



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

LAST REVIEW: 2008-2009
2007-2008

NEXT REVIEW: 2013-2014
2012-2013

STATUS: A
A

COURSE TITLE: Multi-Engine Transition

COMMON COURSE NUMBER: ATF 2400

CREDIT HOURS: 1

CONTACT HOUR BREAKDOWN

(per 16 week term)

CLOCK HOURS:

Lecture: 5 Lab: 20

Clinic: Other:

PREREQUISITE(S): Private Pilot Certificate with Instrument Rating or Instructor’s Approval

COREQUISITE(S): ATF2630

PRE/COREQUISITE(S):

COURSE DESCRIPTION:

This course provides the flight training and experience required to obtain an FAA multi-engine rating. In order to receive credit for this course, the student must have earned a FAA multi-engine rating. Flight training fees are paid directly to the College in advance.

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. Preflight Preparation
2. Multiengine Operation
3. Ground Operations
4. Airport and Traffic Pattern Operations
5. Takeoffs and Climbs
6. Instrument Flight
7. Flight at Critically Slow Airspeeds
8. Emergency Operations
9. Approaches and Landings



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

EVALUATION:

Student will be assessed upon successful completion of the course outcomes by meeting the FAA Practical Test Standards for a multi engine rating and adding a multi engine rating to an existing FAA certificate.



Common Course Number: ATF 2400

UNITS

Unit 1: Preflight Preparation

General Outcome:

- 1.0 The student shall:** Be able to complete tasks relative to preflight preparation in the following areas: certificates and documents, obtaining weather information, cross-country flight planning, night flight operations and aero medical factors.

Specific Measurable Learning Outcomes:

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

- 1.1** Exhibit commercial pilot knowledge by explaining the appropriate:
- A. Pilot certificate privileges and limitations applicable to flights for compensation or hire.
 - B. Medical certificate, class and duration.
 - C. Personal pilot logbook or flight record.
- 1.2** Exhibit commercial pilot knowledge by locating and explaining the significance and importance of the:
- A. Airworthiness and registration certificates.
 - B. Operating limitations, handbooks and manuals.
 - C. Equipment list.
 - D. Weight and balance data.
 - E. Maintenance requirements, tests and appropriate records applicable to flights for hire, including preventive maintenance and maintenance that can be performed by the pilot.
- 1.3** Exhibit commercial pilot knowledge of aviation weather information including high altitude weather and weather activity over wide geographical areas, by promptly and systematically obtaining, reading and analyzing:



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- A. Weather reports and forecasts.
 - B. Weather charts.
 - C. Significant weather prognostics.
 - D. Constant pressure prognostics.
 - E. Pilot weather reports.
 - F. SIGMETs and AIRMETs, including wind-shear reports.
 - G. Notices to Airmen.
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- 1.4** Exhibit commercial pilot knowledge and awareness by explaining aviation weather hazards.
 - 1.5** Use critical judgment in making a competent go/no-go decision based on the weather information.
 - 1.6** Exhibit commercial pilot knowledge by promptly and systematically planning VFR cross-country flights near the maximum range of the airplane, considering payload and fuel including one leg for night operations.
 - 1.7** Select and use current and appropriate aeronautical charts.
 - 1.8** Plot a course for the intended route of flight, including fuel stops, available alternates and suitable course of action for various situations.
 - 1.9** Select prominent en route checkpoints.
 - 1.10** Select most favorable altitudes or flight levels, considering weather conditions and equipment capabilities.
 - 1.11** Compute flight time, headings and fuel requirements.
 - 1.12** Select appropriate radio aids for navigation and communications.
 - 1.13** Identify airspace, obstruction(s) and terrain features.
 - 1.14** Extract and record pertinent information from Airport/Facility Directory publications, including NOTAM and airport information.
 - 1.15** Complete a navigation log.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- 1.16** Complete and simulate filing a VFR flight plan.
- 1.17** Exhibit commercial pilot knowledge by explaining night visual perception including:
- A. Function of various parts of the eye essential for night vision.
 - B. Adaptation of the eye to changing light conditions.
 - C. Correct use of the eye to accommodate changing light conditions.
 - D. Coping with illusions created by various light conditions.
 - E. Effects of pilot's physical condition on visual perception.
 - F. Aids for increasing vision effectiveness.
- 1.18** Exhibit commercial pilot knowledge by explaining personal equipment recommended for night flight operations including:
- A. Types and use of various lighting.
 - B. Arrangement of equipment.
- 1.19** Exhibit commercial pilot knowledge by explaining airplane lighting and equipment for night flight operations including:
- A. Required equipment.
 - B. Additional equipment recommended.
 - C. External light interpretation.
- 1.20** Exhibit commercial pilot knowledge by explaining airport and navigation lighting including:
- A. Meaning of various lights.
 - B. Determining status of lights.
 - C. Airborne activation of runway lights.
- 1.21** Exhibit commercial pilot knowledge by explaining airplane night operations including:
- A. Preparation and preflight.
 - B. Starting, taxiing and run-up
 - C. Takeoff and departure.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- D. Orientation and navigation.
- E. Night emergencies.
- F. Approaches and landings.

