safety in the Shop and on the Flight Line

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   a. Comply with safety precautions associated with compressed gas cylinders.
   b. Employ hearing safety devices religiously.
   c. Practice the use of eye safety devices consistently.
   d. Employ correct respiratory safety equipment when required.
   e. Apply stringent methodical work and shop cleanliness habits and standards; minimizing the potential for accidental injury and damage to aircraft.

2. **Learning Activities:**

   Successfully complete examination 3 covering material presented in this module. (F1,F5,F6,F10)

3. **Equipment and Materials:**

   Safety goggles, full cover face shields, assortment of foam, rubber and plastic earplugs, cushioned earphones, disposable paper or cloth masks, pre-filter and chemical filter respirator, airflow type respirator, safety wire, diagonal wire cutters and fire proof oily rag containers.

4. **Module Outline Ten:** (Ground Operation and Servicing) Shop and flight line safety

   a. Safety involving compressed gases
   b. Hearing protection
   c. Eye protection
   d. Respiratory protection
   e. Shop and flight line safety summary

K. Module Eleven: (Ground Operation and Servicing) Aviation Fuels

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
a. Differentiate reciprocating engine fuels by color, performance numbers and point out the importance of aviation gas octane ratings and proper servicing of reciprocating engines. Discuss aviation gas additives and their function.

b. Describe jet fuels and the function of their additives and differentiate BTU ratings of jet fuel compared to aviation gas.

2. **Learning Activities:**

   Successfully complete examination 3 covering material presented in this module. (F1-F6,F10)

3. **Equipment and Materials:**

   Aviation fuel samples of (80=Red being phased out), 82=Purple, 100=Green, 100LL=Blue and Jet fuel=colorless

4. **Module Outline Eleven:** (Ground Operation and Servicing) Aviation Fuels

   a. Reciprocating-engine fuels
   b. Jet fuels

L. **Module Twelve:** (Ground Operation and Servicing) Aircraft Refueling

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

   a. Identify the correct type and grade of fuel required by any given aircraft.

   b. Point out fuel quality control requirements and proper electrical grounding procedures required during refueling/defueling operations.

   c. Demonstrate correct Over-Wing refueling procedures.

   d. Demonstrate correct Pressure Fueling procedures.

   e. Perform Defueling operations correctly.

2. **Learning Activities:**

   Successfully complete examination 3 covering material presented in this module. (F1-F6,F10)
3. **Equipment and Materials:**
   a. Over-wing refueling nozzle, Bayonet pressure refueling nozzle, grounding cable with grounding jack, fuel sample contaminated with water, aircraft fuel sampling probe and empty fuel sample jar.
   b. Serviceable airframe with Over-Wing or pressure refueling port and cap.

4. **Module Outline Twelve:** (Ground Operation and Servicing) Aircraft Refueling
   a. Preparation for Refueling
   b. Over-Wing Refueling
   c. Pressure Refueling
   d. Defueling

M. **Module Thirteen:** (Ground Operation and Servicing) Aircraft Movement

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   a. Explain and demonstrate correct towing procedures for different landing gear configurations, precautions and sequence.
   b. Describe taxi procedures; demonstrate correct hand and arm signals for day and night and explain communication requirements with tower and correctly interpret light signals from the control tower.
   c. Demonstrate hand and arm signals for helicopters.

2. **Learning Activities:**

   Successfully complete examination 3 covering material covered in this module. (C18,F1-F4,F6,F10)

3. **Equipment and Materials:**

   Scissor type tow bar or tow bar specifically designed for available aircraft, mobile airframe, light wands, chalk blocks two per wheel, power tug or tractor, required for larger airframes.
4. **Module Outline Thirteen**: (Ground Operation and Servicing)
   Aircraft Movement
   
   a. Towing Aircraft
   b. Taxiing
   c. Helicopter Movement

N. **Module Fourteen**: (Ground Operation and Servicing) Aircraft Tiedown

1. **Learning Outcomes**: upon successful completion of this module, the Student will:
   
   a. Demonstrate normal tiedown procedures and correct knot tying.
   
   b. Explain preparation for severe weather tiedown and the use of control surface locks or locking devices and spoiler boards.
   
   c. Explain securing procedures for helicopters during severe weather and specific precautions.

