DOCUMENT RESUME

ED 092 688 CE 001 417

TITLE Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control System (Course Outline), Aviation Mechanics 3 (Air Frame): 9067.04.

INSTITUTION Dade County Public Schools, Miami, Fla.

PUB DATE 71

NOTE 44p.; An Authorized Course of Instruction for the Quinmester Program

EDRS PRICE MF-$0.75 HC-$1.85 PLUS POSTAGE

DESCRIPTORS *Aviation Mechanics; *Aviation Technology; Climate Control; Communications; Course Content; Course Objectives; *Curriculum Guides; *Equipment Maintenance; Fire Protection; Instrumentation; *Instrumentation Technicians; Job Skills; Navigation; Performance Criteria; *Technical Education

IDENTIFIERS *Quinmester Program

ABSTRACT

This document presents an outline for a 135-hour course designed to familiarize the student with manipulative skills and theoretical knowledge concerning aircraft instrument systems like major flight and engine instruments; fire protection and fire fighting systems; warning systems and navigation systems; aircraft cabin control systems, such as heating and pressurization, in accordance with Federal Aviation Agency standards. The aviation maintenance technician must be able to demonstrate the ability to remove and install aircraft instruments, an understanding of the theory and purpose of fire protection and fire extinguisher system components, knowledge of the theory and purpose of aircraft position and warning systems, an understanding of aircraft communication and navigation systems, knowledge of the theory and purpose of aircraft oxygen systems, and the safety procedures necessary for safe maintenance of airframe systems. The behavioral objectives and performance standards necessary for a person to pass the airframe system and component section of the Federal Aviation Administration examination for an aircraft mechanics license are specified. An 11-item bibliography, a list of five filmstrips, and a Quinmester posttest sample are included. (KP)

VT

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

AVIATION MECHANICS 3 (Air Frame)
(Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems)

Department 48 - Course 9067.04

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 1 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

AVIATION MECHANICS 3 (Air Frame)
(Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems)

Department 48 - Course 9067.04

the division of

VOCATIONAL, TECHNICAL AND ADULT EDUCATION

Published by the Dade County School Board

Course Description

9067	48	9067.04	Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems
State Category Number	County Dept. Number	County Course Number	Course Title

This is a course to familiarize the student with manipulative skills and theoretical knowledge concerning aircraft instrument systems, such as major flight and engine instruments; fire protection and fire fighting systems; warning systems and navigation systems; aircraft cabin control systems, such as heating and pressurization in accordance with Federal Aviation Agency (FAA) standards.

Indicators of success: Successful completion of all quinmesters of the Aviation Mechanics (Airframe and Powerplant-General) course number 9073.

PREFACE

The following course outline has been prepared as a guide to help the trainee become proficient in the skills and knowledge required to pass the Airframe System and Component section of the Federal Aviation Administration examination for Aircraft Mechanic's License.

Course 9073, Airframe and Powerplant General is a prerequisite to this course and this must be completed successfully to apply for 9067.04, Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems.

This course is composed of six blocks of instruction which are subdivided into several units requiring one quinmester of 135 hours. Great emphasis will be placed on the use of audio-visual aids and instruction sheets of various types. A list of the Behavioral Objectives the trainee will be required to perform is included. Following each unit title will be found, in parentheses, several letters and numbers designating the time spent in terms of theory and shop work. EIT indicates estimated instructional time, T indicates time spent in theory or classroom work, and L/S indicates time spent in laboratory or shop work.

The level 1 following a unit indicates the student must have knowledge of general principles but no practical application, nor development of manipulative skill. Instruction is given by lecture, demonstration, and discussion.

The level 2 following a unit indicates the student must have knowledge of general principles and limited practical application and sufficient manipulative skill to perform basic operations. Instruction is given by lecture, demonstration, discussion, and limited practical application.

The level 3 following a unit indicates the student must have knowledge of general principles and performance of a high degree of practical application and sufficient manipulative skill to accomplish return to service. Instruction is given by lecture, demonstration, discussion, and a high degree of practical application.

This outline has been developed through the cooperative efforts of the instruction and supervisory personnel, the Quinmester Advisory Committee and the Vocational Teacher Education Service, and has been approved by the Dade County Curriculum Committee.

TABLE OF CONTENTS
with Suggested Hourly Breakdown

GOALS

The aviation maintenance technician must be able to demonstrate:

1. The ability to remove and install aircraft instruments.

2. An understanding of the theory and purpose of fire protection and fire extinguisher system components.

3. A knowledge of the theory and purpose of aircraft position and warning systems.

4. An understanding of aircraft communication and navigation systems.

5. Skill and knowledge necessary to maintain cabin atmosphere control and heating systems.

6. Knowledge of the theory and purpose of aircraft oxygen systems.

7. The safety procedures necessary for safe maintenance of airframe systems.

Course Outline

AVIATION MECHANICS 3 (Air Frame)
(Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems)

Department 48 - Course 9067.04

I. AIRCRAFT INSTRUMENT SYSTEMS (27 hours)

A. Removal and Installation of Aircraft Instruments
(Level - 2) (EIT-15 hrs) (T-7 hrs) (L/S-8 hrs)
1. Handling of Instruments
   a. Precautions with delicate instruments
   b. Gyro handling and roll prevention
   c. Damage due to overtightening case screws
2. Preparation for Storage or Shipment
   a. Sealing and capping
   b. Glass protection
   c. Vibration and shock prevention
3. Installing Instrument Panels and Instruments
   a. Hardware
      (1) Identification
      (2) Routing
      (3) Hose and clamp selection
   b. Panel shock mountings
      (1) Type, number and load rating
      (2) Selection of appropriate instrument
      (3) Deterioration prevention
   c. Installation procedures
      (1) Location in aircraft
      (2) Mounting procedures
      (3) Procedures and precautions when threading fittings
      (4) Operating range marking

