

SYLLABUS
POWERPLANT PHASE VI
AVIA-1260

2011

WESTERN NEBRASKA COMMUNITY COLLEGE
DIVISION OF APPLIED TECHNOLOGY

I. CATALOG DESCRIPTION:

AVIA-1260

Powerplant Phase VI

Prerequisite: None

This course is a study of the history and development of the jet engine and its operating principles. The Brayton cycle is compared to the four-stroke engine in thermodynamics and components. Engine compressor and turbine section design and efficiency will provide the student a comprehensive understanding of the engine. Variations of the turbine engine will be reviewed as auxiliary power units, unducted fans, turboprop, turbo shaft and high bypass fans. Reciprocating and turbine engine induction, exhaust and instrumentation complete this course. **Offered spring semester only.**

(6/70/120/0/0/13)

II. COURSE OBJECTIVES/COMPETENCIES:

- A. Develop safe work habits, and performance skills required of the aviation industry in Engine Induction & Exhaust, Engine Instruments, Turbine Engine Theory as well as Auxiliary Power Units and Unducted Fans. [GE Goal: 5]
- B. Communicate technical data effectively through written, electronic and oral skills. [GE Goal: 1]
- C. Select and interpret data from multiple sources used in the Aviation Industry. [GE Goal: 3]
- D. Develop the critical thinking skills required to execute effectively the tasks listed in the competency section of AVIA-1260. [GE Goal: 2]
- E. Demonstrate the importance of developing quality human relations skills with customers, and fellow employees. [GE Goal: 4]

III. INSTRUCTIONAL MATERIALS:

A. Text

1. Jeppeson. *AC-65-12A Powerplant Textbook.*
2. Jeppeson. *AC-65-9A General Handbook.*
3. Jeppeson. *FAR's Federal Aviation Regulations.*
4. Jeppeson. *AC-43-13-1B Acceptable Methods, Techniques &*

Practices.

5. Jeppeson. *Standards Handbook.*
6. Jeppeson. *Aircraft Technical Dictionary.*
7. Manufacturer's Data

B. Audio-Visual Aids

1. Videos
2. White board
3. Overhead projector, transparencies
4. Overhead data, Service Bulletins, Type Certificate Data

C. Instructional Equipment

1. Aircraft operational turbine and reciprocating engines
2. Turbochargers and controls
3. Complete exhaust system
4. APU's
5. Equipment to perform inspection of aircraft engines
6. Anti-icing mock-up
7. Spar exhaust section
8. FAR 23, 25 and 43
9. Engine and propeller type certificate and data sheets
10. Airworthiness Directives

IV. COURSE OUTLINES:

A. Propulsion Principles

1. A review of physics applications
2. Potential and kinetic energy
3. Gas flows

4. Heat, pressures temperatures and velocities
5. Tests/written and practical

B. Aircraft Turbine Engines

1. Rocket engines, pulse jets, ram jets and turbojet engines
2. Tests/written and practical

C. Types of Turbines

1. Turbojet, turboprop, turboshaft, turbofans
2. Thrust production, momentum change, air pressures, velocities and factors affecting thrust
3. Thrust augmentation, water after burning or reheat mechanism

D. Turbine Engine Station Designations

E. Cold Sections

1. Inlet ducts, subsonic and supersonic
2. Compressor types, centrifugal and axial flow
3. Inlet guide vanes
4. Anti-compressor stall devices
5. Other types of compressors
6. Bypass ratios
7. Construction features
8. Maintenance, performance loss
9. Tests/written and practical

F. Hot Sections

1. Combustion design, advantages and disadvantages
2. Turbine section elements
3. Loads imposed on
4. Materials and coatings

5. Cooling and factors affecting life
6. Tests/written and practical

G. Maintenance checks and servicing of turbines

1. Compressor wash
2. Hot section inspection
3. Performance checks, causes of lost thrust
4. Engine “trimming” and performance
5. Engine overhaul procedures
6. Tests/written and practical

H. Reverse Thrust of Turbines

1. Propeller reverse
2. Turbojet reverse
3. Bypass fan reverse
4. Tests/written and practical

I. Starting, Operation and Safety

1. Preparing the engine to run
2. Preflight engine
3. Area check
4. Check run-up cell
5. Fire guard, hearing protection
6. Tests/written and practical

J. Unducted Fan Engine

1. Advantages: S.F.C., low noise level, low propulsive, efficiency high
2. Disadvantages: complexity and vibration
3. Tests/written and practical

K. Auxiliary Power Units

1. Supplies aircraft with electrical power and compressed air during ground activities
2. Starting operation and maintenance
3. Tests/written and practical
4. Aircraft Exhaust Systems
5. Collectors for horizontal and radial engines
6. Construction techniques and materials
7. Turbochargers, waste gates
8. Leak checks
9. Inspection, checks and maintenance of the system
10. Tests/written and practical

L. Reciprocating Engine Induction Systems

1. Naturally aspirated systems
2. Filters, alternate air, carburetor heat
3. Hot spot and ice protection
4. Superchargers, sea level, altitude, internally driven
5. Turbo superchargers, construction and operation
6. Turbochargers and controls
7. Inspection, checks and maintenance of the systems
8. Tests/written and practical