2. **Learning Activities**:

   Successfully complete examination 3 covering material presented in this module. (C18,F1-F6,F10)

3. **Equipment and Materials**:

   Nylon or polypropylene rope, aircraft chain and clip tiedowns, control surface locking devices and spoiler boards if available for local airframe.

4. **Module Outline Fourteen**: (Ground Operation and Servicing)
   Aircraft Tiedown
   
   a. Normal Tiedown
   b. Preparation for Severe Weather
   c. Securing Helicopters

O. **Module Fifteen**: (Ground Operation and Servicing) Jacking and Hoisting Aircraft

1. **Learning Outcomes**: upon successful completion of this module, the Student will:
a. Point out precautions associated with jacking aircraft, special equipment required and the importance of following manufacture procedures.

b. Explain situations requiring hoisting and necessary special equipment required to safely hoist aircraft.

2. **Learning Activities:**
   Successfully complete examination 3 covering material presented in this module. (C18,F1-F6,F10)

3. **Equipment and Materials:**
   Aircraft jacks, jack pads, strut locks or special tools, maintenance manual and weights required to jack an on site aircraft, inside a maintenance facility.

4. **Module Outline Fifteen:** (Ground Operation and Servicing) Jacking and Hoisting Aircraft
   a. Aircraft Jacking
   b. Aircraft Hoisting

P. **Module Sixteen:** (Ground Operation and Servicing) Aircraft Icing Protection

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   a. Explain the effects of icing on lift and control surfaces.
   b. Distinguish between Type I and Type II anti-icing and deicing fluids.
   c. Explain Deicing and Anti-icing procedures.

2. **Learning Activities:**
   Successfully complete examination 3 covering material presented in this module. (C18,F1-F6,F10)

3. **Module Outline Sixteen:** (Ground Operation and Servicing) Aircraft Icing Protection
   Aircraft Icing Protection
Q. Module Seventeen: (Ground Operation and Servicing) Engine Operation

1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   
   a. Describe precautions taken before starting radial or inverted piston engines, pre-start checks, precautions and weather considerations.
   
   b. Outline float carbureted reciprocating engine start procedures.
   
   c. Describe hand cranking procedures for reciprocating engines.
   
   d. Describe turbine engine starting sequences, pre-checks, precautions and immediate actions upon faulty start.
   
   e. Explain possible turbine engine damage resulting from faulty engine starts.

2. **Learning Activities:** Engine Operation

   Successfully complete examination 3 covering material presented in this module. (F1,F5,F10)

3. **Equipment and Materials:**

   a. Provide a serviceable airframe with (reciprocating or turbine engine); operator’s manual and hearing protection.
   
   b. Aircraft fuel sample tool, aircraft tiedowns, aircraft wheel jack, aircraft tow bar.

4. **Module Outline Seventeen:** (Ground Operation and Servicing) Engine Operation

   a. Reciprocating Engines
      1. Starting engines equipped with float carburetors
      2. Starting engines equipped with fuel injection systems
      3. Hand cranking a reciprocating engine
   
   b. Turbine Engines
      1. Turbine engine starting
      2. Improper starts
         a) No Oil Pressure
         b) Hot Start
         c) Hung Start
R. Module Eighteen: (Cleaning and Corrosion Control) Cleaning

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

   a. Point out the importance of a clean aircraft.

   b. Explain and practice cleaning procedures using a water emulsion type cleaner.

   c. Practice nonmetal cleaning techniques.

   d. Explain and demonstrate powerplant cleaning procedures and after wash lubrication requirements.

   e. Explain paint removal techniques required in the treatment of corrosion under painted surfaces.

2. **Learning Activities:**

   Successfully complete examination 3 covering material presented in this module. (F1,F4,F5,F10)

3. **Equipment and Materials:**

   Emulsion type cleaner meeting MIL-C-43616 specifications, mild soap, water hoses and spray nozzles, 5 gallon buckets, soft bristle brushes, aliphatic naphtha, acetone or dope thinner, chamois or absorbent cotton, plastic window wax, water rinse paint remover (use only products acceptable with local EPA regulations or host nation environmental laws), masking tape, polyethylene sheeting, stiff bristle brushes with nonmetallic bristles, safety goggles, vinyl or latex gloves and shop towels.