1.22 Exhibit knowledge of the elements related to aero-medical factors including:

- A. Hypoxia.
- B. Hyperventilation.
- C. Middle ear and sinus problems.
- D. Spatial disorientation.
- E. Motion sickness.
- F. The effects of alcohol and drugs.
- G. Carbon monoxide poisoning.
- H. Stress and fatigue.

1.23 Exhibit knowledge of nitrogen excesses during scuba dives and explains how this affects a pilot and passenger during flight.



Common Course Number: ATF 2400

Unit 2: Multiengine Operation

General Outcome:

2.0 The student shall: Be able to complete tasks relative to multiengine operation in the following areas: operation of airplane systems, emergency procedures, determining performance and limitations, flight principles engine inoperative and use of minimum equipment list.

Specific Measurable Learning Outcomes:

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

- 2.1** Exhibit commercial pilot knowledge by accurately explaining the applicable normal operating procedures and limitations of the airplane's systems using correct terminology in identifying components, including:
- A. Primary flight controls and trims.
 - B. Wing flaps leading edge devices and spoilers.
 - C. Pilot static system and associated flight instruments.
 - D. Vacuum system and associated flight instruments.
 - E. Landing gear: retraction system, indicators, brakes and tires, nose-wheel steering.
 - F. Power-plant: controls and indicators, induction, carburetion and fuel injection, exhaust and turbo-charging, cooling, fire detection.
 - G. Propellers: type; controls; feather, un-feather, auto-feather and negative torque sensing; synchronizing, synchrophasing.
 - H. Fuel system: capacity, pumps, controls and indicators; cross-feed and transfer; fueling procedures; approved grade, color and additives; drain valves; low-level warning.
 - I. Oil system: capacity, grade, indicators.
 - J. Hydraulic system: controls and indicators, pumps and regulators.
 - K. Electrical system: controls and indicators; alternators or generators; battery, auxiliary power unit; circuit protection; external and internal lighting; associated flight instruments.
 - L. Environmental system: heating, cooling and ventilation, controls and indicators, oxygen and pressurization.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- M. Ice prevention and elimination.
 - N. Avionics.
- 2.2 Exhibit commercial pilot knowledge by correctly explaining the applicable emergency procedures including:
- A. Emergency checklist.
 - B. Partial power loss.
 - C. Engine failure: before lift-off, after lift-off, during climb and cruise, engine securing, restart.
 - D. Single-engine operation: approach and landing, restart.
 - E. Emergency landing: precautionary, without power, ditching, use of approved flotation gear and pyrotechnic signaling devices.
 - F. Engine roughness or overheat.
 - G. Loss of oil pressure.
 - H. Smoke and fire: engine, cabin, electrical, environmental.
 - I. Icing: airframe, power-plant.
 - J. Cross-feed.
 - K. Pressurization.
 - L. Emergency descent.
 - M. Pilot static system and associated instruments.
 - N. Vacuum system and associated instruments.
 - O. Electrical.
 - P. Landing gear.
 - Q. Wing flaps (asymmetrical position).
 - R. Inadvertent door opening.
 - S. Emergency exits.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 2.3 Exhibit commercial pilot knowledge by explaining performance and limitations including a thorough knowledge of the adverse effects of exceeding the limits.
- 2.4 Demonstrate proficient use of the appropriate performance charts, tables and data including cruise control, range and endurance.
- 2.5 Determine the airplane performance, considering the effects of various conditions, in all phases of flight including:
- A. Accelerate-stop distance.
 - B. Accelerate-go distance.
 - C. Takeoff performance, all engines, single engine.
 - D. Climb performance, all engines, and single engine.
 - E. Service ceiling, all engines, single engine.
 - F. Cruise performance.
 - G. Fuel consumption, range, and endurance.
 - H. Descent performance.
 - I. Go-around from rejected landings.
 - J. Landing distance.
- 2.6 Describe the effects of seasonal and atmospheric conditions on the airplane performance.
- 2.7 Compute weight and balance, including adding, removing and shifting weight; and determine if the weight and center of gravity will remain within limits during all phases of flight.
- 2.8 Use mature judgment in making a competent decision on whether the required performance is within the airplane capability and operating limitations.
- 2.9 Exhibit knowledge by explaining the flight principles related to operation with an engine inoperative, including:
- A. Factors affecting single-engine flight: density altitude, drag reduction, airspeed (V_{SSE} , V_{XSE} , V_{YSE} , V_{MC}), aircraft control, weight and center of gravity, critical engine.
 - B. Directional control: reasons for loss of directional control, reasons for variations in V_{MC} , indications of approaching loss of directional control, safe recovery procedure if



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

directional control is lost, V_{MC} in relation to stall speed, whether an engine inoperative loss of directional control demonstration can be safely accomplished in flight.