B. Inspect, Check, Service, Troubleshoot and Repair Indicating Systems
(Level - 2) (EIT-12 hrs) (T-5.5 hrs) (L/S-6.5 hrs)
1. Heading Indicators
   a. Limitations of magnetic compass
   b. Compensation of magnetic compass
   c. Compass calibration cards

I. AIRCRAFT INSTRUMENT SYSTEMS (Contd.)

2. Pitot Static Systems
   a. Purpose
   b. Function
      (1) Static lines
      (2) Associated instruments
   c. Emergency procedures for static failure
3. Temperature Indicating Systems
   a. Vapor pressure temperature instruments
   b. Outside air temperature instruments
      (1) Operation of bi-metallic strip
      (2) Operation of bi-metallic coil
      (3) Operations and limits of electrical resistance
4. Pressure Indicating Systems
   a. Types and uses
   b. Principles of operation
      (1) Bourdon tube
      (2) Diaphram type
      (3) Aneroid system
   c. Troubleshooting procedures
      (1) In flight
      (2) Ground check
5. Gyro Systems
   a. Types
      (1) Turn and bank
      (2) Directional gyro
      (3) Artificial horizon
   b. Principles of operation
      (1) Vacuum system
      (2) Electrical systems
      (3) Gimbal rings
      (4) Caging methods
   c. Limitations of use
      (1) Bank and pitch limits
      (2) Erection mechanisms
   d. Servicing and inspection
      (1) Filters
      (2) Lines and fittings

II. FIRE PROTECTION SYSTEMS (15 hours)

A. Inspection, Checking and Servicing of Smoke and Carbon Monoxide Detectors
(Level - 1) (EIT-2.5 hrs) (T-2.5 hrs) (L/S-0 hrs)
1. Principles of Operation of Smoke Detectors
   a. Methods of smoke detection
      (1) Photo-electric method
      (2) Visual method
   b. Checking smoke detectors
      (1) Air sampling
      (2) Cigarette check
2. Principles of Operation of Carbon Monoxide Detectors
   a. Carbon monoxide detector button
   b. Detectors in aircraft
      (1) Single engine
      (2) Multi-engine

B. Aircraft Fire Detection and Extinguishing Systems
(Level - 3) (EIT-12.5 hrs) (T-5 hrs) (L/S-7.5 hrs)
1. Types of Fire Detectors
   a. Bi-metallic thermal switch type
   b. Thermocouple type
   c. Continuous loop type
2. Selection and Operation of Fire Extinguishers
   a. Classes of fires
      (1) Class A fire
      (2) Class B fire
      (3) Class C fire
      (4) Class D fire
   b. Types of extinguishers used
      (1) Water
      (2) Carbon dioxide
      (3) Chemical
         (a) Soda-acid
         (b) Dry powder
   c. Handling of portable extinguishers
      (1) Distance handler should be from fire
      (2) Using extinguishing agent for protective curtain
      (3) Precautions involving wheel fires
   d. Fuel and oil fires
      (1) Danger of flashbacks
      (2) Selection of proper extinguisher

II. FIRE PROTECTION SYSTEMS (Contd.)

3. Aircraft built-in fire extinguishers
   a. Types of agents used
   b. Discharging methods
      (1) Electrical
      (2) Mechanical
   c. Pressure and discharge indicating systems
      (1) Normal discharge system
      (2) Thermal discharge system
   d. Malfunctions and troubleshooting
      (1) Bottle discharge system
      (2) Pressure and discharge indication system

III. WARNING AND POSITION SYSTEMS (27 hours)

A. Inspection, Checking and Servicing Speed and Take-off Warning Systems and Anti-skid Brake Controls (Level - 1) (EIT-14 hrs) (T-7 hrs) (L/S-7 hrs)
   1. Principles of Operation, Inspection and Checks of Speed, Stall, Take-off Warning and Anti-skid Brake Control Systems
      a. Speed or Mach warning systems
         (1) Purpose
         (2) Sensing methods
         (3) Ground inspection and checks
      b. Install warning systems
         (1) Types
         (2) Principles of operation
         (3) Reasons for silencing system
         (4) Ground checks
            (a) Engine running
            (b) Engine not running
      c. Anti-skid control systems
         (1) Skid detectors
            (a) Types and uses
            (b) Installation procedures
         (2) Anti-skid computers
            (a) Signal transmission to central computer
            (b) Signal interpretation
            (c) Computer reaction to skids

(3) Electrical/hydraulic control units for braking
(a) Signal control during skid
(b) Change in braking action
(c) Anti-locking control
(4) Cockpit controls and ground/flight tie-in
(a) Arming and activation from cockpit
(b) Operation of ground/flight change-over relay
(5) Inspecting and ground checking anti-skid systems

2. Showing Simulated Operation of Anti-skid and Take-off Warning Systems
a. Anti-skid brake control systems
(1) Nomenclature and location of components
(2) Association and tie-in to hydraulic brake systems
(3) Principles of operation
b. Take-off warning system
(1) Nomenclature of components
(2) System activation of monitored functions not correct for take-off

