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AERONAUTICS**



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Air Agency Certificate 2MCT601K

Curriculum Manual

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RECORD OF REVISION

Manual Holder: Mid South Community College, 2000 West Broadway Avenue
West Memphis, V.P. for Technical Programs & Training (MASTER COPY).

When a revision is received, it will be properly placed in the manual, removing any superseded pages, and recording the action below.

The spaces below are used for the Revision Number and Date, the insertion date, and initials of the manual holder.

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PROCEDURES FOR REVISION

Revisions to this document are recorded in the Record of Revision and are reflected in a List of Effective Pages. Each odd and even two sided page that has a revision of its content will be submitted to the Flight Standards District Office for approval prior to incorporation into this document. Once approved, the revision will be sent to each Operations Manual Holder on the Distribution List with a Revision Letter, Revised pages, and a new List of Effective Pages.

The revision letter will include a listing of each odd and even page that is revised and a brief explanation of what has been revised.

Each revised page will have a black vertical line in the left margin highlighting the revised text or figure. The revision number will be reflected at the lower right corner of the page.

The new List of Effective Pages will show the Table of Contents first or second level heading, page number, revision number, and revision date.

The V.P. for Work Force Technology will initiate revisions and maintain a distribution list and control of the Master Copy to monitor each approved copy in the distribution list. The distribution list will be included in every revision letter.

Revision requests along with revised pages may be sent to the Certificate Holding District Office, CHDO principle inspector via email for approval. FAA will return the approved pages to the V.P. for Technical Programs & Training for distribution. An "FAA Approval" block on the lower left of each page and approval stamp on the list of effective pages only, by the FAA Inspector in order to be valid for distribution.

LIST OF EFFECTIVE PAGES

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Engine Fire Protection Systems	120	Original		
Engine Electrical Systems	121	Original		
Engine Electrical Systems	122	Original		
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INTRODUCTION

Curriculum for Aviation Maintenance Technicians

Mid South Community College has a curriculum that consists of **1920 hours** of classroom, lab, and shop instruction (420 hours General, 750 hours Airframe, and 750 hours Powerplant).

The curriculum is designed to satisfy all requirements of FAR 147 and to prepare students to work as licensed aircraft maintenance technicians.

LIST OF INSTRUCTORS

Name	Certificate Number	Sections authorized to teach
Michael D Peugh	2154964	General, Airframe, and Powerplant Sections IAW FAR Part 147, Appendices A, B, C, and D
David W Bond	2676743	General, Airframe, and Powerplant Sections IAW FAR Part 147, Appendices A, B, C, and D
Paul Cierzniewski	2821376 IA	General, Airframe, and Powerplant Sections IAW FAR Part 147, Appendices A, B, C, and D

A Current list of Instructors in the above format is maintained in the FAA file in V.P.'s office for Technical Programs & Training. ***This page does not require a revision.*** The listing on file will be made available to authorized agencies upon request.

GENERAL CURRICULUM SUBJECTS

GENERAL SECTION SUMMARY

Subject	Total	Theory	Lab
Mathematics	30	15	15
Basic Physics	30	15	15
Cleaning and Corrosion Control	30	12	18
Ground Operation and Servicing	30	6	24
Materials and Processes	30	12	18
Fluid Lines and Fittings	30	12	18
Maintenance Publications	24	6	18
Mechanic Privileges and Limitations	6	3	3
Maintenance Forms and Records	24	6	18
Weight and Balance	42	12	30
Aircraft Drawings	24	6	18
Basic Electricity	120	24	96
Total	420	129	291

FAA 147 References:

Basic Electricity - Appendix B, items 1-6
Aircraft Drawings - Appendix B, items 7-10
Weight and Balance - Appendix B, items 11-12
Fluid Lines and Fittings - Appendix B, item 13
Materials and Processes - Appendix B, items 14-19
Ground Operation and Servicing - Appendix B, items 20-21
Cleaning and Corrosion Control - Appendix B, items 22-23
Mathematics - Appendix B, items 24-27
Maintenance Forms and Records – Appendix B, items 28-29
Basic Physics - Appendix B, item 30
Maintenance Publications – Appendix B, items 31-32
Mechanic Privileges and Limitations – Item 33

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BASIC ELECTRICITY

COURSE DESCRIPTION: A thorough introduction to AC and DC electricity. Students learn to calculate and measure volts, amperes, and ohms; to build and analyze circuits; and to use electrical schematics.

COURSE OBJECTIVES: This training is intended to provide the basic electrical skills needed by the Airframe and Powerplant mechanic. Upon completion of this training, the student will be able to repair aircraft electrical systems using diagrams, schematics and procedures from manufacturer's maintenance manuals. The student will be able to use a multimeter to measure voltage, amperage and resistance, and continuity.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Basic Electricity	120	24	96

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected video tapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Electrical Trainer 22956
- Multimeters
- Electrical/navigational lights mockups
- Capacitors
- Resistors
- Wire strippers
- Wire cutters
- Crimpers
- Battery Charger

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Electrical Wiring

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-1: Level 2 - Calculate and measure capacitance and inductance

- Calculate capacitance and inductance in an electrical circuit specified by the instructor

G-2: Level 2 - Calculate and measure electrical power

- Find the power used by an electric motor when the voltage and current are known

G-3: Level 3 - Measure voltage, current, resistance, and continuity

- Compute the voltage and current in an electrical circuit specified by the instructor
- Measure the current in an electrical circuit using a multimeter
- Measure the resistance of several components using an ohmmeter
- Check an electrical circuit for opens or shorts using a multimeter

G-4: Level 3 - Determine the relationship of voltage, current, and resistance in electrical circuits

- Find the total resistance of a combination of resistors connected in a series
- Find the total resistance of a combination of resistors connected in parallel
- Measure the voltage drop across each of the components in a series circuit specified by the instructor
- Given a group of composition resistors, identify the resistance and tolerance of each one by the color code

G-5: Level 3 - Read and interpret aircraft electrical circuit diagrams, including solid-state devices and logic functions

- Identify electrical symbols used in an aircraft service manual
- Use an electrical schematic diagram to locate the source of a malfunction described by the instructor
- Demonstrate the correct way to check a solid-state diode to determine whether or not it is good, or if it is open or shorted

G-6: Level 3 - Inspect and service batteries

- Inspect a battery and installed battery system.
- Accomplish a battery state-of-charge (hydrometer) and/or electrical leak (cell imbalance) test.
- Accomplish removal and/or installation of a battery in an aircraft.
- Set-up and connect a charger to one or more batteries for constant current and/or constant voltage charging.

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) An Introduction to Electricity

- a) Electron Flow
- b) Valence Electrons
- c) Conductors
- d) Insulators
- e) Semiconductors
- f) Ions
- g) Useful Work
- h) Direction of the Flow of Electricity

2) Types of Electricity

- a) Static Electricity
- b) Current Electricity

3) Production of Electricity

- a) Electricity from Heat
- b) Electricity from Chemical Action
- c) Electricity from Pressure
- d) Electricity from Light
- e) Electricity from Magnetism

4) Electrical Relationships

- a) Ohm's Law
 - i) Examples of Ohm's Law Principle
- b) Metric Prefixes

5) Direct Current (DC) Electricity

- a) Direct Current Circuits
 - i) Series Circuits
 - ii) Analysis of a Series Circuit

- iii) Parallel Circuits
- iv) Analysis of a Parallel Circuits
- v) Series-Parallel Circuits
- vi) Kirchhoff's Law
- vii) Circuits with Two Power Sources
- viii) Bridge Circuits
 - (1) Finding the Equivalent Resistance of a Bridge Circuit

6) Alternating Current (AC) Electricity

- a) Production and Use of Alternating Current Electricity
- b) Alternating Current Terms and Values
 - i) Amplitude
 - ii) Phase
 - iii) Power
- c) Effects of Capacitance in an AC Circuit
 - i) Capacitive Reactance
 - ii) Ohm's Law for Capacitive Circuits
 - iii) Series R-C Circuits
 - (1) Power in a Series R-L Circuit
 - iv) Parallel R-C Circuits
- d) Effects of Inductance in AC Circuits
 - i) Self Induction
 - ii) Inductive Reactance
 - iii) Phase Shift in an Inductive Circuits
 - iv) Ohm's Law for Inductive Circuits
 - v) Series R-L Circuits
 - (1) Power in a Series R-L Circuit
 - vi) Parallel R-L Circuits
- e) Circuits with Resistance, Inductance and Capacitance
 - i) Series R-L-C Circuits
 - ii) Parallel R-L-C Circuits
- f) Resonance
 - i) Series Resonance
 - ii) Parallel Resonance
 - iii) L-C Filters
- g) Three – Phase Alternating Current Electricity

7) Electrical Circuit Components

- a) Electrical Measuring Instruments
 - i) Voltmeters
 - ii) Ammeters
 - iii) Ohmmeters
- b) Conductors
- c) Resistors
 - i) Composition Resistor Color Code
 - ii) Wire-wound Resistors
 - iii) Variable Resistors
- d) Switches
 - i) Relays and Solenoids
- e) Circuit Protection Devices
 - i) Fuses
 - ii) Circuit Breakers
- f) Capacitors
 - i) Energy Stored in Capacitors
 - ii) Series and Parallel Capacitors
 - iii) Capacitive Time Constant
- g) Inductors
 - i) Self Induction
 - ii) Mutual Induction

- iii) Series and Parallel Inductances
 - iv) Inductive Time Constant
- h) Transformers
 - i) Types of Transformers
 - ii) Transformer Ratios
 - iii) Transformer Phase
 - iv) Transformer Losses
- i) Rectifiers
- j) Terminal Strips
- 8) Solid State Devices**
 - a) Semiconductors Theory
 - b) Semiconductor Diodes
 - c) Zener Diodes
 - d) Silicon Controlled Rectifiers
 - e) Triacs
 - f) Transistors
 - i) Bipolar Transistors
 - ii) Field Effect Transistors
 - iii) Unijunction Transistors
 - g) Optoelectronic Devices
 - i) Light Emitting Diodes
 - ii) Semiconductor Light Sensors
 - (1) Photodiodes
 - (2) Phototransistor
 - (3) Photofets
 - (4) Light Activated Silicone Controlled Rectifier
 - (5) Photo Resistors
 - (6) Solar Cells
- 9) Integrated Circuits**
 - a) Digital Integrated Circuits
 - i) Buffer
 - ii) Inverter
 - iii) Three-State Buffer
 - iv) Three-State Inverter
 - v) AND Gate
 - vi) NAND Gate
 - vii) OR Gate
 - (1) INCLUSIVE OR Gate
 - (2) EXCLUSIVE OR Gate
 - viii) NOR Gate
 - b) Linear (Analog) Intergrated Circuits
 - i) Operational Amplifiers
- 10) Chemical Energy into Electricity**
 - a) Simple Chemical Cell
 - b) Primary Cells
 - i) Carbon Zinc Cells
 - ii) Alkaline Manganese Cells
 - iii) Mercury Cells
 - iv) Silver Oxide Cells
 - v) Lithium Cells
 - c) Secondary Cells
 - i) Lead-Acid Cells
 - (1) Chemical Changes During Discharge
 - (2) Chemical Changes During Charge
 - ii) Sintered-Plate Nickel-Cadmium Cells
 - (1) Thermal Runaway
 - (2) Cell Memory

(3) Cell Voltage Changes During Discharge

11) Aircraft Batteries

- a) Lead- Acid Batteries
 - i) Battery Charging
 - ii) Battery Installation
- b) Nickel-Cadmium Batteries
 - i) Battery Construction
 - ii) Chemical Changes During Discharge
 - iii) Battery Servicing
 - iv) Capacity Reconditioning
 - v) Thermal Runaway

12) Magnetism

- a) Permanent Magnets
- b) Electromagnets

13) Electrical Motors

- a) Direct Current (DC) Motors
 - i) Permanent Magnet DC Motors
 - ii) Shunt--Wound DC Motors
 - iii) Series--Wound DC Motors
 - iv) Compound – Wound DC Motors
- b) Alternating Current (AC) Motors
 - i) Universal Motors
 - ii) Induction Motors
 - (1) Single Phase Induction Motors
 - (2) Split Phase Induction Motors
 - (3) Capacitor Start Induction Motors
 - (4) Shaded-Pole Induction Motor
 - iii) Repulsion Motors
 - iv) Three-Phase Induction Motors

14) Electrical Generators

- a) Direct Current Generators

15) Aircraft Electrical Circuits

- a) Electric Retractable Landing Gear
- b) Electrically Operated Fuel Valves

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AIRCRAFT DRAWINGS

COURSE DESCRIPTION: Students learn to use drawings and blueprints, including orthographic projections, schematics, graphs, charts, and pictorial representations, and to sketch repairs and alterations.

COURSE OBJECTIVES: This training is intended to provide the basic drawing skills needed by the Airframe and Powerplant student.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Drawings	24	6	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Rulers
- Protractors
- 90-degree angles
- Drawing pencils
- Drafting Boards

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Drawings

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-7: Level 2 - Use aircraft drawings, symbols, and system schematic diagrams

- Identify the center line, hidden line, alternate-position line, and cutting plan on an aircraft drawing specified by the instructor
- Using an electrical schematic diagram specified by the instructor, identify the components shown by the schematic symbols

G-8: Level 3 - Draw sketches of repairs and alterations

- Make a sketch of an aircraft repair specified by the instructor, giving all information that is needed to make the repair
- Make a sketch of an aircraft part using the scale designated by the instructor

G-9: Level 3 - Use blueprint information

- Find the dimensions of an object specified by the instructor on an aircraft drawing
- Locate a part on an aircraft drawing specified by the instructor by using the zone numbers
- Identify the change number of an aircraft drawing specified by the instructor

G-10: Level 3 - Use graphs and charts

- Using a performance chart for a specific aircraft engine, find the brake horsepower developed when the RPM and BMEP are known
- Using an electrical wire chart from AC43.13-1B, find the correct size wire to use when the current, allowable voltage drop, and length of wire are known
- Using a brake specific fuel consumption curve for a specific aircraft engine, find the fuel flow in gallons per hour for a given RPM

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Types of Aircraft Drawings**
 - a) Detail Drawing
 - b) Assembly Drawing
 - c) Installation Drawing
 - d) Sectional Drawing
 - e) Half-sectional Drawing
 - f) Cutaway Drawing
 - g) Exploded-View Drawing
 - h) Schematic Diagram
 - i) Block Diagram
 - j) Repair Drawing
 - k) Wiring Diagrams
 - l) Pictorial Diagrams
 - m) Sketches
- 2) **Drawing Views**
 - a) Perspective Views
 - b) Isometric Views
 - c) Orthographic Views
 - d) Auxiliary Views
- 3) **Drawing Practices**
 - a) Line Types and Weights
 - b) Notes
 - c) Dimensions and Tolerances
 - d) Location Identification on an Aircraft
 - e) Zones
- 4) **Charts**
 - a) Brake Horsepower -- Brake Mean Effectiveness Pressure Chart
 - b) Electric Wire Chart
 - c) Control Cable Tension Chart
 - d) Specific Fuel Consumption – Brake Horsepower Curve

WEIGHT AND BALANCE

COURSE DESCRIPTION: Students perform weight and balance checks that require computation of center-of-gravity and ballast. Aircraft are weighed and students research information and record data.

COURSE OBJECTIVES: This training is intended to provide the basic weight and balance skills needed by the Airframe and Powerplant student.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Weight and Balance	42	12	30

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- 3 point aircraft scales w/ monitor (nose, right main, & left main)
- Aircraft

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Weight and Balance

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-11: Level 2 - Weigh aircraft

- Locate the datum of a specified aircraft using the appropriate Type Certificate Data Sheets
- Locate weigh points, procedures for determining center of gravity, and determine weight point arms for a specified aircraft
- Locate procedures for leveling and leveling points for a specified aircraft
- Identify tare items for a specified aircraft and weighing procedure
- Given the starting aircraft empty weight, empty weight total moment, and weight/location information for specified alterations, find the new empty weight and empty weight center of gravity for an aircraft
- Use the center of gravity envelope in a weight and balance report to find the forward and aft center of gravity limits for a specified weight of the aircraft
- Given information regarding loaded weight, loaded center of gravity, loaded CG range, and ballast arm dimensions, find the amount of ballast needed to bring a specified aircraft into its proper center of gravity range
- Given wheel scale weight information, find the empty weight and the empty weight center of gravity of a specified airplane

G-12: Level 3 - Perform complete weight and balance check and record data

- Using manufacturer's instructions, prepare a specified aircraft for weighing
- Find the empty weight and empty weight center of gravity of an aircraft specified by the instructor
- Find the weight and center of gravity of a fully loaded aircraft specified by the instructor
- Find the loaded weight and the loaded weight center of gravity of a helicopter specified by the instructor; determine whether or not it falls within its weight and center of gravity limits
- Find the amount of fuel needed by a specified aircraft as the minimum fuel for an adverse loaded center of gravity condition

Instruction according to the curriculum outline for this section will be the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Weight & Balance Theory**
 - a) Locating the Balance Point, or Center of Gravity (CG)
 - b) Shifting CG
 - i) Solution by Chart
 - ii) Solution by Formula
- 2) Weight & Balance Documentation**
 - a) FAA-Furnished Information
 - b) Manufacturer-Furnished Information
- 3) Weigh the Aircraft**
 - a) Equipment for Weighing
 - b) Preparation for Weighing
- 4) Locating the Center of Gravity**
 - a) Location with Respect to the Datum
 - i) Tail Wheel Airplane with the Datum Ahead of the Main Wheels
 - ii) Tail Wheel Airplane with the Datum Behind the Main Wheels
 - iii) Nose Wheel Airplane with the Datum Ahead of the Main Wheels
 - iv) Nose Wheel Airplane with the Datum Behind the Main Wheels
 - b) Location with Respect to the Mean Aerodynamic Chord
- 5) Single Engine Aircraft Weight & Balance Computations**
 - a) The Loading Graph
 - b) CG Movement Index Envelope
- 6) Twin Engine Airplane Weight and Balance Computations**
 - a) Finding the Empty Weight and Empty Weight Center of Gravity
 - i) The Chart Method
 - ii) The Formula Method
 - b) Finding the Operational CG
 - i) The Chart Method
 - ii) CG in Percent of MAC
- 7) Adverse Loaded CG Checks**
 - a) Forwarding CG Check
 - b) Aft CG Check
- 8) Center of Gravity Change After Repair or Alteration**
- 9) Determination of Needed Ballast**
- 10) Large Aircraft Weight and Balance Computations**
 - a) Finding the Maximum Payload
 - b) Determining Minutes of Fuel Dump Time
- 11) Weight and Balance Computations with an Electronic Computer**

FLUID LINES AND FITTINGS

COURSE DESCRIPTION: Students fabricate and install rigid and flexible aircraft fluid lines and install fitting.

COURSE OBJECTIVES: This training is intended to provide the basic skills needed by the Airframe and Powerplant student to work with rigid and flexible fluid lines and fittings. Materials used will include those used in aircraft and support equipment applications including but not limited to aluminum, copper, and stainless steel.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Fluid Lines and Fittings	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Hydraulic test stand
- Fuel test stand
- Rigid fluid lines
- Flexible fluid lines
- Various fittings
- Flare Tools
- Tube Bender
- Mandrel

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- none

REQUIRED PROJECTS: (**Bold items are required**) (Un-Bold items are recommended)

G-13: Level 3 - Fabricate and install rigid and flexible fluid lines and fittings

- Make up a piece of rigid tubing that includes cutting it to the correct length, making a bend of the correct angle and radius, and correctly installing the type of fitting specified by the instructor
- Make a proper single flare in a piece of aluminum alloy tubing
- Make a proper double flare in a piece of aluminum alloy tubing
- Install a fitting on a piece of flexible hose and proof test it
- Install a piece of rigid tubing in an aircraft using the correct routing and approved mounting methods
- Identify, by color code, the type of fluid carried in various fluid lines in an aircraft
- Install and properly preset an MS flareless fitting on a piece of rigid tubing
- Repair a piece of damaged rigid tubing by installing a union and the proper connecting fittings

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Fluid Lines

- a) Rigid Fluid Lines
 - i) Tube Cutting
 - ii) Tube Bending
 - iii) Tubing Beading
 - iv) Tubing Flaring
 - (1) Double Flare
 - (2) Single Flare
 - (3) Flared Tube End Fittings
 - v) MS Flareless Fittings
 - vi) Swaged Tube Fittings
 - vii) Installation of Rigid Fluid Lines
 - viii) Repair of Rigid Fluid Lines
 - ix) Identification of Fluid Lines
- b) Flexible Fluid Lines
 - i) Low Pressure Hose
 - ii) Medium Pressure Hose
 - iii) High Pressure Hose
 - iv) Extra-High Pressure Hose
 - v) Teflon Hose
 - vi) Installation of Flexible Hoses
 - vii) Flexible Hose End Fittings

2) Fluid Line Fittings

- a) Pipe Fittings
- b) Universal, or Bulkhead Fittings
- c) AN and AC Flared Tubing

MATERIALS AND PROCESSES

COURSE DESCRIPTION: The following topics are covered: hand tools, hardware, heat-treating, magnetic particle inspection, dye penetrant inspection, chemical etching, visual inspection, and precision measurement. Students will use micrometers, calipers, and hand tools, and perform basic heat-treating and non-destructive inspections.