C. Takeoff emergencies: takeoff planning, decisions after engine failure, single-engine operation.

2.10 Exhibit knowledge of the elements related to the use of an approved minimum equipment list, including:

A. The airworthiness limitations it posed on multiengine aircraft operations with inoperative instruments or equipment.

B. The district office letter of authorization requirement.

C. Supplemental type certificate.

D. Instrument and equipment exemptions.

E. Special flight permit.



Common Course Number: ATF 2400

Unit 3: Ground Operations

General Outcome:

3.0 The student shall: The students should be able to complete tasks relative to ground operations in the following areas: visual inspection, cockpit management, engine ignition, taxiing and pre-takeoff check.

Specific Measurable Learning Outcomes:

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

- 3.1** Exhibit commercial pilot knowledge of airplane visual inspection by explaining the reasons for the inspection, what items should be inspected and how to detect possible defects.
- 3.2** Inspect the airplane by systematically following an appropriate checklist.
- 3.3** Verify that the airplane is in condition for safe flight emphasizing:
 - A. Fuel quantity, grade and type.
 - B. Fuel contamination safeguards.
 - C. Fuel tank venting.
 - D. Oil quantity, grade and type.
 - E. Fuel, oil and hydraulic leaks.
 - F. Oxygen supply, if appropriate.
 - G. Flight controls.
 - H. Structural damage including exhaust system.
 - I. Tie-down, control lock and wheel chock removal.
 - J. Lighting.
 - K. Ice and frost removal.
 - L. Security of baggage, cargo and equipment.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 3.4 Demonstrate proper management of the fuel system
- 3.5 Note any discrepancy and accurately judge whether the airplane is safe for flight or requires maintenance.
- 3.6 Exhibit commercial pilot knowledge of cockpit management by explaining efficient cockpit management procedures, securing cargo and related safety factors.
- 3.7 Organize and arrange material and equipment in a manner that makes them readily available.
- 3.8 Adjust and lock the rudder pedals and pilot's seat to a safe position and assures full control movement.
- 3.9 Ensure that safety belts and shoulder harnesses are fastened.
- 3.10 Brief occupants on the use of safety belts and emergency procedures including the use of flotation gear and pyrotechnic signaling device, when aboard.
- 3.11 Exhibit commercial pilot knowledge by explaining correct engine starting procedures including the use of an external power source, starting under various atmospheric conditions and the effects of using incorrect starting procedures.
- 3.12 Perform all items by systematically following the before-starting and starting checklist.
- 3.13 Demonstrate competence in the care and use of equipment.
- 3.14 Accomplish correct starting procedure with emphasis on:
 - A. Positioning the airplane to avoid creating hazards.
 - B. Determining that the area is clear.
 - C. Adjusting the engine controls.
 - D. Preventing airplane's movement after engine start.
 - E. Avoiding excessive engine RPM and temperatures.
 - F. Checking engine instruments after engine start.
- 3.15 Exhibit commercial pilot knowledge by explaining all aspects of safe taxi procedures including the effect of wind on the airplane during taxiing.
- 3.16 Follow the prescribed taxi checklist, if pertinent.
- 3.17 Perform a brake check immediately after the airplane begins movement and thereafter used proper braking technique.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 3.18 Comply with markings, signals and clearances and follow the proper taxi route.
- 3.19 Demonstrate proficiency in maintaining correct and positive control of the airplane's direction and speed considering existing conditions and use differential power, when necessary.
- 3.20 Position flight controls properly considering wind.
- 3.21 Maintain awareness of the location and movement of all other aircraft and vehicles along the taxi path and in the traffic pattern.
- 3.22 Apply right-of way rules and provides adequate spacing.
- 3.23 Avoid creating hazards to persons or property.
- 3.24 Exhibit commercial pilot knowledge of the pre-takeoff check by thoroughly explaining the reasons for checking the items and how to detect possible malfunctions.
- 3.25 Position the airplane properly considering the surface, possible hazards and wind.
- 3.26 Divide attention inside and outside of the cockpit.
- 3.27 Ensure that the engine temperatures and pressures are suitable for run-up and takeoff and avoids any tendency to overheat the engine.
- 3.28 Perform a critical and systematic check by following the checklist.
- 3.29 Adjust each control or switch as prescribed by the checklist.
- 3.30 Ensure that the airplane is in safe operating condition emphasizing:
 - A. Flight controls and instruments.
 - B. Instruments in normal operating range.
 - C. Engine and propeller operation.
 - D. Carburetor ice check, if applicable.
 - E. Fuel valves positioned properly.
 - F. Seats adjusted and locked for all occupants.
 - G. Safety belts and shoulder harnesses fastened and adjusted for all occupants.
 - H. Doors and windows secured.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- 3.31 Recognize indications of any discrepancy and accurately judge whether the airplane is safe for flight or requires maintenance.
- 3.32 Review the critical takeoff performance airspeeds and expected takeoff distances.
- 3.33 Describe takeoff emergency procedures with emphasis on:
 - A. Engine inoperative cockpit procedures.
 - B. Engine inoperative airspeeds.
 - C. Engine inoperative route to follow considering obstructions and wind conditions.
- 3.34 Obtain and interpret takeoff and departure clearances.