B. Inspection, Checking and Troubleshooting of Landing Gear Position Indicating and Warning Systems (Level - 3) (EIT-13 hrs) (T-4.5 hrs) (L/S-8.5 hrs)
1. Inspecting, Checking, Troubleshooting of Landing Gear Position Indicating and Warning Systems
a. Separate gear safe lights
b. Single gear unsafe light
2. Inspection, Checking, Troubleshooting and Repair of Landing Gear Warning System
a. Types of warning systems
(1) Lights
(2) Horns
b. Purpose of dual switch assembly
(1) Positions - gear up and down
(2) Switch adjustments
c. Methods of checking system on ground
(1) Drop-checking aircraft
(2) Simulated - use of meter

IV. COMMUNICATION AND NAVIGATION SYSTEMS (27 hours)

A. Autopilot and Approach Control Systems
(Level - 1) (EIT-7 hrs) (T-7 hrs) (L/S-0 hrs)

1. Operating Principles of Autopilots
   a. Basic types of autopilots
      (1) Pneumatic/electronic
      (2) Electric/electronic
   b. Sensing devices used in autopilots
      (1) Gyros
         (a) Primary sensing device
         (b) Operating principle
      (2) Accelerometers
         (a) Sensing signals to autopilot
         (b) Relationship to earth's atmosphere
   c. Servo and servomotor systems
      (1) Pneumatic servo
         (a) Purpose
         (b) Use
      (2) Two-phase electric servomotor
         (a) Purpose
         (b) Use
      (3) Feedback and rate control system
   d. Installation requirements of an autopilot system
      (1) Location and mounting of sensing unit
      (2) Applicable directives for installation requirements

2. Operating Principles of Approach Control Systems
   a. Position transmitters and trim indicators
      (1) Functions of position transmitter and related trim indicators
      (2) Check autopilot operation using trim indicators
   b. Altitude hold and approach control functions of an autopilot
      (1) Purpose and value to the pilot
      (2) Operation of altitude hold during climb and descent
      (3) Function of approach control

B. Aircraft Electronic Communication and Navigation Systems
(Level - 1) (EIT-7 hrs) (T-7 hrs) (L/S-0 hrs)

1. Types and Installation of Electronic Communications and Navigation Equipment

a. Electronic communication systems
(1) Radio
(2) Inter-communication
b. Electronic navigation systems
c. Electronic equipment installation and mounting
(1) Electronic racks or compartments
(2) Cooling requirements
(3) Use of shock mounts on delicate equipment
d. Engine noise and radio interference protection
(1) Shielding
(2) Bonding
(3) Filters

2. FCC Regulations Pertaining to Two-way Radio Operation
a. FCC License requirements
(1) Individual
(2) Aircraft
b. FCC Regulations covering transmission techniques
(1) Frequency monitoring
(2) Calling procedure
(3) Acknowledgement procedures
(4) Restrictions on certain transmitted information

C. Antenna and Associated Electronic Equipment Installations (Level - 2) (EIT-13 hrs) (T-7 hrs) (L/S-6 hrs)
1. Repair and Replacement of Antennas and Related Electronic Equipment
a. Radio installation
(1) Specifications and procedures
(2) Major alteration
(3) Location
b. Antenna installation
(1) Critical work item
(2) Location and conforming to specifications
c. FAR procedures for return-to-service
(1) Advisory circulars
(2) Maintenance responsibility

2. Identification and Purpose of Static Dischargers
a. Static dischargers
(1) Cause of corona static
(2) Function of dischargers

IV. COMMUNICATION AND NAVIGATION SYSTEMS (Contd.)

b. Types of dischargers
(1) Carbon wick
(2) Metallic braid
(3) Null-field

V. CABIN ATMOSPHERE CONTROL SYSTEMS (39 hours)

A. Heating, Cooling, Air Conditioning and Pressurization Systems
(Level - 1) (EIT-17 hrs) (T-17 hrs) (L/S-0 hrs)
1. Principles of Operation and Control of Cabin Pressurization
a. Structural provisions for cabin pressurization
(1) Fuselage construction
(2) Negative pressure effects
(3) Leakage control
b. Sources of pressurizing airflow
(1) Superchargers
(2) Compressors
(3) Turbine air bleed
c. Air delivery system
(1) Ducting arrangements
(2) Mixing valves
(3) Check valves
d. Outflow valves
(1) Purpose
(2) Related equipment
(a) Jet pump
(b) Vacuum control
(3) Position
(a) In-flight
(b) Parked
e. Emergency relief valves
(1) Automatic
(2) Manual control
f. Negative pressure relief valve
(1) Purpose
(2) Location
g. Cabin pressure control system
(1) Automatic rate of climb system
(2) Automatic ratio control system

h. Manual pressure control
   (1) Back-up system
   (2) Safety to passengers when using system

2. Function and Principles of Air Conditioning
   a. Functions of air conditioning systems
      (1) Airflow system
      (2) Relation to pressurizing system
      (3) Capacity control
   b. Cabin supercharger or compressor
   c. Cabin mixing valve and temperature control
      (1) Types of air available for mixing
      (2) Design
      (3) Actuator valves
      (4) Manual back-up
   d. Cockpit airflow and temperature control
      (1) Cockpit ventilation
      (2) Electronic rack cooling
   e. Air conditioning functions of the outflow valve
      (1) Ratio of air vented through the outflow valve
      (2) Operation of turbine powered aircraft
   f. Air distribution ducts
      (1) Types
         (a) Large cabin planes
         (b) Small cabin planes
      (2) Construction and routing
   g. Cold air distribution system
      (1) Purpose of separate cold air system
      (2) Maintaining differential pressure
   h. Recirculating fans and ground blowers
      (1) Purpose of recirculating fan
      (2) Function of ground blower