COURSE OBJECTIVES: This training is intended to provide the basic skills needed by the Airframe and Powerplant mechanic in the use of hand tools, precision measuring instruments, processes, and inspection techniques.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Materials and Processes	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Dye penetrant inspection kit
- Magnetic particle inspection tank (mag/de-mag machine for head shots & coils shots)
- Eddy current tester
- Ultrasonic test equipment
- Welding mock-ups w/ various plates, panels, and fixtures w/ various welding defects
- Turnbuckle mock-up benches
- Dial indicators
- Micrometer calipers

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- The Mechanic's Toolbox

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-14: Level 1 - Identify and select appropriate non-destructive testing methods

- Determine appropriate NDT methods to test aircraft parts and structures specified by the instructor

G-15: Level 2 - Perform dye penetrant, eddy current, ultrasonic, and magnetic particle inspections

- Using dye penetrant, inspect a part furnished by the instructor
- Using the magnetic particle method, correctly magnetize, inspect, and demagnetize a part furnished by the instructor
- Using eddy current, inspect a part furnished by the instructor

G-16: Level 1 – Perform basic heat-treating processes

- Explain various heat-treating processes and testing methods for aircraft parts specified by the instructor

G-17: Level 3 - Identify and select aircraft hardware and materials

- Properly safety wire two turnbuckles in an aircraft control system, using the single-wrap method for one turnbuckle and the double-wrap method for the other
- Given an assortment of aircraft bolts, identify a close tolerance bolt, a corrosion-resistant steel bolt, and an aluminum alloy bolt
- Given an assortment of aircraft rivets, identify an AD rivet, a DD rivet, a D rivet, and an A rivet
- Install a swaged fitting on a piece of aircraft control cable
- Correctly install a Heli-coil insert in an aluminum casting
- Properly install a cotter pin in a bolt fitted with a castellated nut

G-18: Level 3 - Inspect and check welds

- Given a piece of metal with a bad weld, identify the reason the weld is not airworthy

G-19: Level 3 - Perform precision measurements

- Use a dial indicator to measure the runout of the crankshaft of an aircraft engine
- Use a telescoping gauge and a micrometer caliper to measure the fit between a shaft and its bushing
- Measure the diameter of a shaft to the nearest ten-thousandth of an inch using a vernier micrometer caliper
- Identify a piece of extra-flexible control cable by the number of strands of wire and measure its diameter

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Materials

- a) Metals
 - i) Ferrous Metals
 - ii) Nonferrous Metals
 - (1) Aluminum Alloys
 - (2) Magnesium Alloys
 - (3) Titanium
 - (4) Monel
- b) Non-metal Materials
 - i) Aircraft Wood
 - ii) Aircraft Fabric
 - iii) Composite Materials
 - (1) Plastic Resins
 - (a) Thermoplastic Resins
 - (b) Thermosetting Resins
 - (i) Polyester Resin
 - (ii) Epoxy Resin
 - (2) Reinforcing Materials
 - (a) Glass Fibers
 - (b) Kevlar
 - (c) Graphite

2) Metal Heat Treatment

- a) Ferrous Metal Heat Treatment
 - i) Hardening
 - ii) Normalizing
 - iii) Annealing
 - iv) Tempering
 - v) Case Hardening
- b) Nonferrous Metal Heat Treatment
 - i) Aluminum and Magnesium Alloys
 - (1) Solution Heat Treatment
 - (2) Precipitation Heat Treatment
 - (3) Annealing
 - (4) Heat Treatment of Rivets
 - (5) Aluminum Alloy Temper Designations
 - ii) Titanium Alloys
 - (1) Stress Relieving
 - (2) Annealing
 - (3) Thermal Hardening
 - (4) Case Hardening
 - iii) Hardness Testing
 - (1) Rockwell Hardness Testing
 - (2) Brinell Hardness Testing

3) Nondestructive Testing

- a) Radiographic Inspection
 - i) X-Rays
 - ii) Gamma Rays
- b) Magnetic Particle Inspection
- c) Eddy Current Inspection
- d) Ultrasonic Inspection
- e) Penetrant Inspection
- f) Bonded Structure Inspection
- g) Welding Inspections

4) Aircraft Hardware

- a) Threaded Fasteners
 - i) Thread Fit
 - ii) The Importance of Torque
 - iii) Aircraft Bolts
 - iv) Clevis Bolts
 - v) Aircraft Nuts
 - vi) Washers
 - vii) Aircraft Screws
 - viii) Cowling Fasteners
- b) Cowling Fasteners
- c) Aircraft Control Cables
 - i) Non-flexible Control Cable
 - ii) Flexible Control Cable
 - iii) Extra Flexible Control Cable
 - iv) Control Cable Terminals
 - v) Turnbuckles
- d) Aircraft Rivets
 - i) Material Specifications
 - ii) Head Styles
 - iii) Identifying Rivets
 - iv) Special Rivets

5) 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

GROUND OPERATION AND SERVICING

COURSE DESCRIPTION: Students learn safe ground procedures including moving, fueling, and securing aircraft, and shop safety.

COURSE OBJECTIVES: This training is intended to provide the basic skills needed by the Airframe and Powerplant mechanic to start, operate, move, service and secure the aircraft. Special emphasis is placed on safety and identification of ground operation hazards.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Ground Operation and Servicing	30	6	24

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Aircraft
- Engine Run Stand
- Aircraft jacks
- Tie-down straps (eyebolts installed in ground)
- Ground wires

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Flight Line Service
- Aeroshell Presents: Aviation Oil
- Aeroshell Presents: Aviation Grease
- How to save money on your annual inspection
- Preflight a Fixed Wing
- Human Performance in Aviation Maintenance
- FAAPart 145 Certified Repair Stations

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-20: Level 2 - Start, ground operate, move, service, and secure aircraft and identify typical ground operations hazards

- Properly start, run up, and shut down an aircraft reciprocating engine
- Properly start, run up, and shut down an aircraft turbine engine
- Demonstrate the correct hand signals to use when directing the operator of an aircraft to start number one, move the aircraft ahead, stop the aircraft, emergency stop the aircraft, and shut down the engine
- Demonstrate the correct way to clear the cylinders of an aircraft reciprocating engine of an hydraulic lock
- Demonstrate the correct method of securing an aircraft to the flight line tie-downs
- Demonstrate the correct way to hand prop an aircraft engine
- Properly secure an airplane for overnight storage on an outside tie-down area
- Jack one wheel of an airplane so that the wheel can be removed, explaining proper safety precautions
- Properly connect a ground power unit to an aircraft for the purpose of starting the engine, explaining proper safety precautions
- Taxi an aircraft using proper safety precautions
- Identify the types/classes of fires that local shop and/or flightline fire extinguishers may be used on

G-21: Level 2 - Identify and select fuels

- Drain a sample of fuel from an aircraft fuel system, check the fuel for the presence of water, and identify the grade of the fuel
- Fuel an aircraft using the proper grade and amount of fuel, explaining proper safety precautions

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE**1) Fire Protection**

- a) Nature of the Fire
- b) Classification of Fires
- c) Fire Extinguishing Agents
- d) Fire Extinguishers
 - i) Water Fire Extinguishers
 - ii) Halon 1211 and 1301 Fire Extinguishers
 - iii) Carbon Dioxide Fire Extinguishers
 - iv) Dry-powder Fire Extinguishers

2) Safety in the Shop and on the Flight Line

- a) Safety Involving Compressed Gases
- b) Hearing Protection
- c) Eye Protection
- d) Respiratory Protection
- e) Shop and Flight Line Safety Summary

3) Aviation Fuels

- a) Reciprocating Engine Fuels
- b) Jet Fuels

4) Aircraft Fueling

- a) Preparation for Fueling
- b) Over-wing Fueling
- c) Pressure Fueling
- d) Defueling

5) Aircraft Movement

- a) Towing
- b) Taxiing
- c) Helicopter Movement

6) Aircraft TieDown

- a) Normal
- b) Preparations for Severe Weather
- c) Securing Helicopters

7) Aircraft Jacking and Hoisting

- a) Aircraft Jacking
- b) Aircraft Hoisting

8) Aircraft Icing Protection**9) Engine Operations**

- a) Reciprocating Engines
 - i) Starting Engines Equipped with Float Carburetors
 - ii) Starting Engines Equipped with a Fuel Injection System
 - iii) Hand-Cranking a Reciprocating Engine
- b) Turbine Engines
 - i) Turbine Engine Starting
 - (1) Improper Starts
 - (a) No oil pressure
 - (b) Hot start
 - (c) Hung start

CLEANING AND CORROSION CONTROL

COURSE DESCRIPTION: Chemicals, materials, and procedures used to clean aircraft and to prevent and control corrosion.

COURSE OBJECTIVES: This training is intended to provide the basic skills needed by the Airframe and Powerplant mechanic to clean aircraft and treat corrosion. This cleaning and treatment instruction will encompass airframe structure, subassemblies and piece parts. Various metals such as aluminum, stainless steel, and titanium will be covered.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Cleaning and Corrosion Control	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various cleaning and anti-corrosion agents
- Various aircraft parts

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Corrosion Control for Aircraft
- Nondestructive Testing for Corrosion Control

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-22: Level 3 - Identify and select cleaning materials and perform aircraft cleaning

- Select the proper cleaning materials and remove grease and exhaust deposits from an aircraft structure
- Select the proper cleaning materials and remove oil that has been spilled on an aircraft tire
- Properly remove the finish from a piece of painted aluminum alloy
- Properly remove the finish from a piece of painted fiberglass reinforced plastic material
- Demonstrate the correct way to clean a transparent plastic cockpit enclosure or windshield
- Treat a piece of welded steel tubular structure to prevent rust and corrosion inside the tubing

G-23: Level 3 - Inspect, identify, remove, and treat aircraft corrosion and perform aircraft cleaning

- Given samples of corroded aircraft structural materials, identify the type of corrosion, describing the correct procedure for removing the corrosion and treating the damaged area to prevent corrosion
- Remove the corrosion from a piece of aluminum alloy furnished by the examiner and treat the metal to prevent further corrosion
- Treat a piece of aircraft structure so moisture cannot reach the metal and cause corrosion
- Demonstrate the correct way to remove rust from a highly stressed engine component
- Remove corrosion from a lead-acid battery box and treat the box to prevent further corrosion
- Treat the cylinders of a reciprocating engine to prevent rust and corrosion when the engine is being prepared for long-term storage

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) **Cleaning**

- a) Aircraft Cleaning
- b) Exterior Cleaning
- c) Non-metal Cleaning
- d) Powerplant Cleaning
- e) Paint Removal

2) **Corrosion Control**

- a) The Chemistry of Corrosion
- b) Types of Corrosion
 - i) Oxidation
 - ii) Surface Corrosion
 - iii) Intergranular Corrosion
 - iv) Exfoliation Corrosion
 - v) Stress Corrosion
 - vi) Galvanic Corrosion
 - vii) Concentration Cell Corrosion
 - (1) Low Oxygen Concentration Cell Corrosion
 - (2) High Metal Ion Concentration Cell Corrosion
 - viii) Fretting Corrosion
 - ix) Filiform Corrosion
- c) Causes of Corrosion
 - i) Air
 - ii) Water
 - iii) Salts
 - iv) Acids and Alkalis
 - v) Mercury
 - vi) Organic Growths
- d) Locations Susceptible to Corrosion
 - i) External Skin Seams and Lap Joints
 - ii) Control Surface Recesses
 - iii) Piano Hinges
 - iv) Engine Inlet areas
 - v) Engine Mount Structure
 - vi) Engine Exhaust Area
 - vii) Landing Gear Boxes
 - viii) Wheel Wells and Landing Gear
 - ix) Fuel Tanks
 - x) Battery Compartments and Vents
 - xi) Bilge Areas
 - xii) Control Cables
 - xiii) Lavatories and Food Service Areas
 - xiv) Welded Areas
- e) Detecting Corrosion
 - i) Visual Inspection
 - ii) Penetrant Inspection
 - iii) Ultrasonic Inspection
 - iv) Radiographic Inspection
- f) Corrosion Removal and Treatment
 - i) Corrosion Treatment of Aluminum Alloys
 - (1) Mechanical Corrosion Removal
 - (2) Chemical Treatment
 - (3) Protective Coatings
 - (4) Oxide Film Protection
 - (a) Electrolytically Formed Oxides
 - (b) Chemically Formed Oxides
 - (5) Organic Finishes

- ii) Corrosion Treatment of Magnesium Alloys
 - (1) Mechanical Corrosion Removal
 - (2) Chemical Treatment
- iii) Corrosion Treatment of Ferrous Metals
 - (1) Mechanical Cleaning
 - (2) Surface Treatment for Steel
 - (a) Cadmium Plating
 - (b) Nickel or Chrome Plating
 - (c) Galvanizing
 - (d) Metal Spraying
 - (e) Organic Finishes
- g) Assessment of Corrosion Damage
- h) Corrosion Control, A Summary

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MATHEMATICS

COURSE DESCRIPTION: A review of basic math including algebraic operations, fractions, exponents, roots, and area and volume of geometric figures.

COURSE OBJECTIVES: This instruction is intended to provide the necessary math skills for the student to use throughout his training and subsequent employment in the field of aviation maintenance.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Mathematics	30	15	15

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- none

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Measurement of Area and Volume

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-24: Level 3 - Extract roots and raise numbers to a given power

- Find the square and cube of a list of numbers
- Find the square root of a list of numbers

G-25: Level 3 - Determine areas and volumes of various geometrical shapes

- Given the span and chord of a rectangular wing, compute the area of the wing
- Given the length, width, and depth of a fuel tank, find the number of U. S. gallons of fuel the tank will hold
- Given the diameter of circle, find its area
- Find the number of square inches of metal needed to make an open-end cylinder having a given diameter and length
- Find the area of a trapezoid when the altitude and the length of both of the bases are given

G-26: Level 3 - Solve ratio, proportion, and percentage problems

- Given a list of common fractions, convert them to decimal fractions
- Given a list of decimal fractions, convert them to common fractions with the smaller whole denominator
- Convert a list of common fractions into percentage
- Find the number that is a given percentage of another number
- Change a list of mixed numbers into improper fractions
- Add, subtract, multiply, and divide a list of common fractions

G-27: Level 3 - Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers

- Add, subtract, multiply, and divide a list of positive and negative numbers
- Given the bore and stroke of an aircraft engine cylinder, compute the piston displacement of one cylinder
- Given the bore, stroke, and clearance volume of an aircraft engine cylinder, compute the compression ratio of the cylinder
- Solve a problem that involves square roots in the numerator and the square of a number in the denominator
- Find the speed of rotation of the shaft of a driven gear when the gear ratio and the rotational speed of the drive gear are given

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Why Study Mathematics**
- 2) **Numerals**
 - a) Arabic Numerals
 - b) Roman Numerals
- 3) **Number System**
 - a) Decimal System
 - b) Binary System
- 4) **Arithmetic**
 - a) Addition
 - b) Subtraction
 - c) Multiplication
 - d) Division
- 5) **Fractions**
 - a) Common Fractions
 - i) Addition of Common Fractions
 - ii) Subtraction of Common Fractions
 - iii) Finding the Smallest Common Denominator
 - iv) Reducing a Fraction to its Lowest Term
 - v) Multiplication of Common Fractions
 - vi) Division of Common Fractions
 - b) Mixed Numbers
 - c) Decimal Fractions
 - i) Addition of Numbers Containing Decimal Fractions
 - ii) Subtraction of Numbers Containing Decimal Fractions
 - iii) Multiplication of Numbers Containing Decimal Fractions
 - iv) Division of Numbers Containing Decimal Fractions
 - d) Converting Common Fractions into Decimals
 - e) Converting Decimal Fractions into Common Fractions
- 6) **Ratio and Proportion**
 - a) Ratio
 - b) Proportion
- 7) **Percentage**
 - a) One Number Which is a Given Percentage of Another
 - b) The Percentage One Number is of Another
 - c) A Number of Which a Given Percentage is Known
- 8) **Signed Numbers**
 - a) Adding Signed Numbers
 - b) Subtracting Signed Numbers
 - c) Multiplying Signed Numbers
 - d) Dividing Signed Numbers
- 9) **Powers and Roots**
 - a) Powers
 - b) Roots
- 10) **Scientific Notation**
 - a) Changing Numbers into Scientific Notation
 - b) Changing Scientific Notation into Ordinary Numbers
 - c) Adding Numbers Using Scientific Notation
 - d) Subtracting Numbers Using Scientific Notation
 - e) Multiplying Numbers Using Scientific Notation
 - f) Dividing Numbers Using Scientific Notation
 - g) Raising Numbers to Powers Using Scientific Notation

11) Trigonometry

- a) Triangles
- b) Trig Function Table
- c) Tangent
- d) Sine
- e) Vector Quantities
- f) Cotangent, Secant, and Cosecant

12) Mathematical Sequence

13) Practical Measurements

- a) Area
- b) Force
- c) Volume

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MAINTENANCE FORMS AND RECORDS

COURSE DESCRIPTION: The student is introduced to the use of technical literature, FAA publications, forms and records, microfiche, and Federal Regulations regarding maintenance personnel.

COURSE OBJECTIVES: This training provides the basic skills needed by the Airframe and Powerplant mechanic to perform aircraft maintenance in accordance with accepted policies, practices and procedures. Heavy emphasis is placed on the proper completion of paperwork and the proper use of maintenance manuals. The student will be exposed to the use of tapes and CD ROMs in addition to microfiche.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Maintenance Forms and Records	24	6	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Form 337
- Aircraft & engine log books

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-28: Level 3 - Write descriptions of work performed, including aircraft discrepancies and corrective actions, using typical aircraft maintenance records

- Prepare a Form 337 describing a major repair or major alteration specified by the instructor
- Prepare a maintenance record entry that records the proper compliance with an Airworthiness Directive specified by the instructor
- Prepare a maintenance record entry that records the required tests and inspection for an altimeter system that is installed on an aircraft that is flown under Instrument Flight Rules

G-29: Level 3 - Complete required maintenance forms, records, and inspection reports

- Prepare a maintenance record entry that approves an aircraft for return to service after a 100-hour inspection
- Given a list of repairs and alterations to an aircraft and engine, identify the operations that require a Form 337 to be filled out
- Locate in the Federal Aviation Regulations the description of the tests and inspections that must be performed on altimeter systems, and on ATC transponders

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Maintenance & Inspection Records

- a) Required Maintenance Records
 - i) Maintenance Record Entries
 - (1) Maintenance Entries
 - (2) Inspection Entries

2) Maintenance Forms

- a) Major Repair and Alteration FAA Form 337
- b) Malfunction or Defect Report
- c) Inspection Reminder

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BASIC PHYSICS

COURSE DESCRIPTION: Basic principles of physics for mechanics such as simple machines, heat dynamics, fluid and gas laws, work and power, and air pressure.

COURSE OBJECTIVES: This instruction is intended to teach the student the principles and application of physical science needed to succeed in his training and employment in the field of aviation maintenance.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Basic Physics	30	15	15

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- None

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Sound and Its Effects x2
- Newton's Law of Motion x2
- How Airplanes Fly
- Temperature, Pressure, and Fluids-Liquids; Parts I & II
- Bernolli's Principle: Why An Airplane Flies; Parts I & II
- Energy, Work, Power, and Force
- Advanced Aerodynamics Angle of attack
- Helicopter Fundamentals
- Aerodynamic Principle
- Sound and Its Effects

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-30: Level 2 - Use and understand the principles of simple machines; sound, fluid, and heat dynamics; basic aerodynamics; aircraft structures; and theory of flight

- Using a drawing of a lever, identify the class of lever and its mechanical advantage
- Using a dimensioned drawing of a hydraulic cylinder, find the amount of force exerted by a specified amount of hydraulic pressure
- Find the amount of force needed to roll a barrel of oil up an inclined plane when the length of the plane, weight of the barrel, and height of the barrel is raised are all known
- Using a diagram of a gear train, find the speed and direction of rotation of the output shaft when the speed and direction of the input shaft are known
- Convert a list of Celsius temperatures into Fahrenheit temperatures
- Give examples of heat transfer by conduction, convection, and radiation

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Matter**
 - a) Chemical Nature of Matter
 - b) Physical Nature of Matter
- 2) **Weight and Mass**
 - a) Density
 - b) Specific Gravity
- 3) **Energy**
 - a) Potential Energy
 - b) Kinetic Energy
 - c) Exchanges between Matter and Energy
 - i) Aerodynamic Lift
 - ii) Nuclear Energy
- 4) **Work and Power**
 - a) Work
 - b) Power
- 5) **Force and Motion**
 - a) Force
 - i) Mechanical Advantage
 - ii) The Law of the Lever
 - (1) First-Class Lever
 - (2) Second-Class Lever
 - (3) Third-Class Lever
 - iii) The Inclined Plane
 - iv) Ropes and Pulleys
 - v) Gears
 - b) Motion
 - i) Speed and Velocity
 - ii) Change in Speed
 - iii) Newton's Laws of Motion
 - iv) Circular Motion
- 6) **Vectors**
- 7) **Stress and Strain**
 - a) Stress
 - i) Tension
 - ii) Compression
 - iii) Torsion
 - iv) Bending
 - v) Shear
 - b) Strain
- 8) **Heat and Temperature**
 - a) Heat
 - i) Work Equivalent of Heat
 - ii) Physical Changes Caused by Heat
 - iii) Sensible Heat
 - iv) Latent Heat
 - v) Dimensional Changes Caused by Heat
 - vi) Specific Heat
 - vii) Transfer of Heat
 - (1) Conduction
 - (2) Convection
 - (3) Radiation
 - b) Temperature

- 9) Pressure**
 - a) Absolute Pressure
 - b) Gage Pressure
 - c) Differential Pressure
- 10) Gas Laws**
 - a) Boyle's Law
 - b) Charles's Law
 - c) General Gas Law
 - d) Dalton's Law
- 11) Fluid Mechanics**
 - a) Pressure Produced by a Fluid
 - i) Pascal's Law
 - ii) Bernoulli's Principle
 - b) Bouoyancy
- 12) Vibration and Sound**
 - a) Vibration
 - i) Resonance
 - b) Sound
 - i) Sound Intensity
 - ii) Speed of Sound
- 13) Light**
 - a) Natural Light
 - b) Characteristics of Light
 - i) Light Travels in Straight Lines
 - ii) Light Spreads out as It Leaves Its Source
 - iii) The Law of Reflection
 - iv) Diffusion of Light
 - v) Speed of Light
- 14) The Atmosphere**
 - a) Composition of the Atmosphere
 - b) Atmospheric Pressure
 - c) Atmosphere Density
 - d) Water Content of the Atmosphere
 - i) Absolute Humidity
 - ii) Relative Humidity
 - iii) Dew Point
 - iv) Vapor Pressure
- 15) Standard Atmosphere
- 16) Basic Fixed-Wing Aerodynamics**
 - a) The Beginnings of Flight
 - b) Two Types of Lift
 - i) Aerostatic Lift
 - ii) Aerodynamic Lift
 - c) Properties of the Atmosphere
 - i) Standard Atmospheric Conditions
 - d) Bernoulli's Principle
 - e) Axes of an Aircraft
 - f) Forces Acting on an Aircraft in Flight
 - i) Thrust
 - ii) Lift
 - iii) Weight
 - iv) Drag
 - g) Development of the Aerodynamic Forces
 - i) Airfoil Sections
 - ii) Aerodynamic Lift
 - iii) Induced Drag
 - iv) Parasite Drag

- h) Flight at High-Lift Conditions
 - i) Ground Effect
 - ii) Effect of High-Lift Devices
 - iii) Boundary Layer Control
 - iv) Vortex Generators
 - v) Effect of Wing Planform
 - vi) Slots and Stall Strips
 - vii) Wing-Tip Vortices
- i) Stability and Control
 - i) Static Stability
 - ii) Dynamic Stability
 - iii) Longitudinal Stability
 - iv) Longitudinal Control: Rotation about the Lateral Axis
 - v) Lateral Stability
 - vi) Lateral Control: Rotation about the Longitudinal Axis
 - vii) Turning Flight
 - viii) Directional Stability
 - (1) The Effect of Sweepback
 - ix) Dutch Roll
 - x) Directional Control: Rotation about the Vertical Axis

17) Basic High-Speed Aerodynamics

- a) Compressibility
 - i) Compressible and Incompressible Flow
 - ii) The Speed of Sound
- b) Flight Speed Ranges
 - i) Subsonic Flight
 - ii) Transonic Flight
 - (1) Effect of Sweepback
 - (2) Forward-Swept Wing
- c) Supersonic Airflow
 - i) Normal Shock Waves
 - ii) Oblique Shock Waves
 - iii) Expansion Waves

18) Basic Rotor-Wing Aerodynamics

- a) Aerodynamic Principles
 - i) Lift, or Rotor Thrust
 - ii) Dissymmetry of Lift
 - iii) Torque
 - iv) Autorotation
 - v) Retreating Blade Stall
 - vi) Ground Effect
 - vii) Translational Lift
 - viii) Gyroscopic Precession
 - ix) Transverse Flow Effect
 - x) Coriolis Effect
 - xi) Settling With Power
- b) Helicopter Flight Controls
 - i) Collective Pitch Control
 - ii) Cyclic Pitch Control
 - iii) Horizontal Stabilizer
 - iv) Antitorque Pedals
 - v) Stabilization Systems
 - vi) Stabilization Systems
 - (1) Stabilizer Bar
 - (2) Offset Flapping Hinge
 - (3) Electronic Stability Augmentation System

MAINTENANCE PUBLICATIONS

COURSE DESCRIPTION: The student is introduced to the use of technical literature, FAA publications, forms and records, microfiche, and Federal Regulations regarding maintenance personnel.

