



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

LAST REVIEW: 2007-2008

(i.e. 2003-2004)

NEXT REVIEW: 2012-2013

(i.e. 2008-2009)

STATUS: A

(A, I, D)

COURSE TITLE: Reciprocating Engines

COMMON COURSE NUMBER: AMT 2300

CREDIT HOURS: 5

CONTACT HOUR BREAKDOWN

(per 16 week term)

CLOCK HOURS: 152.25

(Voc. Course ONLY)

Lecture: 45

Lab: 107.25

Clinic:

Other:

PREREQUISITE(S): None

COREQUISITE(S): None

PRE/COREQUISITE(S): None

COURSE DESCRIPTION *(750 characters, maximum):* The course is designed to cover theory and fundamental requirements for aircraft engines: basic parts of internal combustion engines, two strokes and four strokes cycle, power measurements and calculations, conversion of heat energy into mechanical energy, horsepower, piston displacement, compression ratio, types of horsepower, crankcase assembly, reduction gearing, crankshafts and rod assemblies, cylinder and piston assemblies, and bearings used in reciprocating engines. Student fee charged.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

UNIT TITLES

1. 14-Cylinder or Larger Radial Engine
2. Reciprocating Engine Overhaul
3. Opposed and Radial Engines and Reciprocating Engine Installations
4. Reciprocating Engines

ASSESSMENT:

Please provide a brief description *(250 characters maximum)* that details how students will be assessed on the course outcomes.

1. **Quizzes, Test, and/or Final Exam (cumulative/comprehensive);**
2. **Selected faculty may assess homework, projects, class participation/attendance, and/or extra credit projects.** Upon successful completion of this course, the students should be able to demonstrate an understanding of the theory and basic requirements for aircraft engines.



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UNITS

Unit 1 14-Cylinder or Larger Radial Engine

General Outcome:

- 1.0 The student shall:** The students should be able to inspect and repair 14-cylinder or larger radial engines.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1** Explain the purpose and advantages of using propeller reduction gearing.
- 1.2** Define the characteristics of thrust bearings used in large radial engines.
- 1.3** Define the characteristics of crankshaft bearings used in large radial engines.
- 1.4** Discuss the construction characteristics of the crankshaft and rod assemblies for a two-row radial engine.
- 1.5** Define the loads acting on the power case and nose case of a large radial engine during various conditions of operation.
- 1.6** Describe the methods of classifying reciprocating engines.
- 1.7** Explain the factors that affect the volumetric efficiency of an engine.
- 1.8** Determine the cylinder firing order for various types of engines.



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Unit 2 Reciprocating Engine Overhaul

General Outcome:

2.0 The student shall: The students should be able to overhaul reciprocating engines.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Explain the purpose and operating principles of dynamic dampers used in aircraft engines.
- 2.2 Discuss the characteristics of various crankshaft designs.
- 2.3 Describe the basic operating principles of four-stroke cycle engines.
- 2.4 Explain the characteristics of various piston pin and knuckle pin retention devices.
- 2.5 Discuss the processes used to harden cylinder bores.
- 2.6 Explain the purpose and applicability of choke-type or taper-ground cylinders.
- 2.7 List the wear characteristics of engine cylinder walls.
- 2.8 Explain the purpose of valve overlap in some engines.
- 2.9 Describe the effects of various poppet-type valve face angles.
- 2.10 Explain the characteristics of various types of valve operating mechanisms.
- 2.11 Describe the operating characteristics of zero-lash hydraulic valve lifters.
- 2.12 Time engine valves during engine assembly.
- 2.13 Install valve guides.
- 2.14 Grind and resurface valves and valve seats.