3. Aircraft Combustion Heaters and Exhaust Type Heat Exchangers
   a. Surface combustion heaters
      (1) Principles of operation
      (2) Type of fuel used
      (3) Thermostatic controls
      (4) Fuel/air regulators
   b. Exhaust type heat exchangers
      (1) Advantages and disadvantage of combustion heaters
      (2) Heat transfer principle
      (3) Thermostatic control

c. Cabin and cockpit heating
(1) Use of combustion heater
(2) Use of heat exchange heater
d. Protective features for heater control circuits
(1) Types and uses
(2) Circuit protection
(3) Cabin and cockpit control features
e. Heater safety
(1) Exhaust isolation
(2) Overheat control
f. Inspection and troubleshooting of heaters
(1) Service inspection points
(a) Combustion heater
(b) Heat exchange
(2) Leak detector inspection

4. Aircraft Vapor-cycle and Air-cycle Cooling Systems
a. Aircraft cooling systems
(1) Purpose
(2) Freon vapor-cycle refrigerating system
(a) Function of major components
(b) Location and positioning
(c) Servicing procedures
(3) Air-cycle cooling systems
(a) Principles of operation
(b) Function of expansion turbine
(c) Thermostatic control
b. Troubleshooting cooling systems
(1) Service inspection points
(2) Use of ground power equipment
(3) Reference materials
(a) Troubleshooting charts
(b) Schematic and wiring diagrams

B. Aircraft Oxygen Systems
(Level - 2) (EIT-10 hrs) (T-4 hrs) (L/S-6 hrs)
1. Uses and Purposes of Oxygen Systems
a. Requirements for oxygen systems
(1) High altitude anoxia to passengers
(2) Altitude requirements for use of oxygen by crewmembers
b. Types of oxygen systems
(1) Cabin oxygen system
(2) Individual passenger oxygen station

2. Oxygen Handling Precautions
   a. Danger of oils and greases in or around oxygen system
   b. Care and handling of oxygen bottles
   c. Safety precautions involved in aircraft servicing
   d. Methods of checking for oxygen leaks

C. Repair Procedures of Cabin Atmosphere Control Systems (Level - 2) (EIT-12 hrs) (T-12 hrs) (L/S-0 hrs)
   1. Identification of Cabin Atmosphere Control System Components
      a. Fuel and airflow patterns in surface combustion heaters
         (1) Fuel flow regulation
         (2) Ducting and routing
      b. Heater ignition
         (1) High voltage source
         (2) Spark plugs
      c. Control sensors and overheat protection
         (1) Location of cut-off and overheat switches
         (2) Protective materials around exhaust outlets
      d. Freon vapor-cycle cooling system components
         (1) Liquid level inspection
         (2) Contamination inspection procedures
         (3) Repair and freon charging
      e. Expansion turbine air cycle cooling system components
         (1) Oil level inspection and safetying
         (2) Inspection of turbine and axial flow fan
      f. Sources of repair and replacement information
         (1) Service information
         (2) Troubleshooting and overhaul information
         (3) Illustrated parts breakdown
   2. Repair and Replacement Procedures for Oxygen System Components
      a. Oxygen system trouble symptoms and checks
         (1) Leak indications
         (2) Insufficient regulated flow to oxygen masks
         (3) Repair of flight crew oxygen regulators

V. CABIN ATMOSPHERE CONTROL SYSTEMS (Contd.)

b. Checking of walk-around and therapeutic oxygen equipment
   (1) Inspection requirements of walk-around oxygen system
   (2) Operation of therapeutic oxygen outlet

VI. QUINMESTER POST TEST

BLOCK I - AIRCRAFT INSTRUMENT SYSTEMS

A. Removal and Installation of Aircraft Instruments

1. Handling and Installation of Instruments

Given:

A random display of aircraft instruments, including direct pressure indicating instruments, gyro instruments, temperature indicating instruments, and remote indicators with transmitters.

Performance:

The student will remove at least three instruments from a mock-up, check performance of the instruments and reinstall them in the mock-up.

Standard:

The task of removing, checking and reinstalling the instruments will demonstrate precautions that will prevent damages to the instrument due to mishandling.

2. Preparation for Storage or Shipment

Given:

Three instruments from a mock-up and suitable cartons or storage containers, sealing plugs and shock absorbing shipping materials.

Performance:

The student will seal all openings to the instrument, attach an identification tag and prepare the instrument for storage or shipment.

Standard:

The task of sealing, tagging and preparing the instruments for storage or shipment will demonstrate precautions that will further prevent damage to the instruments.

3. Installing Instrument Panels and Instruments

Given:

An airplane or mock-up provided with mounting brackets, with instruments installed, appropriate panel shock mounts, written reference

information describing the number, type, load rating and procedure for installing the shock mounts and panel.

Performance:

The student will install the shock mounts, panel and instruments into the airplane or mock-up.

Standard:

The panel and instruments need not meet return-to-flight standards, but the installation of mounts, panel and instruments will fully comply with the written installation instructions.

B. Inspect, Check, Service, Troubleshoot and Repair Indicating Systems

1. Heading Indicators

Given:

Manufacturer's service manual or diagrams and written description of heading indicators, mounted in an airplane or mock-up.

Performance:

The student will inspect, check, service, troubleshoot and repair the instruments which have been made faulty by an action of the instructor.

Standard:

The student will interpret the written information, correctly identify and correct the fault in the instrument.

2. Pitot-Static Systems

Given:

Manufacturer's service manuals or diagrams and written description of pitot-static systems, mounted in an airplane or mock-up.

Performance:

The student will inspect, check, service, troubleshoot and repair the instruments which have been made faulty by the action of an instructor.

Standard:

The student will interpret the written information, correctly identify and correct the fault in the instrument.