COURSE OBJECTIVES: This training provides the basic skills needed by the Airframe and Powerplant mechanic to perform aircraft maintenance in accordance with accepted policies, practices, and procedures. Heavy emphasis is placed on the proper completion of paperwork and the proper use of maintenance manuals. The student will be exposed to the use of tapes and CD ROMs in addition to microfiche.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Maintenance Publications	24	6	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Technical library

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-31: Level 3 - Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturers' aircraft maintenance specifications, data sheets, manuals, publications, and related Federal Aviation Regulations, Airworthiness Directives, and Advisory material

- Respond to specific maintenance-related information requests posed by the instructor by researching service bulletins, overhaul manuals, structural repair manuals, parts manuals, instructions for continued airworthiness, Federal Aviation Regulations, Airworthiness Directives, and aircraft maintenance specifications
- Locate and list all applicable Airworthiness Directives for a particular make, model, and serial number of an aircraft, engine, propeller, and appliance

G-32: Level 3 - Read technical data

- As specified by the instructor, interpret data from Type Certificate Data Sheets in relation to conducting maintenance or inspections

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Federal Control of Aviation**
 - a) The Federal Aviation Administration (FAA)
- 2) Federal Aviation Regulations**
- 3) Advisory Circulars**
- 4) Aircraft Certification**
 - a) Approved Type Certificate (ATC)
 - i) Type Certificate Data Sheets, Aircraft Specifications, and Aircraft Listings
 - b) Production Certificates
 - c) Airworthiness Certificate
 - d) Supplemental Type Certificate (STC)
- 5) Airworthiness Directives (AD)**
 - a) Publication of Airworthiness Directives
 - b) General Aviation Airworthiness Alerts
- 6) Technical Standard Orders (TSO) and Parts Manufacturing Approval (PMA)**
- 7) Manufacturer's Maintenance (MM) or Service Manuals**
 - a) Maintenance Intervals
- 8) ATA 100 Specifications**
- 9) Component Maintenance Manuals (CMM)**

MECHANIC PRIVILEGES AND LIMITATIONS

COURSE DESCRIPTION: The student is introduced to the use of technical literature, FAA publications, forms and records, microfiche, and Federal Regulations regarding maintenance personnel.

COURSE OBJECTIVES: This training provides the basic skills needed by the Airframe and Powerplant mechanic to perform aircraft maintenance in accordance with accepted policies, practices and procedures. Heavy emphasis is placed on the proper completion of paperwork and the proper use of maintenance manuals. The student will be exposed to the use of tapes and CD ROMs in addition to microfiche.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Mechanic Privileges and Limitations	6	3	3

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected video tapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- none

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

G-33: Level 3 - Exercise mechanic privileges within the limitations prescribed by Part 65 of the FARs

- Given a list of maintenance functions, identify which ones of them are major airframe repairs, minor airframe repairs, major powerplant repairs, minor powerplant repairs, major airframe alterations, minor airframe alterations, major powerplant alterations, minor powerplant alterations, and which are preventive maintenance
- Given a list of maintenance functions, identify the ones that a mechanic with only a powerplant rating can perform, the ones that a mechanic with only a airframe rating, and the ones that an A & P mechanic cannot perform
- Prepare the correct type of notification that is necessary to advise the FAA of a permanent change of address
- Explain the difference between the privileges of a certified mechanic and a certified repairman
- Explain the differences between a 100-hour inspection and an annual inspection
- Explain the portion of the altimeter and static system inspection required by 14 CFR 91.411 that may be performed by a mechanic with an airframe rating

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Maintenance Classifications

- a) Inspections
 - i) Preflight Inspection
 - ii) Annual and 100-Hour Inspections
 - iii) Progressive Inspections
 - iv) Continuous Airworthiness Inspection Program
 - v) Special Inspections
 - (1) Altimeter and Static System Inspection
 - (2) ATC Transponder Tests and Inspection
 - (3) Other Special Inspections
- b) Repairs
- c) Alterations
- d) Preventative Maintenance

2) Classification of Maintenance Airmen

- a) Mechanic
 - i) Requirements for Certification
 - ii) Privileges and Limitations of a Mechanic
- b) Inspection Authorization (IA)
 - i) Requirements for IA Certification and Renewal
 - ii) Privileges and Limitations of a Mechanic with an Inspection Authorization
- c) Repairmen

AIRFRAME CURRICULUM SUBJECTS

AIRFRAME SECTION SUMMARY

Subject	Total	Theory	Lab
Airframe Inspection	45	12	33
Assembly and Rigging	45	12	33
Sheet Metal and Nonmetallic Structures	150	45	105
Wood Structures	12	3	9
Aircraft Covering	24	6	18
Aircraft Finishes	42	6	36
Welding	12	3	9
Aircraft Electrical Systems	150	45	105
Aircraft Position and Warning Systems	30	12	18
Aircraft Instrument Systems	30	12	18
Communication and Navigation Systems	30	12	18
Hydraulic and Pneumatic Power Systems	30	12	18
Aircraft Fuel Systems	30	12	18
Aircraft Landing Gear Systems	30	12	18
Cabin Atmosphere Control Systems	30	12	18
Ice and Rain Control Systems	30	12	18
Fire Protection Systems	30	12	18
Total	750	240	510

FAR 147 References:

Wood Structures - Appendix C, items 1-3
 Aircraft Covering - Appendix C, items 4-5
 Aircraft Finishes - Appendix C, items 6-9
 Sheet Metal and Non-metallic Structures - Appendix C, items 10-16
 Welding - Appendix C, items 17-21
 Assembly and Rigging - Appendix C, items 22-27
 Airframe Inspections - Appendix C, item 28
 Aircraft Landing Gear Systems - Appendix C, item 29
 Hydraulic and Pneumatic Power System - Appendix C, items 30-32
 Cabin Atmosphere Control Systems - Appendix C, items 33-35
 Aircraft Instrument Systems - Appendix C, items 36-37
 Communication and Navigation Systems - Appendix C, items 38-40
 Aircraft Fuel Systems - Appendix C, items 41-47
 Aircraft Electrical Systems - Appendix C, items 48-50
 Aircraft Position and Warning Systems - Appendix C, items 51-52
 Ice and Rain Control Systems - Appendix C, item 53
 Fire Protection Systems - Appendix C, items 54-55

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WOOD STRUCTURES

COURSE DESCRIPTION: Inspection and repair of wood structures, fabric coverings, and various fiberglass assemblies and subassemblies.

COURSE OBJECTIVES: Students will learn how to inspect and repair of wood structures.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Wood Structures	12	3	9

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various small pieces of wood
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-1: Level 1-Service and repair wood structures

A-2: Level 1-Identify wood defects

A-3: Level 1-Inspect wood structures

- Given several pieces of wood, examine them for condition and for meeting the specifications for aircraft structural wood

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Aircraft Wood Structure

- a) Aircraft Wood
 - i) Types of Wood
 - ii) Evaluating Wood for Aircraft Use
- b) Glues and Gluing
 - i) Types of Glue
 - ii) Surface Preparation for Gluing
 - iii) Proper Gluing Procedures
- c) Construction and Repair of Wood Structures
 - i) Wing Spar Repair
 - ii) Rib Repairs
 - iii) Repair to Damaged Plywood Structures
- d) Protection and Inspection of Wooden Aircraft Structures

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AIRCRAFT COVERING

COURSE DESCRIPTION: Students will learn about a variety of aircraft coverings, including dope & fabric, fiberglass and composites. Students will learn to inspect and repair of these structures.

COURSE OBJECTIVES: Students will develop a working knowledge of fabric and fiberglass coverings, wood and wood structures, and paint and finishes.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Covering	24	6	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various fabric
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Fabric Covering

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-4: Level 1-Select and apply fabric and fiberglass covering materials

- Explain the correct way of removing wrinkles from cotton fabric that is installed on an aircraft structure before the dope is applied

A-5: Level 1-Inspect, test, and repair fabric and fiberglass

- Test the strength of a piece of aircraft fabric using the pull test

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Aircraft Fabric Covering

- a) Fabric Covering Systems
 - i) Organic Fabrics
 - ii) Inorganic Fabrics
 - iii) Covering System Approvals
 - (1) Original Equipment Manufacturer
 - (2) Supplement Type Certificates
 - (3) FAA Field Approval
- b) Aircraft Re-Covering
 - i) Is Re-Covering Necessary?
 - (1) Fabric Testing
 - ii) Preparation for Re-Covering
 - (1) Remove the Old Fabric
 - (2) Inspect the Structure
 - (3) Prepare the Structure
 - iii) Cotton Fabric Covering
 - (1) Textiles
 - (2) Chemicals
 - (3) Installing the Fabric
 - (a) The Envelope Method
 - (b) The Blanket Method
 - (4) Removing the Wrinkles
 - (5) The First Coat of Dope
 - (6) Attaching the Fabric
 - (7) Drain Grommets and Inspection Rings
 - (8) Application of Surface Type
 - (9) Application of the Finish System
 - iv) Inorganic Fabric Covering
 - (1) The Poly-Fiber System
 - (a) Materials Used
 - (b) Installing and Shrinking the Fabric
 - (c) Attaching the Fabric
 - (d) Application of Surface Tape and Hole Reinforcements
 - (e) The Finish
 - (2) The Superflite System
 - (a) Superflite System I
 - (b) Superflite System II
 - (3) The Ceconite 7600 System
 - (a) Materials used
 - (b) Installing the Fabric
 - (c) Shrinking the Fabric
 - (d) Attaching the Fabric
 - (e) The Finish
 - v) Repair of Aircraft Fabric
 - (1) Tear in the Fabric
 - (2) Doped-on Patch

AIRCRAFT FINISHES

COURSE DESCRIPTION: Students will learn about a variety of aircraft finishes. Students will learn to inspect and repair of these structures.

COURSE OBJECTIVES: Students will develop a working knowledge of fabric and fiberglass coverings, wood and wood structures, and paint and finishes.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Finishes	42	6	36

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Paint guns
- Paint spray cans
- Brushes
- Various aircraft paints, primers, and strippers
- Various aircraft parts

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Painting 101

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-6: Level 1-Apply trim, letters, and touch-up paint

- Explain the correct size and location for the identification numbers required on an aircraft

A-7: Level 2-Identify and select aircraft finishing materials

- Identify the correct thinner to use with a list of finishing materials furnished by the instructor
- Mix dope and the correct thinner to get the proper viscosity for spraying, demonstrating the correct way to spray dope on an aircraft structure

A-8: Level 2-Apply finishing materials

- Properly adjust the air pressure on a spray gun and pressure pot for spraying aircraft dope
- Properly clean a piece of aluminum alloy and apply the correct amount of primer for best adherence of the topcoat material
- Demonstrate the correct way to spray a surface with a polyurethane enamel

A-9: Level 2-Inspect finishes and identify any defects

- Properly remove the finish from a piece of fiberglass-reinforced aircraft structure so the that structure can be repaired
- Determine whether the dope that is on a piece of fabric-covered structure is nitrate or butyrate

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Aircraft Painting and Finishing

- a) Metal Finishing
 - i) Paint Removal
 - (1) Chemical Stripping
 - (2) Dry Stripping
 - ii) Preparation for Painting
 - (1) Corrosion Detection
 - (2) Conversion Coating
 - (3) Primers
 - (a) Zinc Chromate
 - (b) Wash Primer
 - (c) Epoxy Primer
 - iii) Finishing Systems
 - (1) Acrylic Lacquer
 - (2) Synthetic Enamel
 - (3) Polyurethane
- b) Fabric Finishing
 - i) Organic Fabric Finishes
 - (1) The Fill Coats
 - (2) The Ultraviolet-Blocking Coats
 - (3) The Finish Coats
 - ii) Inorganic Fabric Finishes
 - iii) Finishing Problems
 - (1) Poor Adhesion
 - (2) Blushing
 - (3) Pinholes
 - (4) Orange Peel
 - (5) Fisheyes
 - (6) Runs and Sags
 - (7) Dope Roping
 - (8) Ringworm and Rejuvenation
- c) Paint and Dope Application
 - i) Finishing Equipment
 - (1) Spray Area
 - (2) Air Supply
 - (3) Spray Equipment
 - (a) Air-Atomized Spray Equipment
 - ii) Safety Equipment
 - (1) Fire Safety
 - (2) Respiratory
 - (3) Toxicity Safety
 - iii) Application of the Finish
 - (1) Spraying on the Finish
 - (a) Adjusting the Spray Pattern
 - (b) Sequence of Painting
 - (2) Paint Gun Problems
 - (a) Distorted Spray Pattern
 - (b) Spray Gun Spitting
 - (c) Cleaning the Spray Equipment
 - (3) Application of Trim and Registration Numbers

SHEET METAL AND NONMETALLIC STRUCTURES

COURSE DESCRIPTION: Basic structural repair techniques for sheet metal, fiberglass laminates, plastics, and honeycomb materials, as well as some interior refinishing.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft structural repair techniques including layout, forming, bending, cutting, painting, and riveting. The fabrication and finish of composite structures will also be covered.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Sheet Metal and Nonmetallic Structures	150	45	105

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Beverly shear
- Roll forming machine
- Sheet Metal bending brakes
- Drill press
- Sanding belts & discs
- Band saw
- Basic sheet metal hand tools
- Vises
- Assortment of rivets
- Rivet guns
- Cleco pliers
- Basic hand tools
- Various fabric types (fiberglass, Kevlar, & carbon fibers)
- Various resins & hardeners
- Basic cleaning chemicals
- Various radomes
- Foam blocks
- Various honeycomb materials
- Various twist drills
- Transparent plexiglass

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Advanced Composite Construction Techniques
- Eyes of Sight
- Composite Structure Awareness
- Metal Working 101
- Aircraft Fiberglass 101
- Measuring and Layout Tools

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-10: Level 2 - Select, install, and remove special fasteners for metallic, bonded, and composite structures

- Lay out an octagonal patch that will restore the strength lost by a crack in a piece of stressed fuselage skin
- Demonstrate proper installation and removal techniques of special metallic and composite fasteners as specified by the instructor

A-11: Level 2 - Inspect bonded structures

- Visually inspect an unpainted composite surface
- Distinguish between a piece of acrylic plastic and a piece of cellulose acetate plastic
- Demonstrate the correct way to check a bonded honeycomb structure for indication of internal delamination

A-12: Level 2 - Inspect, test, and repair fiberglass, plastics, honeycomb, composite, and laminated primary and secondary structures

- Select the proper twist drill and demonstrate the correct way to drill transparent acrylic plastic
- Repair a small damage to a piece of honeycomb structure
- Inspect a composite structure using non-destructive testing methods specified by the instructor

A-13: Level 2 - Inspect, check, service, and repair windows, doors, and interior furnishings

- Inspect an aircraft window for defects
- Select materials and clean a transparent surface specified by the instructor
- Repair a shallow scratch in a piece of transparent acrylic material
- Perform an operational safety check on the doors of an aircraft
- Inspect an aircraft seat for damage and perform a safety check

A-14: Level 3 - Inspect and repair sheet metal structures

- Select the proper twist drill and demonstrate the correct way to drill stainless steel
- Make a flush patch repair to a hole in a sheet metal aircraft structure
- Perform countersinking and dimpling procedures to aluminum alloy sheet as specified by the instructor
- Inspect a sheet metal assembly or repair, as specified by the instructor, for airworthiness

A-15: Level 3 - Install conventional rivets

- Given an assortment of aircraft rivets, identify each by their proper part number and type of material
- Select the correct length and diameter of special rivets furnished by the instructor and properly install them to join two pieces of aluminum alloy sheet
- Demonstrate the correct way to set up and use a squeeze riveter
- Properly remove a series of rivets from a piece of aircraft structure

A-16: Level 3 - Form, layout, and bend sheet metal

- Determine a rivet lay out pattern per specifications provided by the instructor
- Lay out and form a channel of specified dimensions from a piece of aluminum alloy sheet, using the minimum bend radius allowed for the material
- Form a compound curved channel to reinforce a damage in a fuselage frame specified by the instructor
- Bend aluminum alloy sheet per specifications provided by the instructor

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Composite Structures

- a) Composite Materials
 - i) Reinforcing Materials
 - (1) Fiberglass
 - (2) Kelvar
 - (3) Graphic
 - (a) Fiber Orientation
 - (i) Unidirectional Fabrics
 - (ii) Bidirectional Fabrics
 - (4) Hybrids
 - ii) Matrix Materials
 - (1) Polyester Resins
 - (2) Epoxy Resins

- iii) Preimpregnated Materials
 - iv) Adhesives
 - v) Core Materials
 - (1) Foam
 - (2) Honeycomb
 - (3) Fillers
 - b) Manufacturing Methods
 - i) Matched Dies
 - ii) Vacuum Bag
 - iii) Autoclaves
 - iv) Filament Winding
 - c) Composite Structure Inspection and Repair
 - i) Inspection
 - ii) Repair
 - (1) Room-Temperature Cure
 - (2) Hot-Bond Repair
 - (a) Curing the Repair
 - iii) Cutting and Sanding Composite Materials
 - d) Safety Around Composites
 - i) Skin Care
 - ii) Eye Care
 - iii) Respiratory Care
- 2) Transparent Plastics**
- a) Storing and Handling Transparent Plastic Materials
 - b) Working with Transparent Plastic Materials
 - i) Cutting
 - ii) Drilling
 - iii) Forming Acrylic Plastics
 - iv) Cementing Transparent Plastic Materials
 - (1) Methods of Applying Pressure
 - (2) Curing Transparent Plastic Materials
 - c) Cleaning Transparent Plastic Materials
 - i) Polishing and Protection
 - d) Installing Plastic Windshields and Windows
 - e) Repairing Transparent Plastic Materials
 - i) Crazeing
 - ii) Holes
 - iii) Cracks
- 3) Materials for Metal Aircraft Construction**
- a) Nonferrous Metals
 - i) Aluminum Alloys
 - (1) Aluminum Alloy Designation and Characteristics
 - (2) Heat-Treatable Alloys
 - (a) Solution Heat Treatment
 - (b) Precipitation Heat Treatment
 - (c) Annealing
 - (d) Aluminum Alloy Temper Designations
 - (3) Nonheat-Treatable Alloys
 - (4) Corrosion Protection of Aluminum Alloys
 - (a) Cladding
 - (b) Oxide-Film Protection
 - (c) Enamel or Lacquer Coating
 - ii) Magnesium Alloys
 - iii) Titanium
 - b) Ferrous Metals
 - i) Alloy Steels
 - ii) Corrosion-Resistant Steel
 - c) Strength of Metal Structural Materials
 - i) Bearing and Shear Strength

4) Aircraft Structural Fasteners

- a) Solid Rivets
 - i) Rivet Dimensions
 - ii) Rivet Identification
- b) Special Fasteners
 - i) Friction-Lock Cherry Rivets
 - ii) Mechanical-Lock Cherry Rivets
 - iii) Threaded Rivet
 - iv) High-Strength Pin Rivets

5) Tools for Sheet Metal Construction and Repair

- a) Layout Tools
 - i) Combination Set
 - ii) Steel Scales
 - iii) Dividers
- b) Marking Tools
 - i) Punches
- c) Cutting Tools
 - i) Squaring Shear
 - ii) Throatless Shears
 - iii) Scroll Shears
 - iv) Bandsaw
 - v) Hacksaw
 - vi) Files
 - vii) Chisels
- d) Deburring Tools
- e) Drills
 - i) Drill Motors
 - ii) Drill Attachments and Special Drills
- f) Forming Tools
 - i) Cornice Brake
 - ii) Box Brake
 - iii) Slip Roll Former
 - iv) Sandbag
- g) Riveting Tools
 - i) Rivet Gun
 - ii) Rivet Set
 - iii) Bucking Bars
 - iv) Compression Rivet Squeezers
- h) Sheet-Metal Assembly Tools
 - i) Hole Finder
 - ii) Chip Chaser

6) Layout and Forming

- a) Grain of the Metal
- b) Bend Radius
- c) Setback
- d) Bend Allowance
- e) Layout of a Sheet-Metal Channel
 - i) Choose the Correct Bend Radius
 - ii) Find the Setback
 - iii) Find the Length of Each of the Flats
 - iv) Find the Bend Allowance
 - v) Lay Out the Flat Pattern
 - vi) Draw the Sight Lines on the Flat Pattern
- f) Folding a Box
- g) Forming Compound Curves
 - i) Forming Small Compound Curved Parts in the Maintenance Shop
 - ii) Flanging Lightening Holes
 - iii) Jogging

7) Sheet-Metal Joints Using Solid Rivets

- a) Rivet Selection
- b) Rivet Layout
 - i) Rivet Pitch
 - ii) Transverse Pitch
 - iii) Edge Distance
 - iv) Layout Practice
 - (1) Find the Strength Needed by the Joint
 - (2) Select the Rivet
 - (3) Lay Out the Rivet Pattern
- c) Hole Preparation for Protruding Head Rivets
 - i) Drilling the Holes
- d) Hole Preparation for Flush Rivets
 - i) Countersinking
 - ii) Dimpling
 - (1) Radius Dimpling
 - (2) Coin Dimpling
- e) Rivet Installation
 - i) Compression Riveting
 - ii) Gun Riveting
 - (1) Install the Correct Rivet Set
 - (2) Adjust the Hitting Force of the Gun
 - (3) Install the Rivet and Position the Set
 - (4) Select the Bucking Bar and Position It Against the Rivet Shank
 - (5) Drive the Rivet
 - (6) Evaluate the Rivet
 - iii) Removal of Bad Rivets
 - iv) NACA Method of Flush Riveting
 - v) Team Riveting

8) Repair of the Sheet Metal Structure

- a) Appraisal of the Damage
- b) Classification of Damage
- c) Repair of Cracks in Noncritical Areas
- d) Surface Patch for Stressed Skin
- e) Flush Patch
- f) Stringer Repair
- g) Repairs to Pressure Vessels
- h) Repairs to Floats and Seaplane Hulls
- i) Replacement of a Section of the Aircraft Skin
- j) Approval of the Repair

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WELDING

COURSE DESCRIPTION: Basic gas, arc, and TIG welding.