4. **Module Outline Eighteen:** (Cleaning and Corrosion Control) Cleaning

   a. Cleaning
      1. Aircraft Cleaning
      2. Exterior Cleaning
      3. Nonmetal Cleaning
      4. Powerplant Cleaning
      5. Paint Removal

S. Module Nineteen: (Cleaning and Corrosion Control) Corrosion Control
1. **Learning Outcomes:** upon successful completion of this module, the Student will:
   a. Differentiate between the many types of corrosion.
   b. Explain causes of the different types of corrosion.
   c. Point out common areas susceptible to corrosion.
   d. Identify, assess corrosion damage and remove corrosion.
   e. Explain methods of corrosion treatment for common metals found in aircraft structures.

2. **Learning Activities:**

   Successfully complete examination 3 covering material covered in this module. (C18,F1,F5,F10)

3. **Equipment and Materials:**

   a. A serviceable Airframe with operator and maintenance manuals, to tie down and perform inspections and services on including fueling, washing, tie down, cleaning and corrosion control steps practiced. Some samples of aircraft corrosion for inspection and identification purposes and a ground power unit (GPU).
   
   b. 4X, 6X power magnifying glasses, mirrors, explosion proof flashlights, dye penetrant kits or fluorescent penetrant kits with “black light”; clear plastic polish,
   
   c. One of the following corrosion chemical treatment products: alodine conforming to MIL-C-5541, (chromic acid pickling solution Dow No. 1 conforming to MIL-M-3171A, type I), (Dichromate conversion treatment Dow No. 7 conforming to MIL-M-3171A, Type IV), Note: these products should be stored and disposed of according to local EPA and environmental laws.
   
   d. chamois or absorbent cotton, plastic window wax, water rinse paint remover (use only products acceptable with local EPA regulations or host nation environmental laws), masking tape, polyethylene sheeting, stiff bristle brushes with nonmetallic bristles, safety goggles, vinyl or latex gloves and shop towels.
4. **Module Outline Nineteen: (Cleaning and Corrosion Control)**

**Corrosion Control**

a. **Corrosion Control**
   1. Chemistry of Corrosion
   2. Types of Corrosion
      a) Oxidation
      b) Surface Corrosion
      c) Intergranular Corrosion
      d) Exfoliation Corrosion
      e) Stress Corrosion
      f) Galvanic Corrosion
      g) Concentration Cell Corrosion
         1) Low Oxygen Concentration Cell Corrosion
         2) High Metal Ion Concentration Cell Corrosion
      h) Fretting Corrosion
      i) Filiform Corrosion
   
   b. **Causes of Corrosion**
      1. Air
      2. Water
      3. Salts
      4. Acids and Alkalis
      5. Mercury
      6. Organic Growths

   c. **Locations Susceptible to Corrosion**
      1. External Skin Seams and Lap Joints
      2. Control Surface Recesses
      3. Piano Hinges
      4. Engine Inlet Areas
      5. Engine Mount Structures
      6. Engine Exhaust Area
      7. Landing Gear Boxes
      8. Wheel Wells and Landing Gear
      9. Fuel Tanks
      10. Battery Compartments and Vents
      11. Bilge Areas
      12. Control Cables
      13. Lavatories and Food Service Areas
      14. Welded Areas

   d. **Detecting Corrosion**
      1. Visual Inspection
      2. Penetrant Inspection
      3. Ultrasonic Inspection
      4. Radiographic Inspection
e. Removing and Treating Corrosion

1. Corrosion Treatment of Aluminum Alloys
   a) Mechanical Corrosion Removal
   b) Chemical Treatment
   c) Protective Coatings
   d) Oxide Film Protection
      1) Electrolytically Formed Oxides
      2) Chemically Formed Oxides
   e) Organic Finishes

2. Corrosion Treatment of Magnesium Alloys
   a) Mechanical Corrosion Removal
   b) Chemical Treatment

3. Corrosion Treatment of Ferrous Metals
   a) Mechanical Cleaning
   b) Surface Treatment for Steel
      1) Cadmium Plating
      2) Nickel or Chrome Plating
      3) Galvanizing
      4) Metal Spraying
      5) Organic Finishes

4. Assessment of Corrosion Damage

5. Corrosion Control Summary

T. Module Twenty: Mathematics

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

   Perform mathematical calculations ranging from addition, subtraction, multiplication and division of whole numbers, fractions and decimal fractions; the use of scientific notation, and trigonometry and mathematical formula for determining the volume or area of different shapes.