3. Temperature Indicating Systems

Given:

Manufacturer's service manuals or diagrams and written description of temperature indicating systems, mounted in an airplane or mock-up.

Performance:

The student will inspect, check, service, troubleshoot and repair the instruments which have been made faulty by an act of the instructor.

Standard:

The student will interpret the written information, correctly identify and correct the fault in the instrument.

4. Pressure Indicating Systems

Given:

Manufacturer's service manuals or diagrams and written description of pressure indicating systems, mounted in an airplane or mock-up.

Performance:

The student will inspect, check, service, troubleshoot and repair the instruments which have been made faulty by an action of the instructor.

Standard:

The student will interpret the written information, correctly identify and correct the fault in the instrument.

5. Gyro Systems

Given:

Manufacturer's service manuals or diagrams and written description of gyro systems, mounted on an airplane or mock-up.

Performance:

The student will inspect, check, service, troubleshoot and repair the instruments which have been made faulty by the action of an instructor.

Standard:

The student will interpret the written information, correctly identify and correct the fault in the instrument.

BLOCK II - FIRE PROTECTION SYSTEMS

A. Inspection, Checking and Servicing of Smoke and Carbon Monoxide Detectors

1. Principles of Operation of Smoke Detectors
Given:
Written information and completion type essay statements concerning photo-electric and visual smoke detectors.
Performance:
The student will complete six statements concerning how smoke is detected by photo-electric and visual methods and how air sampling is accomplished for smoke detection.
Standard:
Correctly identify at least four statements.

2. Principles of Operation of Carbon Monoxide Detectors
Given:
Written information and multiple choice questions concerning chemical type carbon monoxide detectors.
Performance:
The student will answer 10 multiple choice questions on the uses of chemical type carbon monoxide detector buttons.
Standard:
Correctly answer at least 7 questions.

B. Aircraft Fire Detection and Extinguishing Systems

1. Types of Fire Detectors
Given:
Manufacturer's information or equivalent written information, samples or cut-away drawings of fire detectors and a mock-up with at least one type of operative aircraft fire detector system.
Performance:
The student will write a brief description of the methods of operation of each of the three basic fire detectors. On a mock-up, he will trace the circuit of a fire detection

system and activate the alarm system by heat applied to a fire detector on a mock-up. He will use a tester or voltohmmeter to locate a malfunction introduced into the mock-up circuit and correct the malfunction.

Standard:

At least two written descriptions will be correct in accordance with information provided, the circuit on mock-up will be accurately traced, the alarm will operate and the malfunction will be located and corrected to a return-to-service standard.

2. Selection and Operation of Fire Extinguishers

Given:

Written information or manufacturer's manuals, water and CO^2 or dry powder dry fire extinguishers, samples of fire extinguishing agents, provisions for safety conducting fire extinguishers and materials for class A and B fires, and questions with multiple choice answers, and excerpts from national or local fire safety regulations.

Performance:

The student will select answers to ten questions dealing with proper type of fire extinguishers to use for extinguishing class A, B, and C fires and the kinds of fires included in each classification. He will select proper types of extinguishers, and extinguish one trash or wood fire and one fuel fire. He will select ten answers to questions dealing with hazards and precautions in handling fire extinguishers, in fighting electrical fires and when using certain types of fire extinguishers in closed or poorly ventilated areas, and the characteristics of gasoline and kerosene fires and their extinguishment.

Standard:

Select at least 8 correct answers for each set of ten questions, and one correct type of extinguisher for each class A and B fire. He will handle fire extinguisher and extinguish fires in accordance with safety regulations provided.

3. Aircraft Built-in Fire Extinguishers

Given:

Manufacturer's or equivalent information, an airplane or mock-up with a built-in aircraft fire extinguisher system which is electrically controlled, suitable test equipment and tools.

Performance:

The student will draw a block diagram of the built-in fire extinguisher system, label each major component, showing unit name, location in aircraft and function. He will draw a simplified diagram of the electrical control circuit identifying components and listing function of each component. He will check continuity of the electrical circuit, check the pressure of the fire extinguisher agent in the container and list three possible causes for system failing to operate.

Standard:

At least 70% of the components will be correctly identified, properly located and correct function shown. The electrical circuit will be accurate in accordance with information provided. Container pressure and continuity check of the circuit will be done in accordance with procedures provided, and at least two possible causes of system failure will be correctly listed.

BLOCK III - WARNING AND POSITION SYSTEMS

A. Inspection, Checking, Servicing Speed and Take-Off Warning Systems and Anti-Skid Electrical Brake Controls

1. Principles of Operation, Inspection and Checks of Speed, Stall, and Take-off Warning Systems and Anti-skid Brake Control Systems

Given:

Written information, visual training aids or diagrams and multiple completion essay statements.

Performance:

The student will insert words to complete 20 multiple completion essay statements explaining the principles of operation and basic methods

of installation of speed or mach-warning, stall warning, take-off warning and electrical/hydraulic anti-skid brake control systems.

Standard:

At least 14 statements will be completed correctly.

2. Showing Simulated Operation of Anti-skid and Take-off Warning Systems

Given:

Animated diagrams or simulation mock-up of anti-skid and take-off warning systems.

Performance:

The student will set up the various simulated switches, solenoids, and valves on an anti-skid diagram for normal braking, then show by simulation what occurs when a skid develops on one wheel and on all wheels. On a take-off warning system diagram, he will set up the simulated switches for a normal take-off, then show how a switch would cause take-off warning if flaps were not in proper take-off position and show at least one other cause for take-off warning, on the diagram.