COURSE OBJECTIVES: This training is intended to provide an overview of welding theory and techniques. Emphasis is on theory and safety, and practice lab exercises.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Welding	12	3	9

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Soldering guns
- TIG welding units

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Oxy-Acetylene Welding Series Parts I & II
- ARC Welding Techniques Parts I & II EA-ARC
- TIG Welding Basics
- Repairing Structure Tubing
- MIG Welding Made Easy

REQUIRED PROJECTS: (**Bold items are required**) (Un-Bold items are recommended)

A-17: Level 1 - Weld magnesium and titanium

- Explain proper techniques/materials used for welding magnesium and titanium

A-18: Level 1 - Solder stainless steel

- Contrast techniques for soldering stainless steel as opposed to other types of steel

A-19: Level 1 - Fabricate tubular structures

- Explain proper welding procedures involved in tubular fabrication

A-20: Level 2 - Solder, braze, gas-weld, and arc-weld steel

- Ignite a welding torch, set specified flame patterns, and properly shut down the torch
- Correctly set up a TIG welding rig and make a proper bead across a piece of steel
- Correctly prepare and join two pieces of steel by brazing
- Solder a joint or connection specified by the instructor

A-21: Level 1 - Weld aluminum and stainless steel

- Explain proper techniques/materials used for welding aluminum and stainless steel

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Aircraft Welding

- a) Types of Welding
 - i) Gas Welding
 - (1) Gas Welding Equipment
 - (a) Fuel Gases
 - (i) Oxygen
 - (ii) Acetylene
 - (b) Gas Storage Cylinders
 - (c) Pressure Regulators
 - (i) Oxygen Regulator
 - (ii) Acetylene Regulator
 - (d) Hoses
 - (e) Torches
 - (i) Balanced-Pressure Torches
 - (ii) Injector Torches
 - (f) Torch Tips
 - (g) Torch Lighters
 - (h) Welding Goggles
 - (i) Filler Rod
 - (2) Setting Up the equipment
 - (a) Compressed Gas Safety
 - (b) Connecting the Equipment
 - (c) Lighting and Adjusting the Torch
 - (d) Shutting Down the Equipment
 - (3) Gas Welding Techniques
 - (a) Holding the Torch
 - (b) Welding Positions
 - (4) Welded Joints
 - (5) Control of Expansion and Contraction
 - (6) Characteristics of a Good Weld
- b) Oxyacetylene Cutting
- c) Gas Welding of Aluminum
- d) Brazing and Soldering
 - i) Brazing
 - ii) Silver Soldering
 - iii) Soft Soldering

2) Electric Welding

- a) Electric Arc Welding
 - i) Shielded Metal Arc Welding (SMAW)
 - (1) Gas Shielded Arc Welding
 - ii) Gas Tungsten Arc Welding (GTAW)
 - (1) Shielding Gases
 - (2) Regulator and Flowmeter
 - (3) Power Unit
 - (4) Hand-Held Torches
 - (5) Electrodes
 - (6) Welding Techniques and Procedures
 - (7) Inspection of the Weld
- b) Electrical Resistance Welding
 - i) Spot and Seam Welding

3) Repair of Aircraft Structure by Welding

- a) Specific Welded Repairs
 - i) Welded Patch Repair
 - ii) Longeron Dented at a Cluster
 - iii) Tubing Spliced by the Inner-Sleeve Method
 - iv) Tubing Spliced by the Outer-Sleeve Method

ASSEMBLY AND RIGGING

COURSE DESCRIPTION: Students will learn the proper maintenance procedures for aircraft assembly and rigging, applying basic principles of aerodynamics, including the theory of flight and the function and operation of flight control mechanisms.

COURSE OBJECTIVES: The student will learn the basics of fixed-wing and rotor-wing aerodynamics and apply these concepts to fixed-wing aircraft and helicopters. The student will be instructed in the techniques and practices required to safely rig fixed and rotary wing aircraft.

Subject	Total	Theory	Lab
Assembly and Rigging	45	12	33

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Borescope
- Aircraft jacks
- Turnbuckle mock-up benches
- Inspection mirrors
- Various aircraft

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Bernolli's Principle: Why An Airplane Flies, Parts 1 & 2
- How Airplanes Fly
- Helicopter Fundamentals

COURSE OBJECTIVES: The student will be instructed in the techniques and practices required to safely rig fixed and rotary wing aircraft.

REQUIRED PROJECTS: (**Bold items are required**) (Un-Bold items are recommended)

A-22: Level 1 - Rig rotary-wing aircraft

- Locate rigging procedures for a specified helicopter

A-23: Level 2 - Rig fixed-wing aircraft

- Identify fixed-wing aircraft rigging adjustment locations
- Locate leveling methods and procedures for a specified aircraft

A-24: Level 2 - Check alignment of structures

- Check the flight controls of a specified aircraft, including all secondary controls for the correct direction of movement when the cockpit controls are moved
- Check the primary flight controls surface for its condition of static balance
- Explain the proper way to correct a specified aircraft for a wing-heavy condition

A-25: Level 3 - Assemble aircraft components, including flight control surfaces

- Adjust the tension of an aircraft control cable and properly safety wire the turnbuckle
- Demonstrate the correct way to attach a rod-end bearing to a control horn
- Demonstrate the correct way to determine whether or not a rod-end bearing is screwed into a push-pull tube to the proper depth
- Connect a control cable to a control horn with a clevis bolt, demonstrating the correct way to adjust the tightness of the nut and proper way to safety the nut to the bolt

A-26: Level 3 - Balance, rig, and inspect movable primary and secondary flight control surfaces

- Locate in the appropriate document the control surface movement for a specified airplane, measure this movement, and determine whether or not it is correct
- Check an aircraft landing gear for the proper amount of toe-in or toe-out and for the proper amount of camber
- Inspect the flight control system of a specified aircraft for travel and security

A-27: Level 3 - Jack aircraft

- Using the appropriate document, locate the jacking points and leveling locations of an airplane, explaining the precautions that should be taken when jacking the aircraft
- Determine the jacking requirements for a specified aircraft
- Jack a specified aircraft, employing all appropriate safety precautions

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Airplane Controls

- a) Airplane Primary Flight Controls
 - i) Controls for Roll
 - (1) Ailerons
 - (2) Elevons
 - ii) Controls for Pitch
 - (a) Elevator
 - (b) Stabilator
 - (c) Ruddervator
 - (d) Canard
 - iii) Controls for Yaw
- b) Airplane Secondary Flight Controls
 - (1) Surfaces That Modify the Lift
 - (a) Flaps
 - (i) Plain Flaps
 - (ii) Split Flaps
 - (iii) Slotted Flaps
 - (iv) Fowler Flaps
 - (v) Triple-Slotted Flaps
 - (vi) Leading Edge Flaps
 - (b) Slats
 - (c) Spoilers
 - (2) Devices That Change the Operating Forces
 - (a) Balance Surfaces
 - (b) Tabs
 - (i) Trim Tabs
 - (ii) Balance Tabs
 - (iii) Servo Tabs
 - (iv) Spring Tabs
 - (v) Antiservo Tabs

- (c) Adjustable Stabilizer
 - (d) Balance Panel
 - (e) Bungee Spring
 - (f) Elevator Downspring
 - c) Control System Operating Methods
 - i) Cable Operated Systems
 - (1) Control Cables
 - (2) Fairleads and Pulleys
 - ii) Push-Pull Rod Systems
 - (1) Rod-End Fittings
 - iii) Torque Tube Systems
 - iv) Fly-by-Wire Systems
 - v) Fly-by-Light Systems
 - d) Control Actuation Systems Large Airplanes
 - (1) Roll Control
 - (2) Pitch Control
 - (3) Yaw Control
 - (4) Wing Flaps
- 2) Airplane Assembly and Rigging**
- a) Airplane Assembly
 - i) Installing the Wings and Landing Gear
 - ii) Leveling the Airplane
 - iii) Aligning the wings
 - (1) Dihedral
 - (2) Angle of Incidence
 - (3) Wash In and Wash Out
 - iv) Install and Aligning the Empennage
 - v) Symmetry Check
 - b) Control Surface Installation and Rigging
 - i) Control Surface Balancing
 - ii) Rigging the Ailerons
 - (1) Adjusting Cable Tension
 - (2) Checking Control Travel
 - (3) Checking and Safelying the System
 - iii) Rigging the Elevator
 - iv) Rigging the Rudder
 - v) Control Movement Check
- 3) Helicopter Assembly and Rigging**
- a) Helicopter Controls
 - i) The Swashplate
 - ii) The Collective Pitch Control
 - iii) The Cyclic Pitch Control
 - iv) Horizontal Stabilizers
 - v) Torque Compensation
 - vi) Stabilizer Systems
 - b) Rotor Systems
 - i) Fully Articulated Rotors
 - ii) Semi-rigid Rotors
 - iii) Rigid Rotor
 - c) Helicopter Powerplants
 - i) Reciprocating Engines
 - ii) Turbine Engines
 - iii) Transmission
 - iv) Clutch
 - v) Freewheeling Unit
 - vi) Helicopter Vibrations

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AIRFRAME INSPECTION

COURSE DESCRIPTION: Airworthiness inspections of airframes.

COURSE OBJECTIVES: Students will perform airworthiness inspections of airframes and review airframe subjects in preparation for FAA testing.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Airframe Inspection	45	12	33

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the shop and on the aircraft.

Specific Training Aids/Equipment/Mock-Ups:

- Aircraft
- Basic hand tools
- Various measuring devices
- Log books (aircraft & engines)
- Illustrated parts catalogs
- Maintenance manuals
- Airworthiness Directives (via classroom Internet access)
- Various FAA forms
- Mock forms

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Flight Line Service
- Aeroshell Presents: Aviation Grease
- Aeroshell Presents: Aviation Oil
- Preflight a Fixed Wing
- Preventative Maintenance

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-28: Level 3 - Perform airframe conformity and airworthiness inspections

- Using the aircraft model and serial number specified by the instructor, determine what Airworthiness Directives apply to the aircraft and determine if all of the applicable Airworthiness Directives have been complied with by examining the aircraft maintenance records
- Determine from aircraft records supplied by the instructor whether or not any repetitive Airworthiness Directives must be complied with on a 100-hour inspection
- Determine from aircraft records supplied by the instructor when the next 100-hour inspection is due and when the next annual inspection is due
- Prepare for and perform a 100-hour inspection, making the correct maintenance record entries to show that the inspection has been conducted and the inspection results
- Perform a conformity inspection on an aircraft portion or component thereof and properly record results
- Describe the record entry required when an altimeter system has been inspected in accordance with 14 CFR 91.171

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Required Inspections**
 - a) Preflight Inspection
 - i) Preflight Inspection Sequence
 - b) Special Inspections
 - i) Altimeters and Static Systems
 - ii) Static System Check
 - iii) ATC Transponder
 - c) Major Inspections
 - i) Annual Inspection
 - ii) One-Hundred Hour Inspection
 - iii) Progressive Inspection
 - d) Large Aircraft Inspections
- 2) The Conduct of an Annual or 100-Hour Inspection**
 - a) Examination of the Aircraft Records
 - i) Survey of Maintenance Information
 - b) Inspection of the Aircraft
 - i) Fuel System
 - ii) Landing Gear
 - iii) Airframe
 - iv) Control System
 - c) Record of the Inspection
 - d) Failed Inspection

AIRCRAFT LANDING GEAR SYSTEMS

COURSE DESCRIPTION: Theory, operation, service, and repair of landing gear, retraction systems, wheels, tires, brakes, struts, anti-skid systems, and shocks.

COURSE OBJECTIVES: Students will develop a working knowledge of landing gear, retraction systems, wheels, tires, brakes, struts, anti-skid systems, and shocks.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Landing Gear Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Hydraulic simulator
- Pneumatic simulator
- Landing gear & flaps simulator
- Landing gear simulators
- Brake system simulator
- Brake shoes & brake discs system simulator
- Basic hand tools
- Skydrol & 5606 hydraulic fluid
- Accumulator
- Various aircraft
- Various aircraft tires

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- OLEO Struts

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-29: Level 3 - Inspect, check, service, and repair landing gear, retraction systems, shock struts, brakes, wheels, tires, and steering systems

- Inspect an aircraft tire, explaining the conditions that could cause a tire to be unairworthy
- Demount a tire from an aircraft wheel, inspect the tire for wear, and the wheel and tire for damage, and reinstall the tire on the wheel
- Select an appropriate lubricant and lubricate wheel bearings
- Explain the correct way to store aircraft tires
- Check an aircraft brake for the condition of the lining and the disks
- Check the fluid level in an aircraft brake master cylinder
- Check the fluid level in an aircraft oleo strut and inflate the strut with the correct amount of air or nitrogen
- Check the main wheels of an aircraft for the proper amount of camber and toe-in or toe-out
- Bleed an aircraft brake
- Replace the seals in the wheel cylinder of a single-disk brake
- Inspect a nosewheel shimmy damper and service it with fluid if needed
- Explain the correct way to jack an aircraft so a landing gear retraction can be performed
- Explain the way a particular retractable landing gear is prevented from retracting when the weight of the aircraft is on it

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Landing Gear Types**
 - a) Operation from Water
 - b) Operation from Snow and Ice
 - c) Operation from Hard Surfaces
- 2) **Shock Absorbers**
 - a) Servicing Oleo Shock Struts
 - b) Nonshock-Absorbing Landing Gears
 - c) Wheel Alignment
 - i) Toe-In or Toe-Out
 - ii) Camber
 - iii) Wheel Alignment for Spring Steel Landing Gears
 - iv) Wheel Alignment for Landing Gears with Oleo Struts
 - d) Ground Steering with a Tail Wheel
 - e) Ground Steering with a Nose Wheel
 - f) Shimmy Dampers
- 3) **Landing Gear Retraction Systems**
 - a) Power Pack System
 - i) Lowering the Landing Gear
 - ii) Raising the Landing Gear
 - b) Typical Landing Gear Retraction System
 - c) Emergency Extension of the Landing Gear
- 4) **Aircraft Brakes**
 - a) Brake Actuating Units
 - i) Energizing Brakes
 - ii) Nonenergizing Brakes
 - (1) Expander Tube Brakes
 - (2) Single-Disk Brakes
 - (3) Dual-Disk Brakes
 - (4) Multiple-Disk Brakes
 - (a) Thin-Disk Multiple-Disk Brake
 - (b) Segmented-Rotor Multiple-Disk Brake
 - (c) Carbon Disk Brakes
 - b) Brake Actuation Systems
 - i) Independent Brake Master Cylinders
 - ii) Boosted Brakes
 - iii) Power Brakes
 - (1) System Operation
 - (2) Power Brake Control Valves
 - iv) Antiskid System
 - (1) Antiskid System Components
 - (a) Wheel-Speed Sensors
 - (b) Antiskid Control Valves
 - (c) Antiskid Control Box
 - (2) System Tests
 - (a) Preflight Test
 - (b) Prelanding Check
 - (c) Disabling the System
 - (d) Maintenance Checks
 - (3) Wheel-Speed Sensors
 - (4) Control Box
 - (5) Antiskid Control Valve
 - v) Deboosters
 - vi) Emergency Brake System
 - c) Dual Power Brake Actuating System
 - d) Auto Brake System

- e) Brake Maintenance
 - i) Installation of the Brake on the Aircraft
 - ii) Bleeding the Brakes
 - (1) Gravity Bleeding
 - (2) Pressure Bleeding
- 5) **Aircraft Wheels**
 - a) Wheel Nomenclature
 - i) Inboard Wheel Half
 - ii) Outboard Wheel Half
 - iii) Bead Seat Area
 - b) Wheel Maintenance
 - i) Wheel Removal
 - ii) Tire Removal
 - iii) Wheel Inspection
 - c) Bearing Maintenance
 - d) Tire Installation
 - e) Wheel Installation
- 6) **Aircraft Tires and Tubes**
 - a) Evolution of Aircraft Tires
 - b) Tire Construction
 - i) The Bead
 - ii) The Carcass
 - iii) The Tread
 - iv) The Sidewall
 - v) The Inner Liner
 - c) Tire Inspection
 - i) Inflation
 - ii) Tread Condition
 - iii) Sidewall Condition
 - d) Tire Maintenance
 - i) Inspection
 - ii) Retreading
 - iii) Storage
 - iv) Mounting
 - (1) Tubeless Tires
 - (2) Tube-Type Tires
 - v) Balancing
 - e) Aircraft Tubes
 - f) A Summary of Aircraft Tires

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HYDRAULIC AND PNEUMATIC POWER SYSTEMS

COURSE DESCRIPTION: The course covers the basics of aircraft hydraulic and pneumatic power systems including instruments, operation, servicing, and troubleshooting.

COURSE OBJECTIVES: Students will develop a working knowledge of hydraulic and pneumatic power systems. The use of hydraulic and pneumatic power as applied to aircraft usage will be developed in detail.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Hydraulic and Pneumatic Power Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Hydraulic simulator
- Pneumatic simulator
- Landing gear & flaps simulator
- Landing gear simulators
- Brake system simulator
- Basic hand tools
- Skydrol & 5606 hydraulic fluid
- Accumulator
- Hydraulic fuses

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-30: Level 2 - Repair hydraulic and pneumatic power systems components

- Inspect a hydraulic system filter and service it according to the aircraft manufacturer instructions
- Using a selection of seals supplied by the instructor, identify the seals that are one-way and those that seal in both directions
- Explain the correct way to stop a leak at an MS flareless fitting

A-31: Level 3 - Identify and select hydraulic fluids

- Identify the type of hydraulic fluid by its color, explaining the appearance of contaminated fluid
- Determine the correct type of hydraulic fluid that is required by a particular aircraft and check the system for the correct amount of fluid

A-32: Level 3 - Inspect, check, troubleshoot, service and repair hydraulic and pneumatic power systems

- Measure the air preload in an accumulator
- Explain the action of an aircraft hydraulic system when the accumulator has no air preload
- Charge an accumulator with the correct amount of air or nitrogen
- Explain the correct sequence for adjusting the pressure relief valves in an aircraft hydraulic system
- Adjust the pressure at which a hydraulic pressure relief valve relieves pressure
- Properly install an O-ring seal and backup ring in an actuator cylinder
- Service the emergency air bottle in an aircraft brake system with the correct amount of air or nitrogen
- Remove and replace an actuating cylinder in an aircraft system, purging the air from the system after cylinder reinstallation

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Introduction to Fluid Power Systems

- a) Historical Overview
- b) Basic Laws of Physics
 - i) Review of Terms and Relationships
 - (1) Area
 - (2) Distance
 - (3) Volume
 - (4) Work
 - (5) Power
 - (6) Relationship Between Force, Pressure and Area
 - (7) Relationship Between Volume, Area and Distance
 - (8) The Law of Conservation of Energy
 - (9) Relationship Between Height and Pressure
 - ii) Pascal's Law
 - iii) Mechanical Advantage
 - iv) Bernoulli's Principle
 - (1) Pressure Drop in Moving Fluid
- c) Advantages and Disadvantages of Fluid Power Systems

2) Basic Aircraft Hydraulic Systems

- i) Sealed Brake System
- ii) Reservoir-Type Brake System
- iii) Single-Acting Actuator System
- iv) Double-Acting Actuator
- v) Power Pump Systems
 - (1) Manual Pump Control Valve System
 - (2) Power Control Valve System
 - (3) Automatic Unloading Valve System
 - (4) Open-Center System
- vi) Power Pack System
- vii) Hydraulic Fluids
 - (1) Types of Hydraulic Fluids
 - (a) Vegetable-Based Hydraulic Fluid
 - (b) Mineral-Based Hydraulic Fluid
 - (c) Synthetic Hydrocarbon-Base Hydraulic Fluid
 - (d) Phosphate Ester Hydraulic Fluids
 - (2) Contamination & Protection of Hydraulic Fluids
- b) Hydraulic Reservoirs
 - i) Nonpressurized Reservoirs
 - ii) Pressurized Reservoirs
- c) Hydraulic Pumps
 - i) Hand Pumps
 - ii) Power Pumps
 - (1) Constant-Displacement Pumps
 - (a) Vane-Type Pumps
 - (b) Gear-Type Pumps
 - (c) Gerotor Pumps
 - (d) Piston Pumps
 - (2) Variable-Displacement Pumps
- d) Hydraulic Valves
 - i) Flow Control Valves
 - (1) Check Valves
 - (a) Orifice Check Valve
 - (2) Selector Valves
 - (a) Plug-Type Closed-Center Selector Valve
 - (b) Poppet-Type Closed-Center Selector Valve
 - (c) Poppet-Type Open-Center Selector Valve
 - (d) Spool-Type Closed-Center Selector Valve

- (3) Sequence Valves
- (4) Priority Valve
- (5) Flap Overload Valve
- (6) Flow Equalizer Valve
- (7) Landing Gear Crossflow Valve
- ii) Hydraulic Fuses
- iii) Pressure Control Valves
 - (1) Relief Valves
 - (a) Thermal Relief Valves
 - (2) Automatic Pressure Regulators or Unloading Valves
 - (3) Pressure Reducer
- iv) Hydraulic Accumulators
- v) Hydraulic Filters
- vi) Hydraulic Actuators
 - (1) Linear Actuators
 - (2) Rotary Actuators
 - (3) Servo Actuators
- vii) High Pressure Seals
 - (1) Chevron Seals
 - (2) O-ring
 - (3) T-Seals
- viii) Seal Identification
- ix) Seal Installation
- x) Wipers

3) Fluid Power System Lines and Fittings

- a) Fluid Lines
 - i) Rigid Tubing
 - (1) Preparation for Flared-Tube Fittings
 - (2) Preparation for Flareless Fittings
 - (3) Bending Rigid Tubing
 - ii) Flexible Fluid Lines
 - (1) Low-Pressure Hose
 - (2) Medium-Pressure Hose
 - (3) High -Pressure Hose
 - (4) Teflon Hose
 - iii) Fluid Line Fittings
 - (1) Pipe Fittings
 - (2) AN and AC Flare Fittings
 - (3) Universal or Bulkhead Fittings
 - (4) MS flareless Fittings
 - (5) Quick-Disconnect Fittings
 - iv) Fluid Line Installation
 - (1) Rigid Lines
 - (2) Flexible Lines

4) Pneumatic Systems

- a) Low-Pressure Pneumatic Systems
 - i) Engine-Driven Air Pumps
 - ii) Pneumatic Deicer Systems
 - iii) Pneumatic Gyro Power Systems
- b) Backup High-Pressure Pneumatic Systems
- c) Full Pneumatic Systems

5) Large Aircraft Fluid Power Systems

- a) Sources of Hydraulic Power
- b) Jet Transport Airplane Hydraulic Systems
 - i) System A
 - ii) System B
 - iii) Standby System
 - iv) Reservoir Servicing

6) Hydraulic System Maintenance and Troubleshooting

- a) Hydraulic System Troubleshooting
- b) Troubleshooting Tips and Procedures

CABIN ATMOSPHERE CONTROL SYSTEMS

COURSE DESCRIPTION: Theory of air conditioning, heating, oxygen and cabin pressurization systems. Placement of assemblies and interaction of systems will be detailed.