Common Course Number: ATF 2400

Unit 4: Airport and Traffic Pattern Operations

General Outcome:

4.0 The student shall: Be able to complete tasks relative to airport and traffic pattern operations in the following areas: radio communications and ATC light signals, traffic pattern operations and airport and runway marking and lighting

Specific Measurable Learning Outcomes:

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

- 4.1** Exhibit commercial pilot competency in radio- communications and ATC light signal interpretation including:
- A. Selecting the appropriate frequencies for the facilities to be used.
 - B. Transmitting requests and reports correctly using the recommended standard phraseology.
 - C. Receiving, acknowledging and complying with radio communications.
 - D. Using prescribed procedures following radio communications failure.
- 4.2** Exhibit commercial pilot competency during traffic pattern operation at controlled and uncontrolled airports including:
- A. Collision and wind-shear avoidance procedures.
 - B. Following the established traffic pattern procedures correctly and consistently adhering to instructions or rules.
 - C. Correcting for wind-effect to follow the appropriate ground track.
 - D. Maintaining adequate spacing from other traffic.
 - E. Maintaining the traffic pattern altitude, ± 100 feet.
 - F. Maintaining the special airspeed, ± 10 knots.
 - G. Completing the pre-landing cockpit checklist.
 - H. Maintaining orientation with the runway in use.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- 4.3 Exhibit commercial pilot competency by:
- A. Identify, interpret and conform to airport, runway and taxiway marking aids.
 - B. Identify, interpret and conform to airport lighting aids.



Common Course Number: ATF 2400

Unit 5: Takeoffs and Climbs

General Outcome:

5.0 The student shall: Be able to complete tasks relative to takeoffs and climbs in the following areas: normal and crosswind takeoffs and climbs and maximum performance takeoff and climb.

Specific Measurable Learning Outcomes:

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

- 5.1** Exhibit knowledge by explaining the elements of normal and crosswind takeoffs and climbs, including airspeeds, configurations and emergency procedures.
- 5.2** Adjust the mixture control as recommended for the existing conditions.
- 5.3** Note any obstructions or other hazards in the takeoff path and review takeoff performance.
- 5.4** Verify wind condition.
- 5.5** Align the airplane on the runway centerline.
- 5.6** Apply aileron deflection in the proper direction, as necessary.
- 5.7** Advance the throttles smoothly and positively to maximum allowable power.
- 5.8** Check the engine instruments.
- 5.9** Maintain positive directional control on the runway centerline.
- 5.10** Adjust aileron deflection during acceleration, as necessary.
- 5.11** Rotate at the airspeed to attain lift-off at $V_{MC} + 5$ knots, or the recommended lift-off airspeed and establishes wind-drift correction, as necessary.
- 5.12** Accelerate to $V_Y, \pm 5$ knots.
- 5.13** Retract the wing flaps as recommended at a safe altitude.
- 5.14** Retract the landing gear after a positive rate of climb has been established and a safe landing cannot be accomplished on the remaining runway, or as recommended.
- 5.15** Climb at $V_Y, + 5$ knots, to a safe maneuvering altitude.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 5.16 Maintain takeoff power to a safe maneuvering altitude and sets desired power.
- 5.17 Use noise abatement procedures, as required.
- 5.18 Establish and maintain recommended climb airspeed, ± 5 knots.
- 5.19 Maintain a straight track over the extended runway centerline until a turn is required.
- 5.20 Complete the after-takeoff checklist.
- 5.21 Exhibit knowledge by explaining the elements of a maximum performance takeoff and climb, including airspeeds, configurations and expected performance for specified operating conditions.
- 5.22 Select the recommended wing flap setting.
- 5.23 Adjust the mixture controls as recommended for the existing conditions.
- 5.24 Position the airplane for maximum runway availability and align it with the runway centerline.
- 5.25 Advance throttles smoothly and positively to maximum allowable power.
- 5.26 Check engine instruments.
- 5.27 Adjust the pitch altitude to attain maximum rate of acceleration.
- 5.28 Maintain positive directional control on the runway centerline.
- 5.29 Rotate at the airspeed to attain lift-off at $V_{MC} \pm 5$ knots, or at the recommended airspeed, whichever is greater.
- 5.30 Climb at V_X , $+5 -0$ knots, or the recommended airspeed.
- 5.31 Retract the wing flaps as recommended at a safe altitude.
- 5.32 Retract the landing gear after a positive rate of climb has been established and a safe landing cannot be made on the remaining runway or as recommended.
- 5.33 Climb at V_Y , ± 5 knots, to a safe maneuvering altitude.
- 5.34 Maintain takeoff power to a safe maneuvering altitude and sets desired power.
- 5.35 Use noise abatement procedures as required.
- 5.36 Establish and maintain recommended climb airspeed, ± 5 knots.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- 5.37 Maintain a straight track over the extended runway centerline until a turn is required.
- 5.38 Complete the after-takeoff checklist.