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- 2.15 Explain the purpose of using relatively large piston-to-cylinder wall clearances in aircraft engines.
- 2.16 List the indications of failed or failing engine bearings.
- 2.17 Describe the result of operating an engine at high power settings before the lubricating oil has come up to operating temperature.
- 2.18 Check piston rings for correct end and side clearance.
- 2.19 Check valve stems for stretch.
- 2.20 Repair a scored aluminum piston.
- 2.21 Perform crankshaft "run out."
- 2.22 Prepare engine for disassembly before overhaul.
- 2.23 Measure inside diameter, taper, and out-of-round of a cylinder bore.
- 2.24 Install cylinders and tighten hold-down nuts.
- 2.25 Describe the construction characteristics of air-cooled engine cylinders.
- 2.26 Describe the construction characteristics and the operating principles of poppet-type engine valves.
- 2.27 Describe the construction characteristics of aircraft engine pistons.
- 2.28 List the types and arrangements of piston rings used in aircraft engines.
- 2.29 Explain the purpose of using more than one spring on aircraft engine valves.
- 2.30 Describe the operating principles and construction of spur and pinion-type and planetary-type propeller reduction gearing.
- 2.31 Explain the principles of construction and operation of accessory gear drive trains on reciprocating engines.



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- 2.32 Inspect cast and forged engine crankcase assemblies.
- 2.33 Remove and install studs in engine crankcase and accessory sections



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Unit 3 Opposed and Radial Engines and Reciprocating Engine Installations

General Outcome:

3.0 The student shall: The students should be able to inspect, check, service and repair opposed and radial engines and reciprocating engine installations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Check and adjust engine valve clearances.
- 3.2 Determine the speed and direction of rotation of the cam ring in various radial engines.
- 3.3 Describe the effect of excessive or insufficient valve clearance on engine operations.
- 3.4 Discuss the relationship between operating valve clearance and cold valve clearance.
- 3.5 Perform an ignition system operational check.
- 3.6 Determine the condition of cable-operated engine control systems.
- 3.7 Check and adjust engine idling speed and mixture.
- 3.8 Detect and determine the cause of a "cold" cylinder.
- 3.9 Identify the purpose of establishing one or more critical ranges for certain engine-propeller combinations.
- 3.10 Describe the operating indications of a worn or weak engine.
- 3.11 Explain the effect of a leaking oil dilution valve on engine operation.
- 3.12 Describe the effect of a low oil supply on engine operation.
- 3.13 Describe the indications of a correctly functioning engine oil system.



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- 3.14 Describe the probable cause of oil being thrown out of the breather of a wet-sump engine.
- 3.15 Determine the source and cause of metallic particles found on the oil screen during engine inspection.
- 3.16 Explain the effect of an unbalanced propeller on engine operation.
- 3.17 Describe the power settings most desirable for protracted engine operation.
- 3.18 Dilute engine oil in preparation for cold weather starting operations.
- 3.19 Explain the purpose and operating principles of engine dynamic suspension systems.
- 3.20 Install and time a magneto.



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Unit 4 Reciprocating Engines

General Outcome:

- 4.0 **The student shall:** The students should be able to install, troubleshoot, and remove reciprocating engines.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Describe the effect of throttle position upon fuel-air mixture in the cylinders during starting.
- 4.2 Pre-oil an overhauled engine before starting.
- 4.3 Install air-cooled engine baffles.
- 4.4 Describe the method of hoisting or lifting engines during removal and installation.
- 4.5 Explain the effect of increased engine manifold pressure on master rod bearing load.
- 4.6 Explain the effect of increased engine manifold pressure on master rod bearing load.
- 4.7 Explain the effect of air density on engine power output.
- 4.8 List the causes of engine backfire.
- 4.9 Describe the basic operational sequence for increasing or reducing the power output of an engine equipped with a constant-speed propeller.
- 4.10 List the factors that affect an engine's tendency to detonate.
- 4.11 Explain the effect of induction system air leaks on engine operation.
- 4.12 Describe the indications of a leaking primer system during engine operation.
- 4.13 Explain the effect of exhaust back pressure on engine power output.



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- 4.14 Describe the result of incorrect fuel-air mixture adjustments.
- 4.15 Explain the indication and effect of carburetor icing.
- 4.16 Operate and adjust mechanical push-pull control systems.