2. Learning Activities:

   Successfully complete examination 4 covering material presented in this module. (F1-F6,F10,F11)

3. Module Outline Twenty: Mathematics

   a. Why Study Mathematics?
   b. Numerals
      1. Arabic Numerals
      2. Roman Numbers
   c. Number Systems
1. Decimal System
2. Binary System

d. Arithmetic
1. Addition
2. Subtraction
3. Multiplication
4. Division

e. Fractions
1. Common Fractions
   a) Addition of Common Fractions
   b) Subtraction of Common Fractions
   c) Finding the Smallest Common Denominator
   d) Reducing a Fraction to its Lowest Term
   e) Multiplication of Common Fractions
   f) Division of Common Fractions

2. Mixed Numbers

3. Decimal Fractions
   a) Addition of Numbers Containing Decimal Fractions
   b) Subtraction of Numbers Containing Decimal Fractions
   c) Multiplication of Numbers Containing Decimal Fractions
   d) Division of Numbers Containing Decimal Fractions
   e) Converting Common Fractions into Decimal Fractions
   f) Converting Decimal Fractions into Common Fractions

f. Ratio and Proportion
1. Ratio
2. Proportion

g. Percentage
1. One Number Which is a Given Percentage of Another
2. The percentage One Number is of Another
3. A Number of Which a Given Percentage is Known

h. Signed Numbers
1. Adding Signed Numbers
2. Subtracting Signed Numbers
3. Multiplying Signed Numbers
4. Dividing Signed Numbers

i. Powers and Roots
1. Powers
2. Roots

j. Scientific Notation
1. Changing Numbers into Scientific Notation
2. Changing Scientific Notation into Ordinary Numbers
3. Adding Numbers Using Scientific Notation
4. Subtracting Numbers Using Scientific Notation
5. Multiplying Numbers Using Scientific Notation
6. Dividing Numbers Using Scientific Notation
7. Raising Numbers to Powers Using Scientific Notation

k. Trigonometry
   1. Triangles
   2. Trig Function Table
   3. Tangent
   4. Sine
   5. Vector Quantities
   6. Cotangent, Secant, and Cosecant

l. Mathematical Sequence

m. Practical Measurements
   1. Area
   2. Force
   3. Volume

U. Module Twenty One: Maintenance Forms and Records

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

   Embrace the importance of accurate maintenance, repair and inspection records; make appropriate entries on FAA Form 337 for inspections, repairs and alterations; make appropriate entries on FAA Form 8010-4 (Malfunction or Defect Report) and FAA Form 8600-1 (Inspection Reminder) and ensure proper disposition of these important forms.

2. Learning Activities:

   Successfully complete examination 4 covering material presented in this module. (F1-F6,F10,F11)

3. Equipment and Materials:

   Samples of FAA forms: 337, 8010-4 and 8600-1 for exhibit.

4. Module Outline Twenty One: Maintenance Forms and Records

   a. Maintenance and Inspection Records
      Required Maintenance Records
         a) Maintenance Record Entries
1) Maintenance Entries
2) Inspection Entries

b. Maintenance Forms
1. Major Repair and Alteration FAA Form 337
2. Malfunction of Defect Report
3. Inspection Reminder

V. Module Twenty Two: Basic Physics

1. Learning Outcomes: upon successful completion of this module, the Student will:
   a. Discuss the chemical and physical nature of matter, weight and mass.
   b. Explain the relationship of energy, work, force and motion.
   c. Define stress and strain in relation to aircraft structures
   d. Discuss temperature and heat and the physical changes incurred during temperature change and the transfer of heat.
   e. Explain the forces of gas and liquid pressures and the laws used to calculate the results of these forces.
   f. Discuss the effects and characteristics of sound, vibration and light.

2. Learning Activities:

   Successfully complete examination 4 covering material presented in this module. (F1-F6,F10,F11)