COURSE OBJECTIVES: Students will develop a working knowledge of air conditioning, heating, oxygen, and cabin pressurization systems. Assemblies and subassemblies that are system components and their location in aircraft will be covered.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Cabin Atmosphere Control Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Cabin pressurization trainer
- Oxygen bottles
- Various aircraft
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-33: Level 1 - Inspect, check, troubleshoot, service, and repair heating, cooling, air conditioning, pressurization systems, and air cycle machines

- On a specified aircraft, locate and identify the compressor, the condenser, the evaporator, and the service valves of a vapor-cycle air conditioning system
- Explain the correct way to check a vapor-cycle air conditioning system for leaks
- Explain the correct way to service a vapor-cycle air conditioning system with refrigerant

A-34: Level 1 - Inspect, check, troubleshoot, service and repair heating, cooling, air conditioning, and pressurization systems

- On a specified aircraft, locate and identify the source of pressurized air, the cabin outflow valve, the cabin pressure safety valve, and the cabin pressure controller
- On a specified aircraft, locate and identify the combustion heater, the fuel strainer, the fuel valve, and the thermostat
- Inspect for leaks in the portion of the engine exhaust system that supplies heat for the aircraft cabin heater

A-35: Level 2 - Inspect, check, troubleshoot, service and repair oxygen systems

- Demonstrate the correct way to check an oxygen system for leaks
- Purge an oxygen system to remove all traces of air from the lines
- Service an oxygen system with the proper type and amount of oxygen
- Check the oxygen bottles in an aircraft for the required identification marks and for the status of their hydrostatic tests

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Human Needs in Flight**
 - a) Pressure
 - b) Temperature
 - c) Humidity
 - d) Air Movement
 - e) The Atmosphere
 - i) Standard Conditions
 - ii) The Characteristics Oxygen
 - (1) Oxygen Partial Pressure
 - (2) The Function of Oxygen
 - iii) The Function of Carbon Dioxide
 - iv) The Threat of Carbon Monoxide
- 2) **The Physics of Cabin Atmosphere Control**
 - a) Heat
 - i) Units of Heat
 - ii) Types of Heat
 - iii) Movement of Heat
 - b) Temperature
 - c) Pressure
 - i) Units of Pressure
- 3) **Aircraft Supplemental Oxygen Systems**
 - a) Types of Oxygen Supply
 - i) Gaseous Oxygen
 - ii) Liquid Oxygen
 - iii) Chemical Oxygen Candle
 - iv) Mechanically Separated Oxygen
 - b) Two Types of O₂ Systems
 - i) Continuous Flow
 - (1) Continuous-Flow Regulators
 - (2) Continuous-Flow Masks
 - ii) Demand-Type Oxygen System
 - (1) Diluter-Demand-Type Regulator
 - (2) Pressure-Demand Oxygen Regulator
 - c) Gaseous Oxygen Cylinders
 - d) Oxygen System Servicing
 - i) Oxygen System Filling
 - ii) Purging
 - iii) Leak Checking
 - iv) System Discharge Indication
 - v) Special Precautions
 - (1) Fire Safety
- 4) **Aircraft Pressurization Systems**
 - a) Principles of Pressurization
 - i) Sources of Pressurized Air
 - (1) Reciprocating-Engines-Powered Aircraft
 - (2) Turbine-Engines-Powered Aircraft
 - b) Modes of Pressurization
 - i) The Unpressurized Mode
 - ii) The Isobaric Mode
 - iii) The Constant-Differential Mode
 - c) Pressurization Controls
 - d) Pressurization Instruments
 - e) Cabin Air Pressure Regulator
 - i) Isobaric Control
 - ii) Differential Control
 - iii) Cabin Rate of Climb
 - f) Negative Pressure Relief Valve

- g) Cabin Air Pressure Safety Valve
- h) Augmented Airflow
- 5) **Heaters**
 - a) Exhaust System Heaters
 - b) Combustion Heaters
- 6) **Cooling Systems**
 - a) Air-Cycle Cooling System
 - i) Temperature Control
 - b) Vapor-Cycle Cooling System
 - i) Compressor
 - (1) The Compressor Drive System
 - ii) The Condenser
 - iii) The Receiver-Dryer
 - iv) Thermostatic Expansion Valves
 - v) The Evaporator
 - vi) Service Valves
 - c) Air Conditioning Servicing Equipment
 - i) Manifold Gage Set
 - ii) Charging Stand
 - iii) Vacuum Pumps
 - iv) Leak Detectors
 - v) Refrigerant-12
 - vi) Refrigerant Oil
 - d) Air Conditioning System Checks
 - i) Visual Inspection
 - ii) Operational Check
 - e) Installing a Partial Charge of Refrigerant
 - i) Leak Testing
 - f) Air Conditioning System Servicing
 - i) Discharging the System
 - ii) Replacing System Components
 - iii) Checking Compressor Oil
 - iv) Flushing the System
 - v) Evacuating the System
 - vi) Charging the System

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AIRCRAFT INSTRUMENT SYSTEMS

COURSE DESCRIPTION: Basic aircraft instruments theory, operation, installation, and troubleshooting.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft instruments, pitot static systems, avionics systems, and electronics troubleshooting.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Instrument Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various aircraft instruments
- Instrument and Antenna Trainer

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-36: Level 1 - Inspect, check, service, troubleshoot, and repair electronic flight instrument systems and both mechanical and electrical heading, speed, altitude, temperature, pressure, and position indicating systems to include the use of built in test equipment

- Determine from the proper source what range markings are required on the instruments on a specified aircraft, evaluate the existence/appropriateness of the markings, and install any needed markings
- Check the pitot heater to determine whether or not it is functioning properly
- Locate and identify the components in an exhaust gas temperature indicating system

A-37: Level 2 - Install instruments and perform a static pressure system leak test

- Remove and properly reinstall an instrument from an aircraft panel
- Swing an aircraft compass, and properly prepare and install a compass correction card
- Perform a static system check on a specified aircraft, determining from the proper source if the system meets the requirements for flight under Instrument Flight Rules
- Using an altimeter to find the existing barometric pressure, check a manifold pressure gage to determine whether or not its pointers are set correctly
- Remove, inspect, and reinstall a vacuum or pressure system filter

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) An Overview of Aircraft Instruments

- a) Classification of Instruments
- b) Pressure Measuring Instruments
 - i) Absolute Pressure Instruments
 - ii) Gage Pressure Instruments
 - iii) Differential Pressure Instruments
- c) Temperature Measuring Instruments
 - i) Nonelectrical Temperature Measurements
 - ii) Electrical Temperature Measurements
 - (1) Resistance-Change Instruments
 - (a) Wheatstone Bridge Circuit
 - (b) Ratiometer Circuit
 - (2) Thermocouple instruments
- d) Mechanical Movement Measuring Instruments
 - i) Position-Indicating Lights
 - ii) Synchro Systems
 - (1) DC Selsyn Systems
 - (2) AC Magnesyn Systems
 - (3) AC Autosyn Systems
 - iii) Tachometers
 - (1) Mechanical Tachometer
 - (2) Electric Tachometer
 - iv) Synchrosopes
 - v) Accelerometers
 - vi) Angle of Attack Indicating Systems
- e) Direction Indicating Systems
 - i) Compass Errors
 - (1) Variation
 - (2) Deviation
 - (3) Dip Errors
 - ii) Vertical-Card Magnetic Compass
 - iii) Flux Gate Compass System
- f) Gyroscopic Instruments
 - i) Attitude Gyros
 - (1) Attitude Indicator
 - (2) Heading Indicator
 - ii) Rate Gyros
 - (1) Turn and Slip Indicator
 - (2) Turn Coordinator

2) Aircraft Instrument Systems

- a) Pitot-Static Systems
 - i) Airspeed Indicators
 - (a) True Airspeed Indicator
 - (b) Maximum-Allowable Airspeed Indicator
 - ii) Machmeter
 - iii) Altimeters
 - (1) Encoding Altimeter
 - iv) Vertical Speed Indicators
 - (1) Instantaneous Vertical-Speed Indicator
- b) Gyro Instrument Power Systems
 - i) Gyro Pneumatic Systems
 - (1) Suction Systems
 - (a) Wet Vacuum Pump System
 - (b) Dry Vacuum Pump System
 - (2) Pressure System

- c) Automatic Flight Control Systems
 - i) Command Subsystem
 - ii) Error-Sensing Subsystem
 - iii) Correction Subsystem
 - iv) Follow-up Subsystem
 - v) Flight Director Indicator and Horizontal Situation Indicator
- 3) **Aural Warning Systems**
- 4) **Instrument Installation and Maintenance**
 - i) Instrument Range Marking
 - ii) Instrument Installation
 - iii) Instrument Maintenance
 - iv) Static System Leak Checks
 - v) Instrument Handling

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COMMUNICATION AND NAVIGATION SYSTEMS

COURSE DESCRIPTION: Fundamentals of avionics, their function and the appropriate terminology, functions of communications equipment and navigational equipment including, basics of aircraft communication and navigation systems; including instruments, operation, installation and troubleshooting.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft static systems, avionics systems and electronics troubleshooting. The Students will be required to use the knowledge gained in previous studies of electricity.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Communication and Navigation Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Instrument and Antenna Trainer
- Electronic locator transmitters (for training purposes only)

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-38: Level 1 - Inspect, check, and troubleshoot autopilot servos and approach coupling systems

- Locate and identify the servos used in an autopilot system

A-39: Level 1 - Inspect, check, and service aircraft electronic communication and navigation systems, including VHF passenger address interphones and static discharge devices, aircraft VOR, ILS, LORAN, radar beacon transponders, flight management computers, and GPWS

- Locate the static discharge wicks on an aircraft, explaining their function
- Locate and identify the VHF communications equipment on an aircraft
- Demonstrate the correct way to check the accuracy of VOR equipment using a VOR signal
- Demonstrate the proper way to determine the functioning of the ADF system

A-40: Level 2 - Inspect and repair antenna and electronic equipment installations

- Locate and identify the antenna for the VOR, the DME, the ATC transponder, the ADF, and the Glide Slope
- Inspect the battery of the ELT, determining when it must be replaced
- Demonstrate the correct way to determine that the ELT is not transmitting
- Demonstrate the correct way to check the ELT for operation
- Locate and check the condition of the bonding braid that is used to provide a ground for a specified piece of electronic equipment
- Check all of the antenna on a specified aircraft for security of mounting
- Properly install a BNC connector on a piece of coax cable
- Check the installation of the avionics equipment in a specified aircraft to determine the condition of its mounting, the electrical connections, the antenna, and the ventilation and cooling provisions
- Check the shock mounts on a piece of avionics equipment to determine their condition and whether or not they allow the equipment to strike any adjacent component or structure

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Communication Systems

- a) Basic Radio Theory
 - i) Modulation
 - (1) Amplitude Modulation(AM)
 - (2) Frequency Modulation (FM)
 - (3) Single-Sideband (SSB)
 - ii) Radio Waves
 - (1) Polarization
 - (2) Wavelength
 - (3) Frequency Allocation
 - (4) Radio Wave Propagation
 - iii) Antenna
 - (1) Transmission Lines
 - (2) Communication Radio Antenna
- b) Aircraft Communication Addressing and Reporting System (ACARS)
- c) Selective Calling (SELCAL)
- d) Audio Integrating System (AIS)
 - i) Flight Interphone
 - ii) Cabin Interphone
 - iii) Service Interphone
 - iv) Passenger Entertainment
 - v) Ground Crew Call
 - vi) Cockpit Voice Recorder
- e) Emergency Locator Transmitter (ELT)

2) Electronic Navigation Systems

- a) Automatic Direction Finder (ADF)
- b) Very High Frequency Omnidirectional Range Navigation System (VOR)
 - i) Radio Magnetic Indicator
- c) Instrument Landing System (ILS)
 - i) Compass Locators
 - ii) Localizer
 - iii) Marker Beacons
 - iv) Glide Slope
- d) Radar Beacon Transponder
 - i) Transponder Checks
- e) Distance Measuring Equipment (DME)
- f) Area Navigation (RNAV)
- g) Long Range Navigation (LORAN)
- h) Global Positioning System
 - i) Moving-Map Display
- i) Inertial Navigation System
- j) Microwave Landing System (MLS)
- k) Radar and Radio Altimeters
- l) Ground Proximity Warning System (GPWS)
- m) Traffic Alert Collision Avoidance System (TCAS)
- n) Radar
 - i) Doppler Navigation Radar
 - ii) Weather Radar
- o) Stormscope Weather Mapping System

3) Electronic Instrument Systems

- a) Microcomputers
- b) Digital Indicating and Control Systems
 - i) Electronic Flight Instrument Systems (EFIS)
 - ii) Engine Indicating and Crew Alerting System (EICAS)
 - iii) Electronic Centralized Aircraft Monitor System (ECAM)

- c) Air Data Computer
- d) Flight Management Computer System (FMCS)
- 4) Electronic Systems Installation and Maintenance**
 - a) Approval for the Installation of Electronic Equipment
 - b) Electrical Considerations
 - i) Load Limits
 - ii) Circuit Protection
 - iii) Wiring
 - (1) Bundling and Routing
 - (2) Transmission Lines
 - c) Protection from Electrostatic Discharge Damage
 - d) Weight and Balance
 - e) Cooling
 - f) Shock Mounting
 - g) Static Protection
 - h) Antenna Installation
 - i) Types of Antenna
 - (1) VHF Communication
 - (2) HF Communication
 - (3) VOR/LOC
 - (4) Glide Slope
 - (5) Marker Beacons
 - (6) ADF
 - (7) DME
 - (8) ATC Transponder
 - (9) Radio Altimeter
 - (10) ELT
 - ii) Antenna Structural Attachment

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AIRCRAFT FUEL SYSTEMS

COURSE DESCRIPTION: Airframe fuel systems including tanks, lines, pumps, valves, selectors, and quantity indicating systems.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft fuel systems and associated tanks, lines, pumps, valves, selectors, and quantity indicating systems.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Fuel Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Fuel system trainer
- Fuel bladders
- Metal fuel tanks
- Various aircraft
- Basic hand tools
- Various components

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-41: Level 1 - Check and service fuel dump systems

- Perform an operational check on a fuel dump system

A-42: Level 1 - Perform fuel management transfer and defueling

- Drain all of the sumps of an aircraft fuel system and check for the presence of water

A-43: Level 1 - Inspect, check, and repair pressure fueling systems

- Demonstrate the correct way to adjust the fuel pressure that is produced by an engine-driven fuel pump

A-44: Level 2 - Repair aircraft fuel system components

- Explain the correct way of repairing a leak in an integral fuel tank
- Explain the correct way to check a bladder-type fuel cell for leakage and the correct way to repair this leakage

A-45: Level 2 - Inspect and repair fluid quantity indicating systems

- Demonstrate the correct way to use a fuel drip gage to measure fuel quantity
- Locate and identify the fuel tank probes, the amplifier, and the indicator of an electronic fuel quantity system, explain proper calibration procedures for such a system

A-46: Level 2 - Troubleshoot, service, and repair fluid pressure and temperature warning systems

- Install a fuel pump and perform an operational check
- Perform an operational check of an aircraft temperature warning system

A-47: Level 3 - Inspect, check, service, troubleshoot, and repair aircraft fuel systems

- Properly identify the fuel in the tank of a reciprocating-engine-powered aircraft by its color
- Locate in the proper documentation the correct grade of fuel to be used in an aircraft specified by the instructor
- Explain the correct procedure to follow if a reciprocating engine-powered aircraft has been fueled with turbine fuel, and the engine has been run
- Remove and clean the fuel strainers in an aircraft fuel system, reinstall the strainers, and check them for leakage
- Inspect the fuel selector valves of an aircraft and determine whether or not there is positive indication of the valve being fully on and fully off

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Aviation Fuels**
 - a) Reciprocating Engines
 - i) Aviation Gasoline Grades
 - ii) Aviation Gasoline Characteristics
 - (1) Purity
 - (2) Volatility
 - (3) Antidetonation Qualities
 - iii) Fuel Additives
 - b) Turbine-Engine Fuel
 - i) Turbine Fuel Volatility
 - ii) Turbine Fuel Viscosity
 - iii) Microbial Growth in Turbine Fuel Tanks
 - iv) Fuel Anti-icing
- 2) **Fuel System Requirements**
- 3) **Aircraft Fuel Systems**
 - a) Gravity Feed Fuel System for a Float Carburetor
 - b) Gravity Feed System for a Fuel-Injected Engine
 - c) Low-Wing, Single-Engine Fuel System for a Float Carburetor
 - d) Low-Wing, Twin-Engine Fuel System for Fuel Injected Engines
 - e) Twin-Engine Cross-Feed Fuel System
 - f) Four-Engine Manifold Cross-Feed Fuel System
 - g) Helicopter Fuel System
 - h) Large Turbine-Engine Transport Fuel System
 - i) Fueling and Defueling
 - j) Fuel Dumping
 - k) Instruments and Controls
 - i) Refueling Panel
 - ii) Flight Engineer's Panel
- 4) **Fuel Tanks**
 - a) Built-Up Fuel Tanks
 - b) Integral Fuel Tanks
 - c) Bladder-Type Fuel Tanks
 - d) Fuel Tank Filler Caps
- 5) **Fuel Pumps**
 - a) Electric Auxiliary Pumps
 - b) Plunger-Type Pumps
 - c) Centrifugal Boost Pump
 - d) Ejector Pump Systems
 - e) Engine Driven Fuel Pumps
 - i) Diaphragm-Type Fuel Pump
 - ii) Vane-Type Fuel Pump

- f) Turbine-Engine Fuel Pump
- 6) **Fuel Filters & Strainers**
 - a) Types of Contaminants
 - b) Required Fuel Strainers
- 7) **Fuel Valves**
 - a) Plug-Type Valves
 - b) Poppet-Type Selector Valve
 - c) Electric Motor-Operated Sliding Gate Valve
 - d) Solenoid-Operated Poppet-Type Fuel Shutoff Valve
- 8) **Fuel Heaters**
- 9) **Fuel System Instruments**
 - a) Fuel Quantity Measuring Systems
 - i) Direct-Read Fuel Gages
 - ii) Electrical Resistance-Type Fuel Quantity Indicating System
 - iii) Capacitance-Type Electronic Fuel Quantity Measuring System
 - iv) Drip Gage & Sight Gage
 - b) Flowmeters
 - i) Flowmeters for Large Reciprocating Engines
 - ii) Flowmeters for Fuel-Injected Horizontally Opposed Reciprocating Engines
 - iii) Flowmeters for Turbine Engines
 - c) Computerized Fuel Systems
 - d) Fuel Pressure Warning System
 - e) Fuel Temperature Indicators
- 10) **Fuel System Plumbing**
 - a) Fuel Line Routing
 - b) Fuel Line Alignment
 - c) Bonding
 - d) Support of Fuel System Components
- 11) **Fuel Jettison System**
- 12) **Fueling and Defueling**
- 13) **Fuel System Contamination Control**
 - a) Protection Against Contamination
 - b) Importance of Proper Grade of Fuel
- 14) **Fuel System Troubleshooting**

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AIRCRAFT ELECTRICAL SYSTEMS

COURSE DESCRIPTION: Theory and applications of generators, alternators, motors, wiring and electrical troubleshooting.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft electrical systems and troubleshooting techniques. Emphasis will be placed on aircraft electrical systems and major components, and the proper use of test equipment such as the multimeter.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Aircraft Electrical Systems	150	45	105

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Electrical trainer and training boards
- Multimeters
- Ohmmeters
- Voltmeters
- Various wire sizes
- Capacitors
- Resistors
- Soldering guns
- Wire strippers
- Wire cutters
- Crimpers

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Electrical Wiring 101
- On Wire Splicing

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-48: Level 2 - Repair and inspect aircraft electrical system components, crimp and splice wiring to manufactures' specifications, and repair pins and sockets of aircraft connectors

- Splice an electrical wire using the correct type of splice and the correct insulation
- Install a solderless terminal on a piece of electrical wire
- Correctly attach wires to the terminals of a quick-disconnect connector
- Given the specifications of a shock-mounted electrical component, describe the correct choice of bonding strap

A-49: Level 3 - Install, check, and service airframe electrical wiring, controls, switches, indicators, and protective devices

- Using a wiring diagram of an aircraft electrical system, identify the switches, circuit breakers, wire splices, lamps, and motors
- Given the current requirements and the length of the wire, select the smallest size wire that will carry the current without overheating or producing more than the allowable voltage drop
- Using an ohmmeter, determine whether or not the filament in a light bulb is good
- Inspect the ground cable of the battery installed in an aircraft for condition, tightness of connections, and for evidence of corrosion
- Explain the correct way to adjust the voltage controlled by a vibrator-type voltage regulator
- Secure an electrical wire bundle to an aircraft structure using the proper clamps and grommets
- Inspect and check a landing light
- Using the illustrated parts list for a particular aircraft, inspect an anticollision light installation to see whether or not it conforms with the aircraft manufacturer's installation drawings
- Demonstrate the correct way to tie an electrical wire bundle with spot ties

A-50(a): Level 3 - Inspect, check, troubleshoot, service, and repair alternating and direct current electrical systems

- Check the diodes in a DC alternator for opens or shorts
- Using a voltmeter and an ohmmeter, demonstrate the correct way to troubleshoot an aircraft electrical circuit
- Using a growler and continuity light, check the armature of an aircraft generator for shorted or open coils
- Using the correct test instruments, measure the current that flows through an electrical load specified by the instructor

A-50(b): Level 1 - Inspect, check, and troubleshoot constant speed and integrated speed generators

- Given the specifications of an aircraft generator, find its rated current output
- Using a voltmeter, measure the output voltage of an aircraft generator
- Explain the correct way to flash the field of an aircraft generator

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) An Introduction to Aircraft Electrical Systems

- a) Electrical System Requirements
- b) Review Terms
- c) Direction of Current Flow
- d) Electrical System Components
 - i) DC Power Source
 - ii) Electrical Load
 - iii) Basic Electrical Circuit
 - iv) Circuit Control Devices
 - (1) Switches
 - (2) Semiconductor Diodes
 - (3) Zener Diodes
 - (4) Relays and Solenoids
 - (5) Bipolar Transistors
 - (6) Silicon Controlled Rectifier
- e) Circuit Arrangement
 - i) Series Circuits
 - ii) Parallel Circuits
 - iii) Complex Circuits

2) Aircraft Electrical Power Circuits

- a) Battery Circuits
 - i) Circuit Protection Devices
 - ii) Induced Current Protection
- b) Ground-Power Circuit
- c) Power Generating Systems
 - i) The DC Alternator Circuit
 - (1) Twin-Engine Alternator System Using a Shared Voltage Regulator
 - (2) Twin-Engine Alternator System Using Individual Voltage Regulators
 - ii) The DC Generator Circuit
 - (1) Simple Light-Aircraft Generator System
 - (2) Twin-Engine Generator System Using Vibrator-Type Voltage Regulators
 - (3) Twin-Engine Generator System Using Carbon-Pile Voltage Regulators
 - iii) Turbine-Engine Starter-Generator System
- d) Voltage and Current Indicating Circuits

3) Aircraft Electrical Load Circuits

- a) The Starter Circuit
- b) Navigation Light Circuit
- c) Landing and Taxi Light Circuit
- d) Landing Gear Actuation and Indicating Circuit
- e) Antiskid Brake System
- f) Electrical Propeller Deicing System
- g) Turbine-Engine Autoignition Circuit
- h) Reciprocating-Engine Starting and Ignition Circuit
- i) Split-Bus Circuits for Avionics Protection

4) Electrical Power Systems for Large Aircraft

5) Aircraft Electrical System Installation

- a) Electrical Wire
 - i) Selection of Wire Size
 - ii) Special Types of Wire
- b) Terminal and Connector Installation
 - i) Quick-Disconnect Connectors
 - ii) Terminal Strips
 - iii) Wire Terminals
 - iv) Wire Splices

- c) Wire Identification
- d) Wire Bundling
- e) Junction Boxes
- f) Wiring Installation
 - i) Circuit Control and Protection Devices
 - (1) Switches
 - (2) Fuses and Circuit Breakers

6) Electrical System Troubleshooting

- a) Rules for Systematic Troubleshooting
- b) An Example of Systematic Troubleshooting
- c) Troubleshooting Review
- d) Logic Flow Charts for Troubleshooting
- e) Troubleshooting Tools
 - i) Continuity Light
 - ii) Multimeters
 - iii) Digital Multimeter
 - iv) Clamp-On Ammeter
 - v) Oscilloscopes