M. Instruments

1. Pressure measurement and types
2. Dynamic and static pressure
3. Temperature measurement
4. Powerplant instruments

5. Marking, installation and maintenance
6. Electronic instrumentation
7. Type certificate data sheets
8. Tests/written and practical

V. METHOD OF PRESENTATION:

- A. Class Lecture
- B. Discussion
- C. Shop Demonstration
- D. Films
- E. Individual and Group Activities
- F. Group Problem Solving Sessions

VI. METHOD OF EVALUATION:

A. Criteria

1. Safe work habits and safety procedures observed
2. Craftsmanship
3. Selection and interpretation of reference data
4. Verbal and written knowledge of subject
5. Time of complete project
6. Tests/written and practical

B. Schedule of Tests

1. A final test will be administered upon the completion of all practical projects and classroom instruction. A progress tests will be administered during the course wherever the word "TEST" appears in the course outline

C. Attendance

1. Any time a student is absent, it must be made up to the FAA criteria requirements

VII. COMPETENCY TASK LIST:

A. Introduction to Turbine Engines

1. Nomenclature
2. Principles of operation
3. Study of the pressure volume cycle of turbine engines
4. Factors affecting operation and power performance of turbine engines

B. Overhaul Turbine Engines

1. Identification of components and explain airflow of fan and by-pass turbines
2. Removal and installation of combustion cases and liners
3. Inspection of compressor and turbine blades for stretch, erosion, and foreign object damage
4. Criteria concerning component replacement
5. Modular components

C. Inspect, Check, Service and Repair Turbine Engines and Turbine Engine Installations

1. Basic designs and methods of attachment for turbine blades
2. Types of failures to which turbine components are susceptible
3. Attachment of turbine engines to airframe and/or pods

D. Install, Troubleshoot and Remove Turbine Engines

E. Inspect and Troubleshoot Unducted Fan Systems and Components

1. Introduction to unducted fan systems
2. Operation of unducted systems

F. Auxiliary Power Units

1. Inspect, check, service and troubleshoot turbine-driven auxiliary power units

G. Inspect, Check, Troubleshoot, Service, and Repair Engine Exhaust Systems

1. Inspect, remove, replace, adjust, and repair joints in the exhaust system
 2. Inspect, remove and re-install exhaust heaters
 3. Identify, inspect and describe the operation of turbo-superchargers
- H. Troubleshoot and Repair Engine Thrust Reverser Systems and Related Components
1. Identify and describe the operation of clamshell and cascade thrust reversers
 2. Methods of troubleshooting and repair of thrust reverser systems
- I. Repair Engine Exhaust System Components
1. Recognize materials used in exhaust system components and describe repair procedures
- J. Inspect, Check, Service, Troubleshoot and Repair Engine Ice and Rain Control Systems
1. Describe induction icing and identify probable locations
 2. Inspect, check, service and repair a carburetor preheat system or hot spot
 3. Describe operation of thermal anti-icing systems for turbine engine air intakes
- K. Inspect, Check, Service, Troubleshoot and Repair Heat Exchangers, Superchargers, and Turbine Engine Airflow and Temperature Control Systems
1. Inspection and repair of superchargers
 2. Inspect, service and check a supercharger system
 3. Inspect heat exchangers and describe methods of repair
- L. Inspect, Check, Service, and Repair Carburetor Air Intake and Induction Manifolds
1. Inspect, check, service and repair an air intake duct for a carbureted engine
 2. Inspect, check, service, and repair a carburetor heater system

3. Inspect and service air screens or air filters in the engine air intake
 4. Inspect, check, service, and repair an engine primer system
- M. Troubleshoot, service and repair electrical and mechanical fluid rate of flow indicating systems
1. Troubleshoot, service and repair fluid rate of flow indicating systems
- N. Inspect, check, service, troubleshoot and repair electrical and mechanical engine temperature, pressure and RPM indicating systems
1. Operating principles and installation practices of temperature indicating systems for aircraft engine instrumentation
 2. Check, troubleshoot and repair thermocouple and resistance/radiometer temperature indicating systems
 3. Inspect, check, troubleshoot and repair engine tachometer systems
 4. Purposes, operating principles, requirements and applications of engine inlet and outlet temperature indicating systems
 5. Purpose, operating principles and troubleshooting of manifold pressure indicating systems
 6. Purposes, operating principles and applications of pressure indicating and warning systems used with aircraft engines

VIII. ACADEMIC INTEGRITY:

Academic integrity represents a fundamental bond of trust between colleagues, peers, teachers, and students; academic integrity influences and often controls a learner's individual odyssey. At Western Nebraska Community College, there is no tolerance for plagiarism or any form of academic dishonesty, including unacknowledged "borrowing" of proprietary material, copying answers or papers, or passing off another's work as one's own. Such acts are reported to the appropriate authorities.

A breach of ethics or act of dishonesty can result in:

- failure of a paper or exam within a course
- failure of an entire course (blatant plagiarism, cheating on a test or quiz)
- academic suspension or expulsion from the college

IX. EQUAL ACCESS STATEMENT:

Western Nebraska Community College is committed to providing reasonable accommodation to persons with disabilities. If you qualify under the Americans with Disabilities Act (ADA), please notify the Director of Counseling, 308-635-

6090, as soon as possible to begin the process of documentation review and determination of appropriate accommodation or adaptive strategies.

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