3. Module Outline Twenty Two: Basic Physics

   a. Matter
      1. Chemical Nature of Matter
      2. Physical Nature of Matter
   b. Weight and Mass
      1. Density
      2. Specific Gravity
   c. Energy
      1. Potential Energy
      2. Kinetic Energy
      3. Exchanges Between Matter and Energy
         a) Aerodynamic Lift
         b) Nuclear Energy
d. Work and Power
   1. Work
   2. Power

e. Force and Motion
   1. Force
      a) Mechanical Advantage
      b) The Law of the Lever
         1) First-Class Lever
         2) Second-Class Lever
         3) Third-Class Lever
      c) The Inclined Plane
      d) Ropes and Pulleys
      e) Gears
   2. Motion
      a) Speed and Velocity
      b) Change in speed
      c) Newton’s Laws of Motion
      d) Circular Motion

f. Vectors

g. Stress and Strain
   1. Stress
      a) Tension
      b) Compression
      c) Torsion
      d) Bending
      e) Shear
   2. Strain

h. Heat and Temperature
   1. Heat
      a) Work Equivalent of Heat
      b) Physical Changes Caused by Heat
      c) Sensible Heat
      d) Latent Heat
      e) Dimensional Change Caused by Heat
      f) Specific Heat
      g) Transfer of Heat
         1) Conduction
         2) Convection
         3) Radiation
      h) Temperature

i. Pressure
   1. Absolute Pressure
   2. Gage Pressure
   3. Differential Pressure

j. Gas Laws
   1. Boyle’s Law
2. Charles’s Law
3. General Gas Law
4. Dalton’s Law

k. Fluid Mechanics
1. Pressure Produced by a fluid
   a) Pascal’s Law
   b) Bernoulli’s Principle
2. Buoyancy

l. Vibration and Sound
1. Vibration
   Resonance
2. Sound
   a) Sound Intensity
   b) Speed of Sound

m. Light
1. Natural Light
2. Characteristics of Light
   a) Light Travels in Straight Lines
   b) Light Spreads Out as it Leaves its Source
   c) The Law of Reflection
   d) Diffusion of Light
   e) Speed of Light

W. Module Twenty Three: Regulations and Maintenance Publications

1. Learning Outcomes: upon successful completion of this module, the Student will:
   Demonstrate confidence in the use of many different documents required in the process of properly maintaining aircraft within FAA regulations to include the following publications: Regulations, Advisory Circulars (AC), Approved Type Certificates (ATC), Airworthiness Directives (AD), Technical Standard Orders (TSO), Parts Manufacturer Approval (PMA), Manufacture’s Maintenance or Service Manuals and ATA 100 Specifications and Component Maintenance Manuals (CMM).

2. Learning Activities:

   Successfully complete examination 4 covering material presented in this module. (F1-F6,F10,F11)

3. Equipment and Materials:

   Regulatory documents and maintenance manuals for aircraft used for maintenance training purposes.
4. **Module Outline Twenty Three:** Regulations and Maintenance Publications

   a. Federal Control of Aviation
      The Federal Aviation Administration (FAA)
   b. Federal Aviation Regulations
   c. Advisory Circulars
   d. Aircraft Certification
      1. Approved Type Certificates
         Type Certificate Data Sheets, Aircraft Specifications, and Aircraft Listings
      2. Production Certificates
      3. Airworthiness Certificate
      4. Supplemental Type Certificates (STC)
   e. Airworthiness Directives
      1. Publication of Airworthiness Directives
      2. General Aviation Airworthiness Alerts
   f. Technical Standard Orders (TSO) and Parts Manufacturer Approval (PMA)
   g. Manufacturer’s Maintenance of Service Manuals
      Maintenance Intervals
   h. ATA 100 Specifications
   i. Component Maintenance Manuals (CMM)

X. **Module Twenty Four:** Mechanic Privileges and Limitations

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

   a. Explain the different maintenance classifications ranging from inspections to repairs, alterations and preventive maintenance.
   b. Differentiate the privileges and limitations placed on Mechanics, Inspection Authorization or IA and Repairmen.

2. **Learning Activities:**

   Successfully complete examination 4 covering material presented in this module. (F1-F6,F10,F11)

3. **Module Outline Twenty Four:** Mechanic Privileges and Limitations

   a. Introduction
   b. Maintenance Classification
      1. Inspections
         a) Preflight Inspection
b) Annual and 100-Hour Inspections
c) Progressive Inspection
d) Continuous Airworthiness Inspection Program
e) Special Inspections
   1) Altimeter and Static System Inspection
   2) ATC Transponder Tests and Inspection
   3) Other Special Inspections

2. Repairs
3. Alterations
4. Preventive Maintenance

c. Classification of Maintenance Airmen
1. Mechanic
   a) Requirements for Certification
   b) Privileges and Limitations of a Mechanic
2. Inspection Authorization
   a) Requirements for IA Certification and Renewal
   b) Privileges and Limitations of a Mechanic with an Inspection Authorization
3. Repairmen