7) Electrical Symbols

POSITION AND WARNING SYSTEMS

COURSE DESCRIPTION: Basics of aircraft positioning and warning systems, including instruments, operation, installation, and troubleshooting.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft instruments, pitot static systems, avionics systems, and electronics troubleshooting.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Position and Warning Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Basic hand tools
- Antiskid trainer
- Landing gear trainer
- Various measuring devices
- Aircraft jacks
- Aircraft

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-51: Level 2 - Inspect, check, and service speed and configuration warning systems, electrical brake controls, and anti-skid systems

- Locate and identify the wheel speed sensors, the antiskid valves, and the antiskid control box in an aircraft equipped with an antiskid brake system
- Explain the correct way to check the wheel speed sensors of an antiskid brake system for operation
- Explain the correct way to check for a malfunction in a cabin door warning light circuit
- Using the correct circuit diagram, indicate the items to check if a takeoff warning system failed to warn the pilot that the flaps were not in a takeoff position

A-52: Level 3 - Inspect, check, troubleshoot, and service landing gear position indicating and warning systems

- Locate and identify the down-limit switches, the up-limit switches, and the landing gear safety switch on an aircraft with retractable landing gear
- Using a wiring diagram of a landing gear warning system of an aircraft, explain the malfunctions that could cause the warning horn to fail to sound when the throttles are retarded and the landing gear is not down and locked

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Antiskid System**
 - a) Antiskid System Components
 - i) Wheel Speed Sensors
 - ii) Antiskid Control Valves
 - iii) Antiskid Control Box
 - b) System Tests
 - i) Preflight Test
 - ii) Pre-landing Test
 - iii) Disabling the System
 - iv) Maintenance Checks
 - c) Wheel Speed Sensors
 - d) Control Box
 - e) Antiskid Control Valve
- 2) Antiskid Brake System**
- 3) Synchro systems Mechanical Movement Measuring Instruments**
 - a) Position indicating Lights
 - b) Synchro Systems
 - i) DC Selsyn system
 - ii) AC Magnesyn system
 - iii) AC Autosyn system
- 4) Aural Warning Systems**
- 5) Landing Gear Actuation and Indicating Circuit**

ICE AND RAIN CONTROL SYSTEMS

COURSE DESCRIPTION: Aircraft warning systems, ice and rain control systems, and detection systems.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft warning, ice and rain, and troubleshooting techniques.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Ice and Rain Control Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various aircraft
- Ice and rain trainer
- Propeller deicing boots

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-53: Level 2 - Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems

- Demonstrate the correct way to inspect and clean rubber deicing boots
- Actuate a pitot heater and check it for proper operations
- Explain the way that electrical propeller deicers operate
- Locate and identify the components in a pneumatic deicer system
- Locate and identify the components in an electrically heated windshield system
- Examine the blades of a windshield wiper system and check them for the correct tension and for the correct parking position
- Locate and identify the containers of chemical rain repellent

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Ice Control Systems

- a) Dangers of In-Flight Icing
- b) Type of Ice Control Systems
 - i) Ice Detection Systems
 - ii) Anti-Icing Systems
 - iii) Deicing Systems
- c) Pitot-Static System Ice Protection
- d) Windshield Ice Protection
- e) Airfoil Ice Protection
 - i) Pneumatic Deicer System
 - (1) Single-Engine Airplane Deicing System
 - (2) Multi-Engine Airplane Deicing System
 - ii) Thermal Ice Control Systems
- f) Brake Deice System
- g) Powerplant Ice Protection
 - (1) Reciprocating Engines
 - (2) Turbine Engines
 - (3) Propellers
- h) Water Drain System Ice Protection
- i) Ground Deicing and Anti-Icing

2) Rain Removal Systems

FIRE PROTECTION SYSTEMS

COURSE DESCRIPTION: Aircraft fire warning systems, and fire extinguishing systems.

COURSE OBJECTIVES: Students will develop a working knowledge of aircraft fire warning, and fire extinguishing systems, and troubleshooting techniques.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Fire Protection Systems	30	12	18

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the classroom with projects completed in the shops and on the aircraft as appropriate.

Specific Training Aids/Equipment/Mock-Ups:

- Various aircraft
- Fire system trainer
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

A-54: Level 1 - Inspect, check, and service smoke and carbon monoxide detection systems

- Check a smoke detector for proper operation
- Examine a carbon monoxide detector and explain the way that it would change if it were exposed to an excess of CO

A-55: Level 3 - Inspect, check, service, troubleshoot, and repair aircraft fire detection and extinguishing systems

- Inspect a hand-held CO₂ fire extinguisher and determine if it contains a full charge
- Explain the correct way to check a continuous loop fire detector system for its condition
- Locate and identify the components in a thermo-couple-type fire detection system
- Check a fire detection system specified by the instructor for its condition
- Inspect an HRD fire extinguishing system for security of its components and for the state of charge of its bottles
- Explain the way the electrical circuit for an HRD fire extinguishing system should be checked
- Locate and identify the blow-out plugs that indicate the status of the fire extinguisher system in an aircraft
- Demonstrate the correct way to use a CO₂ fire extinguisher to extinguish a fire in fuel that has spilled on the ground
- Demonstrate the correct way to use a CO₂ fire extinguisher to extinguish an induction system fire in a reciprocating-engine-powered airplane

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Fire Protection**
- 2) Requirements For Fire**
- 3) Fire Detection Systems**
 - a) Fire Detectors and Overheat Detection Systems
 - b) Thermoswitch-Type Fire Detection System
 - c) Rate-of-Temperature-Rise Detection System
 - d) Continuous-Loop Detector System
 - i) Thermistor-Type Continuous-Loop Systems
 - ii) Pneumatic-Type Continuous-Loop System
 - e) Smoke and Flame Detectors
 - i) Carbon Monoxide Detectors
 - ii) Photoelectric Smoke Detectors
 - iii) Ionization-Type Smoke Detectors
 - iv) Visual Smoke Detectors
- 4) Fire Extinguishing Systems**
 - a) Fire-Extinguishing Agents
 - i) Water
 - ii) Inert Cold Gas Agents
 - iii) Carbon Dioxide (CO₂)
 - iv) Liquid Nitrogen (N₂)
 - v) Halogenated Hydrocarbons
 - b) Hand-Held Fire Extinguishers
 - c) Installed Fire-Extinguishing Systems
 - i) Carbon Dioxide Extinguishers Systems
 - ii) High-Rate-Discharge (HRD) Extinguishing Systems
- 5) Complete Fire Protection System**
- 6) Maintenance and Servicing of Fire-Detector Systems**
- 7) Maintenance and Servicing of Fire-Extinguishing Systems**

POWERPLANT CURRICULUM SUBJECTS

POWERPLANT SECTION SUMMARY

Subject	Total	Theory	Lab
Reciprocating Engines	150	30	120
Turbine Engines	80	15	65
Auxiliary Power Units	10	5	5
Engine Inspection	60	20	40
Engine Electrical Systems	40	15	25
Engine Instrument Systems	35	10	25
Propellers	56	20	36
Unducted Fans	4	2	2
Ignition and Starting Systems	90	30	60
Engine Lubrication Systems	30	10	20
Engine Cooling Systems	30	10	20
Engine Fire Protection Systems	30	10	20
Fuel Metering Systems	30	10	20
Engine Fuel Systems	45	15	30
Induction and Engine Airflow Systems	30	10	20
Engine Exhaust and Reverser Systems	30	10	20
Total	750	222	528

FAR 147 References:

Reciprocating Engines – Appendix D, items 1-4
Turbine Engines - Appendix D, items 5-7, 40-41
Engine Inspection - Appendix D, item 8
Engine Instrument Systems - Appendix D, items 9-10
Engine Fire Protection Systems - Appendix D, item 11
Engine Electrical Systems - Appendix D, items 12-13
Engine Lubrication Systems – Appendix D, items 14-16
Ignition and Starting Systems - Appendix D, items 17-19
Fuel Metering Systems - Appendix D, items 20-23
Engine Fuel Systems - Appendix D, items 24-25
Induction and Engine Airflow Systems - Appendix D, items 26-28
Engine Cooling Systems - Appendix D, items 29-30
Engine Exhaust and Reverser Systems - Appendix D, items 31-32
Propellers - Appendix D, items 33-39
Unducted Fans – Appendix D, item 40
Auxilliary Power Units – Appendix D, item 41

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RECIPROCATING ENGINES

COURSE DESCRIPTION: Theory and operation of reciprocating (piston) engines.

COURSE OBJECTIVES: Students will be able to describe the operating principle of a gasoline-fueled aircraft reciprocating engine. They will be able to install an engine in an aircraft, properly rig, remove, replace, check, service, and overhaul reciprocating engines.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Reciprocating Engines	150	30	120

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the shop and on the aircraft.

Specific Training Aids/Equipment/Mock-Ups:

- Basic hand tools
- Radial engines
- Various opposed engines
- Engine test stands
- Various engine parts & pieces
- Various aircraft
- Various Test Equipment

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- The Cylinder Bore Gauge EA-CBG
- Aircraft Engine Overhaul
- Aircraft Ignition System x2
- Assembly and Use of the Time-Rite Indicator
- Continental Cylinder Replacement
- The Cylinder Bore Gauge
- Aircraft Reciprocating Engines
- Reciprocating Overhaul Videos (IO-360, O-360, O-320, & O-200)

REQUIRED PROJECTS: (**Bold items are required**) (Un-Bold items are recommended)

P-1: Level 1 - Inspect and repair a radial engine

- Perform a valve adjustment on a radial engine

P-2: Level 2 - Overhaul a reciprocating engine

- Perform a compression test and record findings
- Inspect valve springs for their specified compression strength
- Correctly remove a cylinder and its piston from a specified engine
- Grind a valve seat in an engine cylinder using the correct stones for grinding and for narrowing the seat
- Examine a rocker arm and/or crankshaft by the magnetic particle inspection method
- Examine a cast aluminum or magnesium engine component by the dye penetrant inspection method
- Perform a variety of overhaul techniques on specified reciprocating engines

P-3: Level 3 - Inspect, check, service, and repair reciprocating engines and engine installations

- Examine the rings installed on a piston for the correct tension, end gap, and side clearance
- Dimensionally inspect an aircraft engine cylinder for bore diameter, out-of-round, and taper
- Inspect the valves from an aircraft engine cylinder for stretch and for their fit in the valve guides
- Using the correct measuring instruments, measure the diameter of journals of a crankshaft and determine whether or not they are within the tolerances allowed by the engine manufacturer
- Examine the bearings in a crankshaft specified by the instructor and determine their physical condition and whether or not they are within dimensional tolerance
- Perform a crankshaft runout inspection on a specified engine
- Demonstrate the correct way to find the top dead center position of the piston in the cylinder

P-4: Level 3 - Install, troubleshoot, and remove a reciprocating engine

- Demonstrate the correct way to start an aircraft reciprocating engine
- Reface an aircraft valve to the recommended angle and check its fit and seal in the valve seat
- Demonstrate the correct way to adjust the oil pressure in an aircraft reciprocating engine
- Identify the sludge plugs in the crankshaft of an aircraft engine and explain their purpose
- Explain the things that should be checked about engine mounts
- Demonstrate the proper techniques and protocol involved with the removal of specified reciprocating engines

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Reciprocating Engine Theory

- a) Energy Transformation
 - (1) The Constant-Volume Cycle of Energy Release
 - (a) Four-Stroke, Five -Event Cycle
 - (b) Two-Stroke Cycle
- b) Work - Power Considerations
 - i) Work
 - ii) Power
 - iii) Horsepower of a Reciprocating Engine
 - (1) Indicated Horsepower
 - (2) Friction Horsepower
 - (3) Brake Horsepower
 - iv) Factors Affecting Engine Power
 - (1) Thermal Efficiency
 - (2) Volumetric Efficiency
 - (3) Mechanical Efficiency
 - (4) Piston Displacement
 - (5) Compression Ratio
 - (6) Ignition Timing
 - v) Power Variations with Altitude
 - vi) Engine Thrust
 - vii) Specific Fuel Consumption

2) Reciprocating Engine Requirements

- a) Reliability
- b) Durability
- c) Operating Flexibility
- d) Specific Weight
- e) Streamlineability

3) Reciprocating Engine Configurations

- a) Cylinder Arrangement
 - i) In-line Engines
 - ii) V Engines
 - iii) Radial Engines
 - iv) Horizontally Opposed Engines

- b) Cylinder Numbering
 - i) Radial Engines
 - ii) In-Line and V-Engines
 - iii) Horizontally Opposed Engines
- c) Firing Order
 - i) Radial Engines
 - ii) In-Line and V-Engines
 - iii) Horizontally Opposed Engines
- d) Cooling Systems
 - i) Liquid Cooling
 - ii) Air Cooling
- e) Lubrication Systems
- f) Engine Identification
- 4) Horizontally Opposed Engine Construction**
 - a) Cylinders
 - i) Cylinder Barrels
 - ii) Cylinder Heads
 - b) Valve Assemblies
 - i) Valves
 - ii) Valve Guides
 - iii) Valve Seats
 - iv) Valve Springs and Retainers
 - c) Pistons
 - i) Wrist Pins
 - ii) Piston Rings
 - (1) Compression Rings
 - (2) Oil Control Rings
 - (3) Oil Wiper or Scraper Rings
 - d) Connecting Rods
 - e) Crankshaft
 - i) Propeller Attachment
 - ii) Dynamic Dampers
 - f) Propeller Reduction Gearing
 - i) External Spur-Type Reduction Gearing
 - ii) Internal Spur-Type Reduction Gearing
 - iii) Planetary (Epicyclic) Reduction Gearing
 - (1) Bevel Planetary Gears
 - (2) Spur Planetary Gears
 - g) Crankcase
 - i) Bearings
 - ii) Crankcase Oil Seals
 - h) Valve Operating Mechanism
 - i) Camshaft
 - ii) Valve Lifters
 - (1) Hydraulic Valve Lifters
 - iii) Pushrods
 - iv) Rocker Arms
- 5) Radial Engine Construction**
 - a) Cylinders
 - b) Crankcase
 - c) Crankshaft
 - d) Connecting Rods
 - e) Propeller Reduction Gearing
 - f) Bearings

- g) Valve Operating Mechanisms
 - i) Hot Valve Clearance
 - ii) Cold Valve Clearance
 - iii) Valve Adjustment: Engines with Floating Cam Rings
- h) Supercharger
- 6) Engine Service Life**
- 7) Reciprocating Engine Operation**
 - a) Starting Reciprocating Engines
 - i) Starting Engines with Float Carburetors
 - ii) Starting Engines with the TCM Fuel Injection System
 - iii) Starting Engines with the RSA Fuel Injection System
 - b) Engine Ground Fires
 - c) Reciprocating Engine Ground Check
- 8) Reciprocating Engine Maintenance Inspections**
 - a) One-Hundred Hour and Annual Inspections
 - i) Preparation for Inspection
 - ii) The Actual Inspection
 - (1) Compression Check
 - (2) Lubrication System
 - (3) Ignition System
 - (4) Fuel System
 - (5) Induction System
 - (6) Exhaust System
 - (7) Turbocharger
 - (8) Cooling System
 - (9) Electrical System
 - (10) Instrument Systems
 - (11) General Condition
 - (12) Propeller
 - iii) Post-Inspection Run-Up and Records
 - b) Top Overhaul
 - c) Major Overhaul and Rebuilding
 - d) Major Overhaul Procedures
 - i) Disassembly
 - ii) Cleaning
 - iii) Inspection
 - (1) Visual Inspection
 - (2) Nondestructive Inspections
 - (a) Magnetic Particle Inspection
 - (i) Circular Magnetization
 - (ii) Longitudinal Magnetization
 - (iii) The Actual Inspection
 - (b) Fluorescent Penetrant Inspection
 - (3) Dimensional Inspection
 - (a) Cylinder and Head Assembly
 - (b) Valves and Valve Springs
 - (c) Piston Rings
 - (d) Crankshaft
 - (e) Connecting Rods
 - iv) Repair
 - (1) Crankcase
 - (2) Crankshaft
 - (3) Cylinders
 - (a) Valves, Guides, and Seats
 - (b) Valve Operating Mechanism

- v) Reassembly
 - (1) Crankshaft
 - (2) Crankcase
 - (3) Pistons and Rings
 - (4) Cylinders
- vi) Final Assembly
- vii) Testing

9) Powerplant Troubleshooting

- a) Rules for Systematic Troubleshooting
- b) An Example of Systematic Troubleshooting

10) Reciprocating Engine Removal and Installation

- a) Removal
- b) Installation

TURBINE ENGINES

COURSE DESCRIPTION: Theory and operation of turbine and turboprop engines.

COURSE OBJECTIVES: Students will service, troubleshoot, and overhaul turbine engines. Students will learn removal and installation of a turbine engine following manufacturers approved procedures.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Turbine Engines	80	15	65

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies. Training will be conducted primarily in the shop and on the aircraft.

Specific Training Aids/Equipment/Mock-Ups:

- PT6 test stand (assembly & disassembly)
- Various fan section blades
- Other various jet engines (disassembly, show, & reassemble)
- Thrust reverser/exhaust pipe assembly
- Basic hand tools
- Torque wrenches
- Auxiliary power unit

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- ABC's of Jet Engine

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-5: Level 2 - Overhaul a turbine engine

- Repair a turbine engine compressor blade by blending
- Demonstrate the correct way to replace turbine blades in a turbine wheel, including the correct way to lock blades in place
- Remove and install various turbine engine components

P-6: Level 3 - Inspect, check, service, and repair turbine engines and turbine engine installations

- Demonstrate the correct way to trim a turbine engine
- Explain the reason for having variable-angle inlet guide vanes on some axial-flow compressors
- Demonstrate the correct way to compute the torque that is produced by a torque wrench with an extension installed on it
- Check for proper torque on a series of bolts on the case of a turbine engine and correctly safety-wire them
- Check the blades in a stage of an axial-flow compressor specified by the instructor for indications of damage and for security in the wheel
- Identify the various stations of a turbine engine and tell what pressure and temperature exist at each station during engine operation
- Inspect the insulating blanket around a turbine engine for proper security and for indications of damage

P-7: Level 3 - Remove, install and troubleshoot turbine engines

- Demonstrate the correct way to start, run-up, and shut down an aircraft turbine engine
- Correctly remove and replace a burner can in a turbine engine specified by the instructor
- Correctly remove and replace a fuel nozzle in a turbine engine specified by the instructor
- Identify the point at which bleed air is taken from a turbine engine
- Perform various troubleshooting procedures on turbine engines and turbine engine components as specified by the instructor

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) Aircraft Turbine Engines**
 - a) Non-Air-Breathing (Rocket) Engines
 - b) Air-Breathing Reaction Engines
 - i) Pulse-Jet Engines
 - ii) Ramjet Engines
 - iii) Turbojet Engines
 - c) Gas Turbine Engines
 - i) Types of Gas Turbine Engines
 - (1) Turbojet
 - (2) Turboprop
 - (3) Turboshaft
 - (4) Turbonfan
- 2) Thrust**
 - a) The Production of Thrust
 - i) Mass
 - ii) Momentum Change
 - iii) Air Pressure at Nozzle
 - iv) Turbofan Engine Thrust
 - v) Distribution of Thrust
 - (1) Measurement of Thrust
 - (2) Factors Affecting Thrust
 - (a) Airspeed
 - (b) Mass Airflow
 - (c) Ram Effect
 - vi) Thrust Augmentation
 - (1) Water Injection
 - (2) Afterburners
 - vii) Thrust Horsepower
 - viii) Equivalent Shaft Horsepower
- 3) Turbine Engine Terms and Definitions**
 - a) Engine Station Designations
- 4) The Cold Section**
 - a) Air Inlet Ducts
 - i) Subsonic Inlet Ducts
 - (1) Blow-In Doors
 - (2) Foreign-Object Damage
 - ii) Supersonic Inlet Ducts
 - b) Compressors
 - i) Types of Compressors
 - (1) Centrifugal Compressors
 - (a) Principle of Operation
 - (2) Axial-Flow Compressors
 - (a) Principle of Operation
 - (b) Compression Ratio
 - (c) Surges and Stalls
 - (d) Angle of Attack
 - (e) Cascade Effect
 - (f) Types of Axial-Flow Compressors
 - (i) Single-Spool Axial-Flow Compressors
 - (ii) Dual-Spool Axial-Flow Compressors
 - ii) Turbofans
 - (1) Turbofan Engine Configurations
 - (2) Turbofan Engine Bypass Ratio
 - (3) Turbofan Pressure Ratio

- iii) Compressor Design Features
 - (1) Convergent Airflow Path
 - (2) Blade Attachment
 - (3) Blade Design
 - (4) Guide Vanes and Stator Vanes
 - (5) Hybrid Compressor Engine
 - c) Diffuser Section
- 5) The Hot Section**
 - a) Combustion Section
 - i) Multiple-Can Combustors
 - ii) Can-Annular Combustors
 - iii) Annular Combustors
 - iv) Reverse-Flow Annular Combustors
 - b) Turbine Section
 - i) Turbine Sections Elements
 - ii) Turbine Inlet Guide Vanes
 - iii) Turbine Design and Construction
 - iv) Turbine Blade Design
 - (1) Shrouded Turbine Blades
 - v) Blade-Tip Clearance Control
 - vi) Turbine Cooling
 - vii) Turbine Blade Construction
 - viii) Turbine Features
- 6) Accessory Section**
 - a) Accessory Drives
 - b) Propeller Reduction Gear Systems
- 7) Turbine Engine Operation**
 - a) Starting Gas Turbine Engines
 - i) Improper Starts
 - (1) No Oil Pressure
 - (2) Hot Start
 - (3) Hung Start
- 8) Turbine Engine Maintenance**
 - a) On-Condition Maintenance
 - b) Trend Monitoring
 - c) Types of Maintenance
- 9) Turbine Engine Inspections and Repair**
 - a) Borescope, Fiberscope, Electronic Imaging
 - b) Routine Inspections
 - i) Preflight Inspection
 - ii) Cold Section Inspection
 - (1) Compressor Cleaning
 - (2) Compressor Repair
 - iii) Hot Section Inspection
 - c) Nonroutine Inspections
 - i) Foreign Object Damage (FOD)
 - ii) Overtemperature or Overspeed Operation
 - d) Repair Considerations
 - i) Torque Wrenches
 - ii) Safety Wiring
- 10) Turbine Engine Troubleshooting**

ENGINE INSPECTION

COURSE DESCRIPTION: Airworthiness inspections of powerplants.