Standard:

At least one set-up of switches for anti-skid action will be correct and at least one cause for take-off warning will be properly shown.

B. Inspection, Checking and Troubleshooting of Landing Gear Position Indicating and Warning Systems

1. Inspecting, Checking, Troubleshooting and Repair of Landing Gear Position Indicating System

Given:

Manufacturer's manual or equivalent information and aircraft mock-up having retractable landing gear with a position indicating system installed and operating.

Performance:

The student will check the operation of the position indicating lights by operating the landing gear, inspect the components of the position indicating system, troubleshoot and repair three different malfunctions introduced by the instructor, with each malfunction being corrected before the next is introduced.

Standard:

Locate and repair at least two of the malfunctions to a return-to-flight level in accordance with procedures provided.

2. Inspecting, Checking, Troubleshooting and Repair of Landing Gear with a Warning System Installed and Operating

Given:

Manufacturer's manual or equivalent written information, an aircraft or mock-up having retractable landing gear with a warning system installed and operating.

Performance:

The student will check the operation of the warning lights or horn by operating the landing gear, inspect the components of the warning system, troubleshoot and repair three different malfunctions introduced by the instructor, with each malfunction being corrected before the next is introduced.

Standard:

Locate and repair at least two of the malfunctions to a return-to-flight level in accordance with procedures provided.

BLOCK IV - COMMUNICATION AND NAVIGATION SYSTEMS

A. Autopilot and Approach Control Systems

1. Operating Principles of Autopilots

Given:

Manufacturer's manuals, written information, and multiple choice essay statements.

Performance:

The student will complete 25 essay statements by supplying the correct answer, concerning the purposes and operation of an autopilot, the operating principles of the sensing devices used to provide heading, altitude, and altitude information to the autopilot, and the purpose and operation of servomotors.

Standard:

Correctly complete a minimum of 18 statements.

2. Operating Principles of Approach Control Systems
   Given:
   Manufacturer's manuals, written information, and a programmed text.
   Performance:
   The student will complete the programmed text, concerning the function of position transmitters, trim indicators, and the purpose and operation of an approach control system.
   Standard:
   The student will complete the program within the alloted time.

B. Aircraft Electronic Communication and Navigation Systems

1. Types and Installation of Electronic Communication and Navigation Equipment
   Given:
   AC 43.13-1 or equivalent published information, and questions with multiple choice answers.
   Performance:
   The student will select answers to 21 questions concerning electronic communication and navigation systems. The questions will deal with types of equipment used in various aircraft, where and how the equipment is mounted, cooling and reduction of electrical interference.
   Standard:
   Select at least 14 correct answers.

2. FCC Regulations Pertaining to Two-way Radio Operation
   Given:
   FCC Regulations pertaining to aircraft radio operation, or equivalent publication and questions concerning these regulations.
   Performance:
   The student will write answers to 10 questions concerning the operation of aircraft and ground radio transmitters, acceptable practices and vocabulary usage, proper recognition and acknowledgement procedures and rules covering display of licenses.
   Standard:
   Correct answers to at least 7 questions.

C. Antenna and Associated Electronic Equipment Installations

1. Repair and Replacement of Antennas and Associated Electronic Equipment

Given:

Manufacturer's manuals, AC 43.13-1, AC 43.9-1A, AC 43.13-2 or equivalent publications, an aircraft or mock-up with electronic installations which are using fixed wire, blade or whip and flush mounted antennas.

Performance:

The student will locate repair and replacement information for the various antennas. Using this information, he will replace one antenna and repair one other antenna which has been intentionally damaged by the instructor.

Standard:

Locate proper information and perform replacement and repairs in accordance with published procedures and specifications to a return-to-flight standard.

2. Identification and Purpose of Static Dischargers

Given:

Written information, AC 43.13-1 or equivalent publication, sample static dischargers on an aircraft or mock-up and drawings of static dischargers which include carbon impregnated braid types, metallic types, null-field types and an ohmmeter.

Performance:

The student will identify each of the three types of static dischargers and write a brief description of how each type performs its intended function, inspection procedures and basic wear and damage indications requiring repair. He will also inspect the mounting and test the epoxy bond resistance.

Standard:

At least two identifications, two descriptions of functions, and two descriptions of repair procedures will be correct, in accordance with information provided.

BLOCK V - CABIN ATMOSPHERE CONTROL SYSTEMS

A. Heating, Cooling, Air Conditioning and Pressurization Systems

1. Principles of Operation and Control of Cabin Pressurization

   Given:

   Written information, schematic diagrams and questions with multiple choice answers concerning aircraft cabin pressurization.

   Performance:

   The student will select answers for 25 questions concerning the basic principles of cabin pressurization, how it is controlled, the relationship of cabin pressure to ambient pressure during a flight, the purpose and operation of check valves in delivery air ducts, outflow valves, emergency relief valves and negative pressure relief valves.

   Standard:

   Select correct answers to at least 18 questions.

2. Functions and Principles of Air Conditioning

   Given:

   Written information and diagrams of an aircraft air conditioning system.

   Performance:

   The student will write a brief description of the functions of each of the components in an air conditioning system.

   Standard:

   At least 8 descriptions will be in accordance with information provided.

3. Aircraft Combustion Heaters and Exhaust Type Heat Exchangers

   Given:

   Written information and questions with multiple choice answers concerning aircraft surface combustion heaters and exhaust type heat exchangers.

   Performance:

   The student will select answers for 10 questions, with regard to surface combustion heater operating principles and trouble-shooting, exhaust type heat exchanger

operation and troubleshooting, and inspection requirements of cabin heating units.

Standard:

Select correct answers for at least seven questions.