Common Course Number: ATF 2400

Unit 6: Instrument Flight

General Outcome:

6.0 The student shall: Be able to complete tasks relative to instrument flight in the following areas: engine failure during straight-and-level flight and turns, instrument approach -- one engine inoperative.

Specific Measurable Learning Outcomes:

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

- 6.1** Exhibit commercial pilot knowledge by explaining the reasons for the procedures used if engine failure occurs during straight-and-level flight and during turns while on instruments.
- 6.2** Recognize engine failure promptly during straight-and-level flight and during standard-rate turns.
- 6.3** Set the engine controls, reduces drag and identify and verify the inoperative engine.
- 6.4** Establish the best engine inoperative airspeed and trims the airplane.
- 6.5** Verify the accomplishment of prescribed checklist procedures for securing the inoperative engine.
- 6.6** Establish and maintain a bank toward the operating engine, as necessary, for best performance in straight-and-level flight.
- 6.7** Maintain a bank angle, as necessary, for best performance in a turn of approximately standard rate.
- 6.8** Attempt to determine the reason for the engine malfunction.
- 6.9** Maintain an altitude or a minimum sink rate sufficient to continue flight considering:
 - A. Density altitude.
 - B. Service ceiling.
 - C. Gross weight.
 - D. Elevation of terrain and obstructions.
- 6.10** Monitor the operating engine and make necessary adjustments.
- 6.11** Maintain the specified altitude ± 100 feet, if within the airplane's capability, the specified airspeed ± 10 knots and the specified heading $\pm 10^\circ$, if in straight flight.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 6.12 Recognize the airplane's performance capability and decide an appropriate action to ensure a safe landing.
- 6.13 Avoid imminent loss of control or attempted flight contrary to the single-engine operating limitations of the airplane.
- 6.14 Exhibit commercial pilot knowledge of cockpit management used for a published instrument approach.
- 6.15 Request and receive an actual or a simulated clearance for an instrument approach.
- 6.16 Follow instructions and instrument approach procedures correctly.
- 6.17 Determine the appropriate rate of descent considering wind and the designated missed approach point.
- 6.18 Descend on course so as to arrive at the DH or MDA, whichever is appropriate, in a position from which a normal landing can be made straight-in or circling.
- 6.19 Maintain the specified airspeed, ± 10 knots.
- 6.20 Avoid full-scale deflection on the CDI or glide slope indicators, descent below minimums, or exceeding the radius of turn as dictated by the visibility minimums for the aircraft approach category, while circling.
- 6.21 Execute a missed approach at the designated missed approach point and follow appropriate checklist items for airplane cleanup.
- 6.22 Communicate properly with ATC.
- 6.23 Exhibit commercial pilot knowledge by explaining the multiengine procedures used during a published instrument approach with one engine inoperative.
- 6.24 Request and receive an actual or simulated clearance for a published instrument approach.
- 6.25 Recognize engine failure promptly.
- 6.26 Set the engine controls, reduce drag and identify and verify the inoperative engine.
- 6.27 Establish the best engine inoperative airspeed and trim the airplane.
- 6.28 Verify the accomplishment of the prescribed checklist procedures for securing the inoperative engine.
- 6.29 Establish and maintain a bank toward the operating engine, as necessary, for best performance.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 6.30 Attempt to determine the reason for the engine malfunction.
- 6.31 Request and receive an actual or simulated clearance for a published instrument approach with one engine inoperative.
- 6.32 Follow instructions and instrument approach procedures.
- 6.33 Recite the missed approach procedure and decide on the point at which the approach will continue or discontinue considering the performance capability of the airplane.
- 6.34 Descend on course so as to arrive at the DH or MDA, whichever is appropriate, in a position from which a normal landing can be made straight-in or circling.
- 6.35 Maintain the specified airspeed, ± 10 knots.
- 6.36 Avoid full-scale deflection on the CDI or glide slope indicators, descent below minimums, or exceeding the radius of turn as dictated by the visibility minimums for the aircraft approach category, while circling.
- 6.37 Communicate properly with ATC.
- 6.38 Complete safe landing.