COURSE OBJECTIVES: Students will perform powerplant airworthiness inspections.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Inspection	60	20	40

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Borescope
- Various engines
- Various aircraft
- Basic hand tools
- Inspection mirrors
- Cylinder compression testing device

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Care and Handling of Borescope Equipment
- Differential Compression

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-8: Level 3 - Perform powerplant conformity and airworthiness inspections

- Perform a compression check on a specified reciprocating engine
- Using the correct reference material, perform a hot-start inspection on a specified turbine engine
- Using the correct reference material, perform an overspeed inspection on a specified turbine engine
- Using the correct reference information, list all of the Airworthiness Directives that are applicable to a particular aircraft powerplant
- Check the applicable publications and determine whether or not the engine and propeller installed on a particular aircraft are certificated for it
- Given a specified data plate on a turbine engine, explain the meaning of the various limitations that are listed on it
- Demonstrate the correct way to connect a Jetcal analyzer to a turbine engine to measure the exhaust gas temperature and the engine RPM
- Perform a borescope inspection of the cylinders of a specified reciprocating engine
- Perform a borescope inspection of the internal portion of a specified turbine engine
- Perform a 100-hour inspection of an aircraft engine specified by the instructor and list all discrepancies that would cause the engine to be unairworthy
- Perform a 100-hour inspection of an aircraft engine specified by the instructor and list all discrepancies that would cause the engine to be unairworthy

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Reciprocating Engine Maintenance Inspections

- a) One-Hundred-Hour and Annual Inspections
 - i) Preparation for Inspection
 - ii) The Actual Inspection
 - (1) Compression Check
 - (2) Lubrication System
 - (3) Ignition System
 - (4) Fuel System
 - (5) Induction System
 - (6) Exhaust System
 - (7) Turbocharger
 - (8) Cooling System
 - (9) Electrical System
 - (10) Instrument Systems
 - (11) General Condition
 - (12) Propeller
 - iii) Post-Inspection Run-Up and Records

2) Turbine Engine Inspections and Repair

- a) Borescope, Fiberscope, Electronic Imaging
- b) Routine Inspections
 - i) Preflight Inspections
 - ii) Cold Section Inspection
 - (1) Compressor Cleaning
 - (2) Compressor Repair
 - iii) Hot Section Inspection
- c) Nonroutine Inspections
 - i) Foreign Object Damage (FOD)
 - ii) Overtemperature or Overspeed Operation
- d) Repair Considerations
 - i) Torque Wrenches
 - ii) Safety Wiring

ENGINE INSTRUMENT SYSTEMS

COURSE DESCRIPTION: Removal, installation, and inspection of reciprocating and turbine engine instruments.

COURSE OBJECTIVES: Students will learn inspection, check & service, troubleshooting, removal; installation of reciprocating and turbine engine instruments, following manufacturers approved procedures.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Instrument Systems	35	10	25

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various instruments
- Various aircraft
- Various engine test stands
- Basic hand tools
- Soldering iron

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-9: Level 2 - Troubleshoot, service, and repair electrical and mechanical fluid rate-of-flow indicating systems

- Locate and inspect the fuel flow components of a specified aircraft engine
- Remove, inspect, and reinstall a fuel flow transmitter

P-10: Level 3 - Inspect, check, service, troubleshoot, and repair electrical and mechanical engine temperature, pressure, and RPM indicating systems

- Explain how an EGT indicator can assist the pilot in getting the proper fuel-air mixture ratio for engine operation
- Demonstrate the correct way to use a Jetcal analyzer to check the thermocouple system used to measure the exhaust gas temperature on a turbine engine
- Check the exhaust gas temperature system installed on a reciprocating engine for the condition of the probes and for security of mounting of the thermocouples
- Check a thermocouple-type cylinder head temperature indicator system for the condition of the pickup at the cylinder head, the condition of the lead resistor, and for the correct reading of the indicator when the engine is cold
- Check a manifold pressure gage for the correct reading of the instrument when the engine is not running
- Explain the correct meaning of each of the colored limitation markings on an aircraft engine instrument
- Check the markings on engine instruments to determine whether or not these markings agree with the engine limitations specified in the appropriate Type Certificate Data Sheets
- Inspect the shock mounts that support the instrument panel in an aircraft for their condition
- Check the tachometer cable used on a light aircraft reciprocating engine for security of mounting and for evidence of kinking

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147

COURSE OUTLINE

- 1) **The Evolution of Powerplant Instruments**
- 2) **Types of Powerplant Instruments**
 - a) Pressure Measurement
 - b) Types of Pressure
 - i) Absolute Pressure
 - ii) Gage Pressure
 - iii) Differential Pressure
 - iv) Total Pressure
 - v) Dynamic Pressure
 - vi) Static Pressure
 - c) Pressure-Measuring Instruments
 - i) Engine Lubricating Oil Pressure
 - ii) Pressure Gage—Measuring Oil Temperature
 - iii) Fuel Pressure
 - iv) Fuel Pressure Warning System
 - v) Pressure Gage—Measuring Fuel Flow
 - vi) MAP (Manifold Absolute Pressure)
 - vii) EPR (Engine Pressure Ratio)
 - d) Temperature Measurement
 - i) Ratiometer Instruments
 - ii) Thermocouple Instruments
 - (1) CHT (Reciprocating Engine Cylinder Head Temperature)
 - (2) EGT (Reciprocating Engine Exhaust Gas Temperature)
 - (3) EGT (Turbine Engine Exhaust Gas Temperature)
 - e) Mechanical Movement
 - i) Tachometers
 - (1) Mechanical Tachometers
 - (2) Electric Tachometers
 - ii) Synchrosopes
 - iii) Fuel Flowmeters for Large Reciprocating Engines
 - iv) Flowmeters for Turbine Engines
 - v) Torquemeters
- 3) **Powerplant Instrument Marking, Installation, and Maintenance**
 - a) Instrument Range Marking
 - b) Instrument Installation
 - c) Instrument Handling
- 4) **Electronic Instrumentation**
 - a) Digital indicating and Control Systems
 - i) Microcomputers
 - b) Computerized Fuel System
 - c) EICAS (Engine Indication and Crew Alerting System)

ENGINE FIRE PROTECTION SYSTEMS

COURSE DESCRIPTION: Fire protection systems and components, including inspection, repair, and service.

COURSE OBJECTIVES: Students will acquire a working knowledge of fire protection systems, as applied to large, intermediate, and small aircraft.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Fire Protection Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various aircraft
- Basic hand tools
- Fire systems trainer

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-11 Level 3 - Inspect, check, service, troubleshoot, and repair engine fire detection and extinguishing systems

- Locate and identify the fire protection components in a specified aircraft
- Examine the HRD bottles installed in an aircraft and determine whether or not they have sufficient charge in them
- Examine a portable fire extinguisher to determine whether or not it contains a full charge and when it was last serviced
- Locate and identify the blow-out plugs on the side of an engine nacelle and explain the meaning of each
- Check a specified fire detection system, explaining what is taking place at each stage
- Repair an engine fire detector heat sensing loop malfunction

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147

COURSE OUTLINE

- 1) Fire Protection Systems**
 - a) Types of fires
 - b) Fire Zones
- 2) Fire Detection and Warning Systems**
 - a) Thermoswitch-Type Fire Detection System
 - b) Rate-of-Temperature-Rise Detection System
 - c) Continuous-Loop Fire and Overheat Detection Systems
 - i) Thermistor-Type Continuous-Loop Systems
 - ii) Pneumatic-Type Continuous-Loop Systems
- 3) Fire-Extinguishing Systems**
 - a) Fire-Extinguishing Agents
 - i) Carbon Dioxide (CO₂)
 - ii) Liquid Nitrogen (N₂)
 - iii) Halogenated Hydrocarbons
 - b) Powerplant Fire-Extinguishing Systems
 - i) Carbon Dioxide Extinguishing Systems
 - ii) HRD (High-Rate-Discharge) Extinguishing Systems
- 4) Complete Fire Protection System**
- 5) Maintenance and Service of Fire-Detection Systems**
- 6) Maintenance and Service of Fire-Extinguishing Systems**

ENGINE ELECTRICAL SYSTEMS

COURSE DESCRIPTION: Study of reciprocating engine and turbine engine electrical systems. Students will also check armatures using a growler, generators, alternators, and engine wiring.

COURSE OBJECTIVES: Students will acquire a working knowledge of powerplant electrical systems.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Electrical Systems	40	15	25

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various engines
- Various aircraft
- Basic hand tools
- Electrical testing devices
- Wire strippers
- Wire cutters
- Crimpers
- Electrical trainer

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-12 Level 2 - Repair engine electrical system components

- Use the illustrated parts catalog for a specified aircraft to find the part numbers of a series of components specified by the instructor
- Select the correct solderless terminal for an electrical wire and install it using the proper tool
- Install wires in a quick-disconnect connector using the proper insulation and secure the wires with the proper clamp
- Using the wiring diagram of an aircraft generator system, explain the probable causes of the generator failing to keep the aircraft battery charged

P-13 Level 3 - Install, check, and service engine electrical wiring, controls, switches, indicators, and protective devices

- Disassemble, clean, and check an aircraft generator according to the service instructions furnished by generator manufacturer
- Check the armature of a DC generator on a growler, turn the commutator, and undercut the mica according to the manufacturer's instructions
- Install and properly seal the brushes in a DC generator, checking the brush tension to determine whether or not it is within the tolerance allowed by the generator manufacturer
- Demonstrate the correct way to flash the field of a DC generator
- Check the diodes in a DC alternator for shorts or opens
- Using a multimeter, check the continuity in a specified electrical circuit
- Using the wire chart in AC 43.13-1B, find the wire size needed to carry a specified amount of current for a specified distance without exceeding the allowable current-carrying limits or the allowable voltage drop
- Replace and check a current limiter

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Generation of Current Electricity**
- 2) **Electricity Produced by Magnetism**
 - a) AC Generator Principles
 - b) DC Generators and Alternators
 - i) Field Magnets
 - ii) Armature
 - (1) Armature Reaction
 - (2) Compensating Windings and Interpoles
 - iii) DC Generator Controls
 - (1) Current Limiter
 - (2) Reverse-Current Cutout and Switch
 - (3) Voltage Regulator
 - iv) DC Generator systems – Small Aircraft
 - v) DC Alternators
 - (1) DC Alternator Controls
 - vi) Starter Generators
- 3) **AC Power – Large Aircraft**
 - a) AC Generators
 - b) AC Generator Controls
- 4) **Invertors**
- 5) **Aircraft Electrical System Installation**
 - a) Electrical Wire
 - i) Selection of Wire Size
 - ii) Special Types of Wire
 - b) Terminal and Connector Installation
 - i) Quick-Disconnect Connectors
 - ii) Terminal Strips
 - iii) Wire Terminals
 - iv) Wire Splices
 - c) Wire Identification
 - d) Wire Bundling
 - e) Junction Boxes
 - f) Wiring Installation
 - i) Circuit Control and Protection Devices
 - (1) Switches
 - (2) Fuses and Circuit Breakers

LUBRICATION SYSTEMS

COURSE DESCRIPTION: Lubrication and cooling systems. Students learn to identify and select aircraft lubricants. Projects include adjustment of oil pressure and inspection of oil pumps.

COURSE OBJECTIVES: Students will acquire a working knowledge of engine lubrication systems; including lubricant requirements, system components; inspection, servicing, and maintenance.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Lubrication Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Constant speed drive unit
- Oil/fuel heat exchange unit
- Various lubricating agents
- Basic hand tools
- Various oil filters
- Hydraulic fuses

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-14 Level 2 - Identify and select lubricants

- Using a list of oils that are approved for an aircraft engine, choose the correct oil for the existing climatic conditions and justify the choice

P-15 Level 2 - Repair engine lubricating system components

- Using a diagram of a turbine engine lubrication system, identify the filters, spray nozzles, pumps, relief valves, check valves, and bypass valves
- Remove an oil strainer from an engine, clean and inspect it, and reinstall it in the engine
- Demonstrate the proper way to change the oil filter on an aircraft engine, explaining the precautions that must be taken to keep from damaging the engine when installing the new filter
- Demonstrate the correct way to inspect an oil filter that has been removed from an aircraft engine

P-16 Level 3 - Inspect, check, service, troubleshoot, and repair engine lubrication systems

- Demonstrate the correct way to adjust the oil pressure on a specified engine
- Demonstrate the correct way to preoil a specified engine
- Using the Type Certificate Data Sheets for a specified aircraft, find the oil quantity specified and the amount of undrainable oil that is trapped in the system
- Demonstrate the correct way to inspect an engine for the source of an oil leak
- Demonstrate the correct way to dilute the oil in an aircraft reciprocating engine prior to shutting down the engine
- Explain the way that a Cuno filter operates

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Functions of the Lubrication System**
 - a) Reduces Friction
 - b) Seals and Cushion
 - c) Removes Heat
 - d) Cleans Inside of Engine
 - e) Protects Against Corrosion
 - f) Performs Hydraulic Action
- 2) **Reciprocating Engine Lubricating Oils**
 - a) Characteristics of Reciprocating Engine Lubricating Oil
 - i) Viscosity
 - ii) Viscosity index
 - iii) Gravity
 - iv) Ignition Points
 - v) Low-Temperature Points
 - vi) Color
 - vii) Residue
 - b) Types of Reciprocating Engine Lubricating Oil
 - i) Straight Mineral Oil
 - ii) Metallic-Ash Detergent Oil
 - iii) Ashless-Dispersant Oil
 - iv) Multiviscosity Oil
 - v) Synthetic Oil
 - vi) Semisynthetic Oil
 - vii) Extreme Pressure (EP) Lubricants
 - c) Compatibility of Lubricating Oils
- 3) **Reciprocating Engine Lubrication Systems**
 - a) Types of Lubrication Systems
 - b) Oil Supply Storage
 - i) Wet-Sump
 - ii) Dry-Sump
 - c) Internal Lubrication
- 4) **Lubrication System Components**
 - a) Pumps
 - i) Spur-Gear Pump
 - ii) Gerotor Pump
 - b) Pressure Relief Valve
 - c) Oil Filter Systems
 - d) Oil Filter Elements
 - e) Oil coolers
 - f) Oil Reservoirs
 - i) Wet-Sump
 - ii) Dry-Sump
 - g) Lubrication System Instrumentation
 - i) Oil Pressure Measurement
 - ii) Oil Temperature Measurement
- 5) **Spectrometric Oil Analysis**
- 6) **Requirements for Turbine Engine Lubricants**
 - a) Synthetic Lubricating Oil
- 7) **Turbine Engine Lubricating Systems**
 - a) Wet-Sump Lubrication System
 - b) Dry-Sump Lubrication System
 - i) Hot-Tank Lubrication System
 - ii) Cold-Tank Lubrication System

- c) Lubrication System Subsystems
 - i) Pressure Subsystem
 - ii) Scavenge Subsystem
 - iii) Vent Subsystem
- d) Bearings and Seals
 - i) Bearings
 - ii) Seals
 - (1) Carbon Seals
 - (2) Labyrinth Seals
 - iii) Bearing Lubrication
- e) Lubrication System Components
 - i) Oil Tanks
 - ii) Oil Pumps
 - iii) Oil-Pressure Relief Valves
 - iv) Oil Filters
 - (1) Last-Chance Filters
 - v) Oil Coolers
 - vi) Air-Oil Separator
 - vii) Breathers and Pressurizing Components
 - viii) Chip Detector
- f) Lubrication System Instrumentation
 - i) Oil Pressure
 - (1) Low-Pressure Warning Light
 - ii) Oil Temperature
 - iii) Oil Quantity
 - iv) Filter Bypass Warning Light
- g) Lubrication System Servicing
- h) Oil Analysis

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IGNITION AND STARTING SYSTEMS

COURSE DESCRIPTION: Study of reciprocating engine and turbine engine ignition systems, igniters, spark plugs, magnetos, wiring harnesses, booster coils, and vibrator coils. Students disassemble and assemble magnetos, rebuild harnesses and time magnetos to engines. Students will also check armatures using a growler, generators, alternators, and engine wiring.

COURSE OBJECTIVES: Students will acquire a working knowledge of ignition and powerplant electrical systems. Principles learned in previous electrical courses will be applied.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Ignition and Starting Systems	90	30	60

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various magnetos
- Electric harnesses
- Various engines
- Various spark plugs
- GPU air starter
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Aircraft Ignition System x2
- Aircraft Magneto Ignition System

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-17 Level 2 - Overhaul magneto and ignition harness

- Check the strength of the magnet in an aircraft magneto and determine whether or not it meets the manufacturer's specifications
- Demonstrate the correct way to internally time an aircraft magneto
- Using the proper information, place the magnet of a magneto in its E-gap position
- Check a high-tension magneto lead for its physical and electrical condition

P-18 Level 2 - Inspect, service, troubleshoot, and repair reciprocating and turbine engine ignition systems and components

- Draw a schematic of the ignition of an aircraft magneto ignition system, including the coil, condenser, breaker points, distributor, spark plugs, and ignition switch
- Using the correct test equipment, check the condition of the condenser in an aircraft magneto
- Demonstrate the correct way to clean, gap, and test aircraft spark plugs
- Using the correct publications, compile a list of spark plugs that are approved for a specified aircraft engine
- Using the proper publications, compile a list of igniters that are approved for a specified aircraft turbine engine
- Demonstrate the correct way to inspect and clean a turbine engine igniter
- Using the proper reference material, explain the correct way to inspect the ignition system of a turbine engine

P-19A Level 3 - Inspect, service, troubleshoot, and repair turbine engine electrical starting systems

- Inspect a turbine engine electrical system for proper installation
- On a specified engine, perform an engine run-up that includes a check of a turbine engine electrical starting system
- Repair an engine direct drive electric starter
- Inspect and test an ignition harness with a high tension lead tester
- Bench test specified ignition system components

P-19B Level 1 - Inspect, service, and troubleshoot turbine engine pneumatic starting systems

- Differentiate between pneumatic starting systems and electrical starting systems

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Introduction to Reciprocating Engine Ignition Systems

- a) Battery Ignition Systems
- b) Magneto Ignition Systems
 - i) High-Tension magneto Systems
 - ii) Low-Tension Magneto Systems

2) Auxiliary Starting Systems

- a) Impulse Coupling
- b) Induction Vibrator System

3) Special Types of Magnetos

- a) Double Magnetos
- b) Magnetos with Compensated Cams

4) Magneto Installation

- a) Internal Timing
- b) Timing the Magneto to the Engine
 - i) Preparing the Engine
 - ii) Installing Magnetos without Impulse Couplings
 - iii) Installing Magnetos with Impulse Couplings

5) Magneto Inspection and Servicing

- a) Magneto Overhaul
- b) Magneto Check on Engine Run-up
- c) Magneto Safety Check

6) Ignition Harness

7) Spark Plugs

- a) Spark Plug Design
 - i) Spark Plug Size
 - ii) Electrodes
 - (1) Massive Electrodes
 - (2) Fine-Wire Electrodes
 - (3) Projecting Electrodes
 - iii) Insulation
 - iv) Shielding
 - v) Resistors
 - vi) Reach
 - vii) Heat Range
- b) Spark Plug Construction

8) Spark Plug Servicing

- a) Removal
- b) Inspection
- c) Cleaning
- d) Gapping
 - i) Massive Electrode Spark Plugs
 - ii) Fine-Wire Spark Plugs
- e) Testing
- f) Installation

9) The Evolution of Reciprocating Engine Starting Systems

10) Electric Starters for Large Engines

11) Electric Starters for Small engines

- a) Starters with an Overrunning Clutch
- b) Starters with Bendix Drive
- c) Starters with Right-Angle Drive Adapter

12) Electric Starter Troubleshooting and Maintenance

13) Turbine Engine Ignition Systems

- a) High-Energy Ignition Systems
 - i) Ignition Exciters
 - ii) Autoignition System
 - iii) Igniters
- b) Turbine Engine Ignition System Servicing

14) Turbine Engine Starting Systems

- a) Air Turbine Starter
- b) Electric Starter
- c) Starter Generator
- d) Combustion Starter
- e) Air Impingement Starter

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FUEL METERING SYSTEMS

COURSE DESCRIPTION: Reciprocating and turbine engine fuel metering systems, including carburetors and injectors. Projects include disassembly and adjustment of carburetors, removal, and repair of fuel controls, replacement of fuel pumps, and fabrication of fuel lines.

COURSE OBJECTIVES: Student will acquire a working knowledge of various carburetors, fuel injection systems and fuel metering as applied to aircraft including propeller driven, jets and helicopters.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Fuel Metering Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various engines
- Various aircraft
- Loose carburetors
- Basic hand tools
- Fuel systems trainer

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Fuel Metering Systems x2
- RSA Fuel Injection Systems x2

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-20 Level 1 – Troubleshoot and adjust turbine engine fuel metering systems and electronic engine fuel controls

- Locate and identify on a turbine engine fuel control the controls that are adjusted to trim the engine
- Using a diagram of a water injection system installed on a turbine engine, explain the way that the system operates

P-21 Level 2 – Overhaul carburetor

- Using the correct reference material, adjust the float level in an aircraft carburetor
- Service a carburetor fuel screen

P-22 Level 2 – Repair engine fuel metering system components

- Remove and clean the fuel strainer in a specified carburetor or fuel injection system
- Remove and properly clean a set of injection nozzles from a specified engine, explaining the points to check when cleaning and installing the nozzles

P-23 Level 3 - Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine fuel metering systems

- Install a float carburetor on a specified aircraft engine, adjusting the idling RPM and mixture, and checking to determine that the engine develops the proper static RPM
- Demonstrate the proper way to determine whether or not the idling RPM and mixture are correct on a fuel-injected reciprocating engine
- Using a diagram of a pressure carburetor, explain the way the air metering and the fuel metering forces are produced
- Using a diagram of a Bendix fuel injection system, explain the way the air metering and the fuel metering forces are produced
- Using a diagram of a Teledyne-Continental fuel injection pump, explain the way the orifice controls the high unmetered fuel pressure
- Explain the way that the idling RPM and the idle mixture ratio are adjusted on a specified pressure carburetor or fuel injection system

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Transformation of Energy**
 - a) Thermal Energy
 - b) Specific Fuel Consumption
 - c) Mixture Ratio and Engine Power
 - d) Detonation and Preignition
- 2) **Reciprocating Engine Fuels**
 - a) Aviation Gasoline
 - i) Gasoline Specifications
 - (1) Heat Energy Content
 - (2) Vapor Pressure
 - (3) Critical Pressure and Temperature
 - ii) Gasoline Additives
 - iii) Gasoline Ratings
 - b) Automobile Gasoline
 - c) Importance of Proper Fuel Grade
- 3) **Reciprocating Engine Fuel Metering Systems**
 - a) Float Carburetors
 - i) Main Metering System
 - (1) Air Bleed
 - (2) Airflow Regulation
 - ii) Idling System
 - iii) Acceleration System
 - iv) Mixture Control System
 - v) Power Enrichment or Economizer System
 - vi) Service & Maintenance - Float Carburetors
 - vii) Run-up & Idle Adjustment
 - b) Pressure Carburetors
 - i) Bendix PS - Pressure Carburetors
 - (1) Main Metering System
 - (2) Idling System
 - (3) Acceleration System
 - (4) Mixture Control System
 - (5) Power Enrichment System
 - ii) Pressure Carburetor Installation & Maintenance
 - iii) Run-up & Idle Adjustment
 - c) Fuel Injection Systems
 - i) Precision Airmotive RSA Fuel Injection System
 - (1) Main Metering System
 - (2) Idling System
 - (3) Mixture Control System
 - (4) Power Enrichment System
 - (5) Flow Divider
 - (6) Nozzles
 - ii) Installation and Maintenance of RSA Fuel Injection Systems
 - (1) Run-Up and Idle Adjustment
 - iii) Teledyne-Continental Fuel Injection System
 - (1) Injector Pump
 - (2) Fuel-Air Control Unit
 - (3) Fuel Manifold Valve
 - (4) Injector Nozzles
 - iv) Installation and Maintenance of TCM Fuel Injection Systems
 - (1) Adjusting High and Low Unmetered Fuel Pressure

- 4) Antidetonation Injection Systems**
- 5) Turbine Engine Fuels**
 - a) Jet fuel Volatility
 - b) Jet fuel Viscosity
 - c) Microbial Growth in Jet Fuel Tanks
 - d) Fuel Anti-icing
 - e) Fuel Handling
- 6) Turbine Engine Fuel Systems**
 - a) Fuel System Components
 - i) Fuel Pumps
 - ii) Fuel Strainers
 - iii) Fuel Controls
 - iv) Fuel Flowmeter
 - v) Fuel-Oil Heat Exchanger
 - vi) Fuel Nozzles
 - vii) Pressurizing and Dump Valve
 - b) Turbine Engine Fuel Control
 - i) Hydromechanical Fuel Control
 - (1) Emergency Fuel Control
 - (2) Turboprop Engine Fuel Control
 - ii) Electronic Engine Fuel Control Systems
 - (1) Supervisory Electronic Engine Control
 - (2) Full Authority Digital Electronic Control (FADEC)
 - iii) Fuel Control Adjustments

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ENGINE FUEL SYSTEMS

COURSE DESCRIPTION: Reciprocating and turbine engine fuel systems. Projects include disassembly and adjustment of carburetors, removal, and repair of fuel controls, replacement of fuel pumps, and fabrication of fuel lines.