4. Aircraft Vapor-cycle and Air-cycle Cooling Systems

Given:

Written information, unlabeled diagrams and completion type essay statements relative to aircraft vapor-cycle and air-cycle cooling systems.

Performance:

The student will inspect labels in spaces provided to identify components in diagrams of a freon vapor-cycle aircraft refrigeration system and an aircraft air-cycle cooling system. He will complete essay statements concerning freon system components, air-cycle machine components and checking, servicing and troubleshooting aircraft cooling systems.

Standard:

Correct labels and completion words for at least 70% of the spaces provided.

B. Aircraft Oxygen Systems

1. Uses and Purposes of Oxygen Systems

Given:

Manufacturer's service manual, or equivalent publication, check sheet or work card, an aircraft or mock-up with an operative oxygen system.

Performance:

The student will check the oxygen system for leakage, check bottle pressure and replace a high pressure oxygen bottle. He will inspect oxygen masks for contamination and check an oxygen mask and regulator for proper operation.

Standard:

All performance will be in compliance with the check sheet or work card provided.

2. Oxygen Handling Precautions

Given:

Written information sheets and 10 questions with multiple choice answers.

Performance:

The student will select answers to 10 questions dealing with repair or replacement of oxygen system components, including high pressure oxygen bottles, regulators, walk-around bottles and regulators, oxygen masks, ground servicing precautions and therapeutic oxygen equipment.

Standard:

Select at least 8 correct answers.

C. Repair Procedures of Cabin Atmosphere Control Systems

1. Identification of Cabin Atmosphere Control System Components

Given:

Written information and unlabeled cut-away drawings.

Performance:

The student will identify and label the major components in a cut-away drawing of a surface combustion heater, fuel and combustion air inlets, ventilating air inlets and outlets, exhaust, fuel nozzle, spark plug, overheat thermal switches and show flow patterns by arrows. He will label the major components of a freon-vapor-cycle cooling system. He will identify and label the following items in an air-cycle cooling system, turbine air intake and outlet, turbine, axial flow fan, fan air intake and outler, oil reservoir, bearing, oil wick, primary and secondary heat exchange and show air route through the turbine, heat exchangers and fan outlet section.

Standard:

Correct labels and arrows for at least 70% of the specified items.

2. Repair and Replacement Procedures for Oxygen System Components

Given:

Manufacturer's service manuals, AC 43.13-2 or equivalent publication, samples of drawings of oxygen system components, and multiple choice questions.

Performance:

The student will select answers to 10 questions dealing with replacement of oxygen system components, flight crew masks, passenger oxygen masks and therapeutic oxygen equipment.

Standard:

Select at least 8 correct answers.

BIBLIOGRAPHY
(Aircraft Instrument, Fire Protection, Warning, Communication, Navigation and Cabin Atmosphere Control Systems)

Basic References:

1. Northrop Institute of Technology. Maintenance and Repair of Aerospace Vehicles. 3rd ed. New York: McGraw-Hill Book Company, Inc., 1967. Pp. 358.

2. Northrop Institute of Technology. Basic Science for Aerospace Vehicles. 1st ed. New York: McGraw-Hill Book Company, Inc., 1963. Pp. 320.

Supplementary References:

1. U.S. Department of Air Force. Ground Safety; Accident Prevention Handbook. AFM 32-3. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1962. Pp. 348.

2. Northrop Institute of Technology. Electricity and Electronics for Aerospace Vehicles. 1st ed. New York: McGraw-Hill Book Company, Inc., 1962. Pp. 392.

3. U.S. Department of Air Force. Fundamentals of Electricity for Aircraft Maintenance, AF 52-7. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1962. Pp. 162.

Federal Aviation Publications:

1. Federal Aviation Administration. Federal Aviation Regulations Parts: 1, 23, 25, 27, 29, 37, 39, 43, 45, 47, 65, 91 and 145. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1969.

2. Federal Aviation Administration. Aircraft Type Certificate Data Sheets and Specifications. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1967.

3. Federal Aviation Administration. Summary of Supplemental Type Certificates. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1965.

4. Federal Aviation Administration. Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair, Advisory Circular 43.13-1. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1965. Pp. 232.

5. Federal Aviation Administration. Acceptable Methods, Techniques, and Practices - Aircraft Alterations, Advisory Circular 43.13-2. Washington, D.C.: U.S. Government Printing Office, 1965. Pp. 74.

6. Federal Aviation Administration. Airframe and Powerplant Mechanics Examination Guide, Advisory Circular 65-2A. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1969. Pp. 63.

Films:

1. Oxygen Equipment Servicing. 16mm. 21 min. Black and White.

Filmstrips:

1. Aircraft and Radio Communications. Part A. Color. Sanderson Films.
   Aircraft and Radio Communications. Part B. Color. Sanderson Films.

2. Aircraft Wiring Systems. Part I. #201. 35mm. Black and White.
   Aircraft Wiring Systems. Part II #202. 35mm. Black and White.

3. Cessna Instruments and Systems. Part A. 35mm. Color. Sanderson Films.
   Cessna Instruments and Systems. Part B. 35mm. Color. Sanderson Films.
   Cessna Instruments and Systems. Part C. 35mm. Color. Sanderson Films.

4. Electric Instruments. Color. FOM.

A P P E N D I X

Quinmester Post Test Sample

Quinmester Post Test

Name_____ Date_____ Score_____

Multiple Choice Test Items

Each statement needs a word, a figure or a phrase to make it correct. Only one of the choices listed is correct. Place the number of the choice you make in the space provided on the answer sheet.