Common Course Number: ATF 2400

Unit 7: Flight at Critically Slow Airspeeds

General Outcome:

7.0 The student shall: Be able to complete tasks relative to flight at critically slow airspeeds in the following areas: stalls, maneuvering during slow flight and steep power turns.

Specific Measurable Learning Outcomes:

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

- 7.1 Exhibit knowledge by explaining the aerodynamic factors associated with stalls and recoveries.
- 7.2 Select an entry altitude that allows a recovery to be completed no less than 3,000 feet AGL.
- 7.3 Stabilize the aircraft at V_{YSE} in level flight with gear and flap configuration as specified by the examiner.
- 7.4 Establish straight-and-level flight or level 20° bank turns, $\pm 5^{\circ}$ as specified by the examiner.
- 7.5 Adjust pitch and power as necessary to induce a stall while maintaining altitude, ± 50 feet.
- 7.6 Recognize a stall and recovers at the first indication through proper power and control application:
 - A. Straight-ahead standards: Maintains heading, $\pm 10^{\circ}$ and altitude, ± 50 feet during the entry and maintains heading, $\pm 10^{\circ}$ and altitude, ± 100 feet during the recovery.
 - B. Turning standards: Maintains 20° of bank, $\pm 5^{\circ}$ and altitude, ± 50 feet during the entry and levels the wings and maintains heading, $\pm 10^{\circ}$ and altitude, ± 100 feet during the recovery.
- 7.7 Avoid excessive pitch change or a secondary stall during any recovery.
- 7.8 Return to airspeed and configuration as specified by the examiner.
- 7.9 Exhibit knowledge by explaining the flight characteristics and controllability associated with maneuvering during slow flight.
- 7.10 Select an entry altitude that will allow the maneuver to be performed no lower than 3,000 feet AGL.
- 7.11 Establish and maintain slow flight, specified gear position, various flap settings and angles of bank, during straight-and-level flight and level turns.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 7.12 Maintain the specified altitude, ± 100 feet.
- 7.13 Maintain the specified heading during straight flight ± 10 .
- 7.14 Maintain the specified bank angle, $\pm 5^\circ$, during turning flight.
- 7.15 Maintain airspeed of 5 knots (± 5 knots) above stall speed or V_{MC} whichever is greater.
- 7.16 Exhibit knowledge by explaining the performance factors associated with steep power turns, including load factor and angle-of-bank limitations, effect on stall speed, power required and over-banking tendency.
- 7.17 Select an altitude that will allow the maneuver to be performed no lower than 3,000 feet AGL.
- 7.18 Establish the recommended entry airspeed.
- 7.19 Enter a 360° turn maintaining a bank angle of at least 45° , $+5^\circ$, in smooth, stabilized, coordinated flight.
- 7.20 Recognize the need to apply a smooth, coordinated control to maintain the specified altitude, ± 100 feet and the specified airspeed, ± 10 knots.
- 7.21 Divide attention between airplane control and orientation.
- 7.22 After completing a 360° turn, reverses direction of turn at the entry heading, $\pm 10^\circ$ and performs a 360° turn, then rolls out at the entry heading, ± 10 .
- 7.23 Avoid any indication of an approaching stall or tendency to exceed the structural limits of the airplane during the turns.



Common Course Number: ATF 2400

Unit 8: Emergency Operations

General Outcome:

8.0 The student shall: Be able to complete tasks in emergency operations in the following areas: systems and equipment malfunctions, maneuvering with one engine inoperative, engine inoperative loss of directional control demonstration, demonstrating the effects of various airspeeds and configurations during engine inoperative performance, engine failure on takeoff before V_{MC} , engine failure after lift-off, engine failure en route and approach and landing with an inoperative engine.