COURSE OBJECTIVES: Student will acquire a working knowledge of various engine fuel system components.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Fuel Systems	45	15	30

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Fuel system trainer
- Loose carburetors
- Turbocharger Trainer
- Various aircraft
- Various engines
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-24 Level 2 - Repair engine fuel system components

- Locate and identify the fuel strainers in the fuel system of a turbine engine
- Remove and clean a fuel strainer, reinstall it, and pressure check it for leaks
- Locate and identify the fuel heater in the fuel system of a turbine engine
- Using the proper reference material, explain the way that a submerged boost pump should be removed from an aircraft fuel tank

P-25 Level 3 - Inspect, check, service, troubleshoot, and repair engine fuel systems

- Demonstrate the correct way to adjust the pressure on an engine-driven fuel pump
- Using a diagram of a specified engine-driven fuel pump, explain the operation of the bypass valve and the pressure relief valve
- Inspect a fuel selector valve in an aircraft and determine if each position of the valve can be positively identified by feel
- Check a fuel selector valve for proper operation
- Inspect an engine driven fuel pumps for leaks and security, performing an engine fuel pressure check

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Aircraft Fuel Systems**
 - a) Gravity-Feed Fuel System for a Float Carburetor
 - b) Gravity-Feed System for a Fuel-Injection Engine
 - c) Low-Wing, Single-Engine Fuel System for a Float Carburetor
 - d) Low-Wing, Twin-Engine Fuel System for Fuel-Injection Engines
 - e) Twin-Engine Cross-Feed Fuel System
 - f) Four-Engine Manifold Cross-Feed Fuel System
 - g) Helicopter Fuel System
 - h) Large Turbine-Engine Transport Fuel System
 - i) Fueling and Defueling
 - j) Fuel Dumping
 - k) Instruments and Controls
 - i) Refueling panel
 - ii) Flight Engineer's Panel
- 2) **Fuel Tanks**
 - a) Built-Up Fuel Tanks
 - b) Integral Fuel Tanks
 - c) Bladder-Type Fuel Tanks
 - d) Fuel Tank Filler Caps
- 3) **Fuel Pumps**
 - a) Electrical Auxiliary Pumps
 - b) Plunger Type Pumps
 - c) Centrifugal Boost Pump
 - d) Ejector Pump Systems
 - e) Engine-Driven Fuel Pumps
 - i) Diaphragm-Type Fuel Pump
 - ii) Vane-Type Fuel Pump
- 4) **Fuel Filters & Strainers**
 - a) Types of Contaminants
 - b) Required Fuel Strainers
- 5) **Fuel Valves**
 - a) Plug-Type Valves
 - b) Poppet-Type Selector Valve
 - c) Electric Motor-Operated Sliding Gate Valve
 - d) Solenoid-Operated Poppet-Type Fuel Shutoff Valve
- 6) **Fuel Heaters**
- 7) **Turbine Engine Fuel Systems**
 - a) Fuel System Components
 - i) Fuel Pumps
 - ii) Fuel Strainers
 - iii) Fuel Controls
 - iv) Fuel Flowmeter
 - v) Fuel-Oil Heat Exchanger
 - vi) Fuel Nozzles
 - vii) Pressurizing and Dump Valve

INDUCTION AND ENGINE AIRFLOW SYSTEMS

COURSE DESCRIPTION: Engine ice and rain control, baffles, carburetor heat, heat exchangers, superchargers and turbochargers, intake, cooling systems, and starters.

COURSE OBJECTIVES: Engine ice and rain control, baffles, carburetor heat, heat exchangers, superchargers and turbochargers, intake, cooling systems, and starters.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Induction and Engine Airflow Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various aircraft
- Various engines
- Basic hand tools
- Loose carburetors
- Turbocharger Trainer

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-26 Level 2 - Inspect, check, troubleshoot, service, and repair engine ice and rain control systems

- Using a diagram of the ice control system for a turbine engine, explain the way the each component removes or prevents the formation of ice
- Check the proper operation of an engine anti-ice system

P-27 Level 1 - Inspect, check, service, troubleshoot, and repair heat exchangers, superchargers, and turbine engine airflow and temperature control systems

- Locate and identify the components in the control system of a turbocharger
- Using a diagram of a turbocharger installation, explain the operation of the type of controller that is installed
- Demonstrate all elements that should be inspected on a turbocharger installation
- Explain the correct way to check the operation of a turbocharger system on an aircraft engine
- Using a diagram of the clutch system of a two-speed internal supercharger, explain the way that the clutches operate to change the speed of the impeller
- Explain the correct way to use a two-speed supercharger to maintain the maximum engine power as the airplane gains altitude
- Explain the way that the antisurge bleed system in a turbojet engine prevents compressor stall

P-28 Level 3 - Inspect, check, service, and repair carburetor air intake and induction manifolds

- Demonstrate the correct way to clean the carburetor air filter for an aircraft engine
- Inspect a carburetor heater air box, explaining all elements to be checked
- Rig or repair a carburetor heater air box
- Inspect the induction system of a reciprocating engine for condition, explaining the things that could cause a loss of engine power
- Explain the way that an induction system fire should be extinguished in an aircraft reciprocating engine
- Replace an induction system manifold gasket and/or induction tube

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147

COURSE OUTLINE

- 1) **Powerplant Ice Protection**
 - a) Reciprocating Engines
 - b) Turbine Engines
- 2) **Reciprocating Engine Induction Systems**
 - a) Naturally Aspirated Engine Induction Systems
 - i) Alternate Air System
 - b) Superchargers
 - i) Internal Superchargers
 - ii) Turbosuperchargers and Turbochargers
 - (1) Turbocharger Controls
 - (a) Adjustable Bypass Restrictor
 - (b) Manually-Controlled Waste Gate
 - (c) Automatic Turbocharger Control Systems
 - (d) Teledyne-Continental Motors (TCM) System
 - (e) Textron-Lycoming Engine Turbocharger Controls
- 3) **Turbine Engine Air Inlet Ducts**
 - a) Subsonic Inlet Ducts
 - i) Blow-In Ducts
 - ii) Foreign-Object Damage
 - b) Supersonic Inlet Ducts

ENGINE COOLING SYSTEMS

COURSE DESCRIPTION: Lubrication and cooling systems. Students learn to identify and select aircraft lubricants. Projects include adjustment of oil pressure and inspection of oil pumps.

COURSE OBJECTIVES: Students will acquire a working knowledge of engine cooling systems; including components, inspection, servicing, and maintenance.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Cooling Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Engine oil/fuel heat exchanger (jet engines)
- Cylinder heads (fins)
- Basic hand tools
- Various engines
- Various aircraft

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-29 Level 2 - Repair engine cooling system components

- Examine the baffles in a reciprocating engine installation, explaining the things in the baffle system that could cause engine damage
- Repair an engine pressure baffle plate
- Using the proper reference materials, repair damaged fins on an air-cooled engine cylinder

P-30 Level 3 - Inspect, check, troubleshoot, service and repair engine cooling systems

- Using a diagram of the augmentor system installed on a reciprocating engine, explain the way that this system aids in the cooling of the engine
- Inspect the cowl flap system of an air-cooled engine and determine whether or not the flaps reach their fully open and fully closed positions
- Inspect the cooling fan and baffles installed with a helicopter engine
- Demonstrate proper inspections techniques for checking the insulating blanket around a turbine engine
- Using a drawing of the cooling system of a turbine engine, explain the way that cooling air removes heat from the engine
- Inspect an air-cooled engine cylinder, explaining the things that would indicate that the cylinder has been improperly cooled

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Evolution of Reciprocating Engine Cooling Systems

- a) Air-Cooled Engines
 - i) Fins
 - ii) Cowling
 - (1) Radial Engine Cowling
 - (2) Horizontally Opposed Engine Cowling
 - iii) Augmentor Tubes
- b) Liquid-Cooled Engines
- c) Cooling System Inspection and Maintenance

2) Turbine Engine Cooling Systems

ENGINE EXHAUST AND REVERSER SYSTEMS

COURSE DESCRIPTION: Study of exhaust and reverser systems, including, inspection, checks, troubleshooting, service/repair and maintenance practices. Turbine, turbo-prop, and reciprocating engine systems will be covered.

COURSE OBJECTIVES: Students will acquire a working knowledge of induction and airflow, and exhaust and reverser systems. Turbine, turbo-prop, and reciprocating engine systems will be covered.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Engine Exhaust and Reverser Systems	30	10	20

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Exhaust/thrust reverser (jet engine)
- Various aircraft
- Various engines
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-31 Level 2 - Repair engine exhaust system components

- Demonstrate the correct way to remove and replace a section of the exhaust system of a reciprocating engine
- Demonstrate the correct way to clean ceramic-coated components in an aircraft engine exhaust system
- Replace one or more exhaust gaskets

P-32(a) Level 3 - Inspect, check, troubleshoot, service, and repair engine exhaust systems

- Demonstrate the correct way to inspect the exhaust system of a reciprocating engine for leaks
- Locate and identify the components in the exhaust gas temperature indicating system in a turbine engine
- Locate and identify the components in a turbocharger system installed on a reciprocating engine
- Using a diagram, explain the way that noise suppressors on a turbine engine decrease the noise level
- Inspect an engine muffler used to supply heat to the aircraft cabin, explaining the way that the muffler should be checked to ensure no leakage
- Demonstrate the procedures to accomplish a pressurization check of an aircraft engine exhaust system

P-32(b) Level 1 - Troubleshoot and repair engine thrust reverser systems, and related components

- Using a diagram, explain the correct way of inspecting the thrust reversers on a specified turbine engine for proper deployment and proper stowage

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147

COURSE OUTLINE

- 1) Reciprocating Engine Exhaust Systems**
 - a) Evolution of Reciprocating Engine Exhaust Systems
 - b) Cabin and Carburetor Heat Provisions
 - c) Mufflers
 - d) Augmentor Tubes
 - e) Power Recovery Devices
 - i) Turbochargers
 - ii) Power Recovery Turbines
- 2) Exhaust System Inspection and Repair**
 - a) Carbon Monoxide Detection
 - b) Exhaust System Inspection
 - c) Exhaust System Repairs
- 3) Turbine Engine Exhaust**
 - a) Noise Suppressors
 - b) Thrust Reversers
 - c) Afterburners
 - d) Vectored Thrust Engines

PROPELLERS

COURSE DESCRIPTION: Theory and operation of propellers including ice control, governors, balancing, synchronizing, and propeller lubrication. Includes service and repair of fixed-pitch, constant speed, and feathering propellers. Various propeller configurations (constant speed, variable pitch, etc.) will be covered in detail.

COURSE OBJECTIVES: Students will acquire a working knowledge of propellers and related systems and components, including, inspection, check & service, troubleshooting, repair and maintenance of a variety of components.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Propellers	56	20	36

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- Various propellers & blades
- Various governors
- Propeller reduction gear box
- Propeller heaters
- Blade pitch adjustment tools
- Various aircraft
- Various engines
- Basic hand tools

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- Propellers and Controls

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-33: Level 1 - Inspect, check, service, and repair propeller synchronizing and ice control systems

- Inspect the propeller synchronizing and ice control system of a specified aircraft

P-34: Level 2 - Identify and select propeller lubricants

- Demonstrate the correct way to lubricate a propeller, using the proper reference materials to find the lubricants to be used

P-35: Level 1 - Balance propellers

- Explain how to use a propeller balancing kit to balance an aircraft propeller

P-36: Level 2 - Repair propeller control system components

- Locate and identify the components in the propeller installation on a turboprop engine
- Inspect a spinner/bulkhead for defects and proper alignment and installation

P-37: Level 3 - Inspect, check, service, and repair fixed-pitch, constant speed, and feathering propellers, and propeller governing systems

- Measure the track of a propeller and, using the correct reference materials, determine whether or not it is within allowable tolerance
- Using the correct reference material, find out if there is any RPM range that is restricted for a specified engine-propeller combination
- Demonstrate the correct way to adjust a propeller governor to get the correct takeoff RPM
- Using a universal propeller protractor and the correct reference materials, measure the pitch angle of the blades of a specified propeller
- Inspect a wooden propeller for condition, explaining the things that could make a wooden propeller unairworthy
- Using a diagram of a propeller governor and the propeller it is used with, explain the operation of the governor during on-speed operation, overspeed operation, and underspeed operation
- Using the correct reference material, find out if there is any RPM range that is restricted for a specified engine-propeller combination
- Demonstrate the correct way to check a feathering propeller during ground operation of the engine

P-38: Level 3 - Install, troubleshoot, and remove propellers

- Inspect a propeller for damage and explain the way to remove small surface damage
- Remove a propeller from a splined or tapered shaft, reinstall it, and properly safety it
- Remove and reinstall a propeller on a flanged shaft, explaining the precautions that should be taken in this operation
- Leak check a constant speed propeller installation

P-39: Level 3 - Repair aluminum alloy propeller blades

- Repair minor surface damage to aluminum alloy propeller blades

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) Introduction to Aircraft Propellers

- a) Propeller Theory
 - i) Propeller Pitch
 - ii) Angle of Attack
 - iii) Tip Speed
 - iv) Propeller Efficiency
 - v) Forces Acting on Propellers
 - (1) Centrifugal Force
 - (2) Thrust Bending Force
 - (3) Torque Bending Force
 - (4) Aerodynamic Twisting Force
 - (5) Centrifugal Twisting Force
 - vi) Asymmetrical Loading
- b) Classification of Propellers
 - i) Materials
 - ii) Number of Blades
 - iii) Pitch Change Methods

2) Propellers for Reciprocating Engines

- a) Fixed-Pitch Propellers
 - i) Wood Propellers
 - ii) Metal Propellers
- b) Ground-Adjustable Propellers
- c) Controllable-Pitch Propellers
 - i) Two-Position Propellers
- d) Automatic Propellers
- e) Constant-Speed Propellers
 - i) Principles of Operation
 - (1) Counterweight Propellers
 - (2) Noncounterweight Propellers
 - ii) Propeller Governor

- f) Feathering Constant-Speed Propellers
 - i) Hamilton Standard Hydromatic Feathering Propeller
 - ii) Hartzell Steel Hub Feathering Propeller
 - iii) McCauley Constant-Speed Feathering Propeller
- g) Reversible Constant-Speed Propeller
- 3) Propellers for Turbine Engines**
 - a) Turboprop Engines
 - i) Garrett TPE331 Engine
 - (1) Propeller
 - (2) Power Management
 - ii) Pratt & Whitney of Canada PT6 Engine
 - (1) Propeller
 - (2) Engine Controls
 - (a) Governor
 - (b) Beta Operation
 - (c) Overspeed Governor
 - (d) Autofeather System
 - b) Composite Propeller Blades
 - c) UHB (Ultrahigh-Bypass Ratio) Engines
- 4) Propeller Installation, Inspection, and Maintenance**
 - a) Installation on a Flanged Shaft
 - b) Installation on a Splined Shaft
 - c) Installation on a Tapered Shaft
 - d) Propeller Vibration
 - e) Propeller Track
 - f) Propeller Balance
 - g) Propeller Inspections
 - i) Wood Propellers
 - ii) Metal Propellers
 - h) Propeller Storage
 - i) Composite Propeller Blades
 - j) Propeller Repairs and Alterations
 - k) Determining Propeller Repairability
- 5) Propeller Auxiliary Systems**
 - a) Synchronizer Systems
 - b) Synchrophasing System
 - c) Ice Control Systems

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UNDUCTED FANS

COURSE DESCRIPTION: One of the new developments in aircraft propulsion is the ultra-high bypass (UHB) turbofan, or unducted fan (UDF) engine. This type of engine is a cross between a turbofan and a turboprop, and uses a short multibladed propeller.

COURSE OBJECTIVES: Students will understand the principle of the unducted fan system and the advantages and disadvantages of this type of propulsion.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Unducted Fans	4	2	2

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- None

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (Bold items are required) (Un-Bold items are recommended)

P-40: Level 1 - Inspect and troubleshoot unducted fan systems and components

- Explain various troubleshooting procedures on unducted fan system components as specified by the instructor

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

1) UHB (ultra-high Bypass Ratio) Engines

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AUXILIARY POWER UNITS

COURSE DESCRIPTION: Modern turbine-powered aircraft are made independent of ground-power sources by using an installed auxiliary power unit (APU) to provide electricity and compressed air when the main engines are not operating.

COURSE OBJECTIVES: Students will understand the purpose of an APU and will be able to describe the operating principle of the various controls of this system.

INSTRUCTIONAL HOURS:

Subject	Total	Theory	Lab
Auxiliary Power Units	10	5	5

EQUIPMENT & AIDS: A classroom equipped with an overhead projector and a video player available. Classroom presentation will involve lecture, and the use of selected videotapes, and overhead transparencies.

Specific Training Aids/Equipment/Mock-Ups:

- GTC-85

RECOMMENDED VIDEO TAPES:

Any selection from the appropriate section from the Video Catalog listed at the end of this document. Video/DVD selections appropriate for this course include:

- None

REQUIRED PROJECTS: (**Bold items are required**) (Un-Bold items are recommended)

P-41: Level 1 - Inspect, check, service, and troubleshoot turbine-driven auxiliary power units

- Inspect a turbine-powered auxiliary power unit to determine proper operation
- Demonstrate the proper procedures for replacing an igniter plug
- Test a turbine-powered auxiliary power unit

Instruction according to the curriculum outline for this section will meet the teaching levels and subject content required by FAR 147.

COURSE OUTLINE

- 1) **Electrical Power Systems for Large Aircraft**
- 2) **Transport Category Aircraft Systems**

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VIDEO/DVD CATALOG LISTING

Disclaimer: List below is subject to change due to inventory completion.

<u>Title</u>	<u>Section</u>
Measurement of Area and Volume	Mathematics
Temperature, Pressure, and Fluids-Liquids; Parts I & II	Basic Physics
Sound and Its Effects x2	Basic Physics
Newton's Law of Motion x2	Basic Physics
How Airplanes Fly	Basic Physics
Bernolli's Principle: Why An Airplane Flies; Parts I & II	Basic Physics
Approaching the Speed of Sound	Basic Physics
Energy, Work, Power, and Force	Basic Physics
Aerodynamic Principle	Basic Physics
Helicopter Fundamentals	Basic Physics
Advanced Aerodynamics Angle of Attack	Basic Physics
Corrosion Control for Aircraft	Cleaning & Corrosion Control
Nondestructive Testing for Corrosion Control	Cleaning & Corrosion Control
Vernier Caliper	Materials & Processes
Use and abuse of Twist Drills	Materials & Processes
Cutting Threads with Taps and Dies	Materials & Processes
The Mechanic's Toolbox	Materials & Processes
Critical Operations Critical Processes	Ground Operations & Servicing
Aircraft Flight Line Service	Ground Operations & Servicing
How to save money on your Annual Inspection	Ground Operations & Servicing
Aeroshell Presents: Aviation Oil	Ground Operations & Servicing
Aeroshell Presents: Aviation Grease	Ground Operations & Servicing
Preflight a Fixed Wing	Ground Operations & Servicing
Human Performance in Aviation Maintenance	Ground Operations & Servicing
FAAPart 145 Certified Repair Stations	Ground Operations & Servicing
Care and Lubication	Ground Operations & Servicing
Weight and Balance 101 for Homebuilts	Weight & Balance
Weight and Balance	Weight & Balance
Aircraft Drawings	Aircraft Drawings
Electrical Wiring 101	Basic Electricity
On Wiring Splicing	Aircraft Electrical Systems
Aircraft Fabric Covering	Aircraft Covering
Aircraft Painting 101	Aircraft Finishes
747/777 Put Together Quick	Sheet Metal & Nonmetallic Structures
Metal Working 101	Sheet Metal & Nonmetallic Structures
Measuring and Layout Tools	Sheet Metal & Nonmetallic Structures
Advanced Composite Construction Techniques	Sheet Metal & Nonmetallic Structures
Composite Structure Awareness	Sheet Metal & Nonmetallic Structures
Basic Composite Aircraft Construction	Sheet Metal & Nonmetallic Structures
Basic Composite Construction Techniques	Sheet Metal & Nonmetallic Structures

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Change 0

Aircraft Fiberglass 101
 Eyes of Flight
 History of Flight the Wright Brothers 5 Parts
 Bernoulli's Principle: Why An Airplane Flies, Parts 1 & 2
 How Airplanes Fly
 Advanced Aerodynamics Angle of Attack
 Helicopter Fundamentals
 Aerodynamic Principle
 Oxy-Acetylene Welding Series Parts I & II
 ARC Welding Techniques Parts I & II
 MIG Made Easy
 TIG Welding Basics
 Repair Structural Tubing
 Aircraft Wheels and Brakes
 OLEO Struts
 Reciprocating Engine Overhaul (IO-360, O-320, o-200, & O-360)
 The Cylinder Bore Gauge
 Aircraft Reciprocating Engines
 Assembly and Use of the Time-Rite Indicator
 Differential Compression
 Continental Operations Critical Processes
 ABC's of Jet Engine
 Care and Handling of Borescope Equipment
 Preventative Maintenance
 Annual Inspection Powerplant
 Care and Lubrication
 RSA Fuel Injection System
 Fuel Metering Systems
 Ignition System
 Aircraft Magneto Ignition System
 Propeller Repair
 Propeller and Controls

Sheet Metal & Nonmetallic Structures
 Sheet Metal & Nonmetallic Structures
 Basic Aerodynamics/Assembly & Rigging
 Basic Aerodynamics/Assembly & Rigging
 Basic Aerodynamics/Assembly & Rigging
 Basic Aerodynamics/Assembly & Rigging
 Basic Aerodynamics/Assembly & Rigging
 Basic Aerodynamics/Assembly & Rigging
 Welding
 Welding
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 Aircraft Landing Gear Systems
 Aircraft Landing Gear Systems
 Reciprocating Engines
 Reciprocating Engines
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 Reciprocating Engines
 Reciprocating Engines
 Reciprocating Engines
 Reciprocating Engines
 Turbine Engines
 Engine Inspection
 Engine Inspection
 Engine Inspection
 Lubrication Systems
 Fuel Metering Systems
 Fuel Metering Systems
 Fuel Metering Systems
 Ignition & Starting Systems
 Ignition & Starting Systems
 Propellers
 Propellers