1. After normal discharge of a fire extinguisher system, you should
    1. purge the system with nitrogen and replace the bottle
    2. purge the system with water and replace the bottle
    3. flush the system with a mild chemical solution
    4. replace the bottle

2. If the sight gauge on a freon air conditioning system indicates low, you should
    1. add oil to the freon and operate the system
    2. operate system and see if the system stabilizes
    3. refill system and recheck level
    4. operate system and check for leaks

3. The function of the condenser in the freon air-conditioning system is to
    1. change the freon into a liquid to supply the compressor
    2. cause the freon to give up heat to the outside air
    3. absorb the outside air, changing the liquid into a gas
    4. condense the hot liquid freon into a gas

4. How is radio equipment mounted?
    1. Supported by grounding straps
    2. With shock mounts between the equipment and the aircraft structure
    3. Bolted down solid to avoid shifting
    4. Supported by cradle straps

5. The purpose of a position transmitter in an autopilot system is
    1. to inform the autopilot when you are on course
    2. sense static and dynamic air pressure changes and send signal
    3. to produce a signal proportional to the angular displacement of a control surface
    4. to send a rate signal, proportional to variation

6. What is the primary purpose of an autopilot system?
    1. To relieve the pilot on long periods of flight
    2. To hold a predetermined heading
    3. To hold an exact heading during rough weather
    4. To aid in making precision instrument approaches to a field

7. Built-in fire extinguisher systems for reciprocating engines are usually charged with
    1. carbon dioxide and nitrogen
    2. carbon tetrachloride
    3. sodium bicarbonate
    4. freon and nitrogen

8. What color are fire extinguisher system lines coded?
    1. Yellow
    2. Red and green
    3. Green and yellow
    4. Brown

9. In a landing gear system, what indicates proper position?
    1. Red light-unsafe gear, green light-down, no light-gear up
    2. Red light-unsafe gear, green light-gear up, green light-gear down
    3. Red light-unsafe gear, green light-gear-up, no light-gear down
    4. Red light-gear up, green light-gear down, no light-gear in transit between up and down

10. Pertaining to the rate of climb indicator, if the rate of climb rises too rapidly
    1. adjust the inflow of air
    2. equalize cabin pressure
    3. adjust the outflow valve
    4. open valve in manual controller by shifting to "auto"

11. The purpose of a cabin pressurization control valve is to
    1. turn the compressor on and off
    2. vent excess air overboard
    3. control the compressor volume
    4. return the air to the compressor

12. After fully pressurizing an oxygen system, the leakage rate should not exceed
    1. 2% in a period of 12 hours
    2. 1% in a period of 24 hours
    3. no leakage allowed
    4. one-half percent in 24 hours

13. When checking an oxygen system for leaks, you should
    1. use a special soap solution and check for bubbles
    2. use a fast spreading cleaning solvent on the fittings
    3. torque all fittings and check for cracks
    4. check for cracks with dye penetrant

14. What unit in the autopilot system applies the torque to the control surfaces?
    1. The rate transmitter
    2. The controller
    3. The discriminator
    4. The servo unit

15. When mounting a loop antenna on the bottom of an aircraft, caution should be taken
    1. to secure it to a primary structure
    2. not to secure it to a primary structure
    3. to mount it no more than 30^{o} from the vertical axis
    4. to have the null parallel to the longitudinal axis

16. When installing a DME or LOOP antenna, it should be aligned
    1. near the centerline of the aircraft
    2. with the lateral axis
    3. with the vertical axis
    4. in such a manner as to eliminate the null

17. Under which of the following conditions will the landing gear warning horn blow?
    1. Gear down and locked and throttles retarded
    2. Gear up and locked and throttles retarded
    3. Gear down and locked and throttles advanced
    4. Gear up and locked and throttles advanced

18. The electrical solenoid in an aircraft anti-skid system
    1. traps pressure in the brake
    2. relieves pressure to the brakes
    3. transfers pressure to the opposite brake
    4. dumps boost pressure, allowing less pressure to the brakes

19. In a fixed-fire extinguishing system, a thermal discharge of the system is indicated by the exposure of a
    1. yellow disc
    2. green disc
    3. blue disc
    4. red disc

20. What is the purpose of the "Jet Pump" in an air conditioning system?
    1. Pumps compressor freon
    2. Pumps bleed air to the turbine
    3. Draws large amounts of air through the heat exchanger
    4. Pumps cold air to the mixing valve

21. A mixing valve in an air conditioning system
    1. mixes cabin air with dry air to lower humidity
    2. limits the flow of hot, cold or cool air
    3. mixes outside air with cabin air
    4. mixes cabin air with cargo compartment air

22. Which instruments use both pitot and static pressure?
    1. Gyro compass
    2. Airspeed indicator
    3. Altimeter
    4. Turn and slip indicator

23. A loop-fire signaling device works by
    1. gases in the line exerting pressure when heated
    2. terminals coming to a melting point
    3. a thermocouple and a heat detecting wire
    4. ceramic material in a tube changing resistance when heat is applied

24. To extinguish a brake fire, you would use
    1. a dry chemical
    2. carbon dioxide
    3. foam
    4. water

25. How would you check a fire extinguisher bottle for full charge?

1. Weigh it
2. Sight gauge
3. A dip stick
4. Pressure meter

KEY TO QUINMESTER POST TEST
9067.04

1.	4	9.	1	17.	2
2.	4	10.	3	18.	2
3.	3	11.	2	19.	4
4.	2	12.	2	20.	4
5.	3	13.	1	21.	2
6.	1	14.	4	22.	2
7.	1	15.	1	23.	4
8.	4	16.	1	24.	1
				25.	1