Specific Measurable Learning Outcomes:

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

- 8.1** Exhibit knowledge by explaining causes indications and pilot actions for various systems and equipment malfunctions.
- 8.2** Analyze the situation and takes appropriate action for simulated emergencies such as:
- A. Partial power loss.
 - B. Engine roughness or overheat.
 - C. Loss of oil pressure.
 - D. Carburetor or induction system icing.
 - E. Fuel starvation.
 - F. Fire in flight.
 - G. Electrical system malfunctions.
 - H. Hydraulic system malfunction.
 - I. Landing gear or wing flap malfunction.
 - J. Door opening in flight.
 - K. Trim inoperative.
 - L. Pressurization system malfunctions.
 - M. Other malfunctions.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 8.3 Exhibit commercial pilot knowledge by explaining the flight characteristics and controllability associated with maneuvering with one engine inoperative.
- 8.4 Set the engine controls, reduce drag, identify and verify the inoperative engine after simulated engine failure.
- 8.5 Attain the best engine inoperative airspeed and trim the airplane.
- 8.6 Maintain control of the airplane.
- 8.7 Attempt to determine the reason for the engine malfunction.
- 8.8 Follow the prescribed checklist to verify procedures for securing the inoperative engine.
- 8.9 Establish a bank toward the operating engine, as necessary, for best performance.
- 8.10 Turn toward the nearest suitable airport.
- 8.11 Monitor the operating engine and make necessary adjustments.
- 8.12 Demonstrate coordinated flight with one engine inoperative (propeller feathered, if possible) including:
 - A. Straight-and-level flight.
 - B. Turns in both directions.
 - C. Descents to assigned altitudes.
 - D. Climb to assigned altitudes. If airplane is capable of climbs under existing conditions.
- 8.13 Maintain the specified altitude, ± 100 feet, when a constant altitude is specified and levels off from climbs and descents at specified altitudes, ± 100 feet.
- 8.14 Maintain the specified heading during straight flight, $\pm 10^\circ$.
- 8.15 Maintain the specified bank angle, $\pm 10^\circ$, during turns.
- 8.16 Divide attention between coordinated control, flight path, and orientation.
- 8.17 Demonstrate engine restart in accordance with prescribed procedures.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 8.18** Exhibit knowledge by explaining the causes of loss of directional control at airspeeds less than V_{MC} , the factors affecting V_{MC} , and the safe recovery procedures.
- 8.19** Select an entry altitude that will allow recoveries to be completed no less than 3,000 feet AGL.
- 8.20** Establish the airplane configuration with:
- A. Propeller set to high RPM.
 - B. Landing gear retracted.
 - C. Flaps set in takeoff position.
 - D. Cowl flaps set in takeoff position.
 - E. Airspeed at V_{YSE} .
 - F. Trim set for takeoff.
 - G. Power on the critical engine reduced to idle (avoid abrupt power reduction).
- 8.21** Establish a single-engine climb altitude (inoperative engine propeller wind-milling with climb power applied to the operating engine).
- 8.22** Establish a bank toward the operating engine, as necessary, for best performance.
- 8.23** Reduce the airspeed slowly with the elevators while applying rudder to maintain directional control until all available rudders is applied.
- 8.24** Recognize the indications of loss of directional control.
- 8.25** Recover promptly by simultaneously reducing the power on the operating engine and reducing the angle of attack as necessary to regain directional control and airspeed.
- 8.26** Maintain directional control, $\pm 20^\circ$, during the entry and recovery.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 8.27 Accelerate to V_{YSE} , ± 5 knots, during the recovery.
- 8.28 Exhibit knowledge by explaining the effects of various airspeeds and configurations on performance during engine inoperative operation.
- 8.29 Select an entry altitude that will allow recoveries to be completed no lower than 3,000 feet AGL.
- 8.30 Establish V_{YSE} with critical engine at zero thrust.
- 8.31 Vary the airspeed from V_{YSE} and demonstrate the effect of the airspeed changes on performance.
- 8.32 Maintain V_{YSE} and demonstrate the effect of each of the following on performance:
 - A. Extension of landing gear.
 - B. Extension of wing flaps.
 - C. Extension of both landing gear and wing flaps.
 - D. Wind-milling of propeller on the critical engine.
- 8.33 Exhibit commercial pilot knowledge by explaining the reasons for the procedures used for engine failure during takeoff before V_{MC} including related safety factors.
- 8.34 Align the airplane on the runway centerline.
- 8.35 Advance the throttles smoothly to maximum allowable power.
- 8.36 Check engine instruments.
- 8.37 Maintain directional control on the runway centerline.
- 8.38 Close throttles smoothly and promptly when engine failure occurs.
- 8.39 Maintain directional control and apply braking, as necessary.
- 8.40 Exhibit commercial pilot knowledge by explaining the reasons for the procedures used if engine failure occurs after lift-off including related safety factors.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 8.41 Recognize engine failure promptly.
- 8.42 Set the engine controls, reduce drag, and identify and verify the inoperative engine simulated engine failure.
- 8.43 Establish V_{YSE} if there are no obstructions; if obstructions are present, establish V_{XSE} or V_{MC} cleared, then V_{YSE} and trim the airplane.
- 8.44 Maintain positive control of the airplane.
- 8.45 Follow the prescribed checklist to verify the accomplishment of procedures for securing the inoperative engine.
- 8.46 Establish a bank toward the operating engine as required for best performance.
- 8.47 Recognize the airplane's performance capability; if climb or level flight is impossible, maintain V_{YSE} and initiate an approach to the most suitable landing area.
- 8.48 Attempt to determine the reason for the engine malfunction.
- 8.49 Monitor the operating engine and make necessary adjustments.
- 8.50 Maintain the specified heading, $\pm 10^\circ$, and the specified airspeed, ± 5 knots.
- 8.51 Divide attention between coordinated airplane control, flight path, and orientation.
- 8.52 Contact the appropriate facility for assistance, if necessary.
- 8.53 Exhibit commercial pilot knowledge by explaining the techniques and procedures used if engine failure occurs while en route.
- 8.54 Set the engine controls, reduce drag, and identify and verify the inoperative engine after simulated engine.
- 8.55 Attain the best engine inoperative.
- 8.56 Maintain control of the airplane.
- 8.57 Attempt to determine the reason for the engine malfunction.
- 8.58 Follow the prescribed checklist to verify the accomplishment of procedures for securing the inoperative engine.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 8.59 Establish a bank toward the operating engine, as necessary, for best performance.
- 8.60 Turn toward nearest suitable airport.
- 8.61 Maintain an altitude or a minimum sink rate sufficient to continue flight considering:
 - A. Density altitude.
 - B. Service ceiling.
 - C. Gross weight.
 - D. Elevation of terrain and obstructions.
- 8.62 Monitor the operating engine and make necessary adjustments.
- 8.63 Maintain the specified altitude, ± 100 feet, if within the airplanes capability, the specified heading $\pm 10^\circ$, and the specified airspeed, ± 5 knots.
- 8.64 Divide attention between coordinated airplane control, flight path, and orientation.
- 8.65 Contact appropriate facility for assistance, if necessary.
- 8.66 Exhibit commercial pilot knowledge by explaining the procedure used during an approach and landing with an inoperative engine.
- 8.67 Set the engine controls, reduce drag and identify and verify inoperative engine after simulated engine failure.
- 8.68 Establish the recommended airspeed and trim the airplane.
- 8.69 Follow the prescribed checklist to verify procedures for securing the inoperative engine and complete prelanding checklist.
- 8.70 Establish a bank toward the operating engine as a required for best performance.
- 8.71 Maintain proper track on final approach.
- 8.72 Establish the approach and landing configuration and power.
- 8.73 Maintain a stabilized descent angle and the recommended final approach airspeed (not less than VYSE) until landing is assured.
- 8.74 Touch down smoothly beyond and within 500 feet of a specified point, with no drift and the longitudinal axis aligned with the runway centerline.
- 8.75 Maintain positive directional control during after-landing roll.



Common Course Number: ATF 2400

Unit 9: Approaches and Landings

General Outcome:

9.0 The student shall: Be able to complete tasks relative to approaches and landings in the following areas: normal and crosswind approaches and landings, go-around from rejected (balked) landing, maximum performance approach and landing, and after-landing procedures.

Specific Measurable Learning Outcomes:

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

- 9.1** Exhibit commercial pilot knowledge by explaining the elements of normal and crosswind approaches and landings including airspeeds, configurations, performance, and related safety factors.
- 9.2** Establish the approach and landing configuration and adjust the power controls, as required.
- 9.3** Maintain a stabilized descent angle and the recommended approach airspeed, with gust factor applied, ± 5 knots.
- 9.4** Note any obstructions or other hazards in the approach path and landing area, and consider landing performance capability.
- 9.5** Verify wind condition and make positive correction for crosswind.
- 9.6** Maintain a precise ground track on final approach.
- 9.7** Recognize and promptly correct deviations during approach and landing.
- 9.8** Make smooth, timely, and precise control application during the transition from approach to landing round-out (flare).
- 9.9** Touch down smoothly at approximate stalling speed, beyond and within 200 feet of a specified point, with no drift and the airplane's longitudinal axis aligned with the runway centerline.
- 9.10** Maintain positive directional control and crosswind correction during the after-landing roll.
- 9.11** Complete the after-landing checklist in a timely manner.



BROWARD COMMUNITY COLLEGE

COURSE OUTLINE

Common Course Number: ATF 2400

- 9.12 Exhibit commercial pilot knowledge by explaining the elements of a go-around procedure, including the recognition of the need to go around, the importance of making a timely decision, the use of recommended airspeeds, the drag effect of wing flaps and landing gear, and the importance of properly coping with undesirable pitch and yaw tendencies.
- 9.13 Make a timely decision to go around from a rejected landing.
- 9.14 Apply takeoff power and establish the precise pitch attitude required to attain the recommended airspeed.
- 9.15 Retract the wing flaps, as recommended, or at a safe altitude, and establish V_Y .
- 9.16 Retract the landing gear after a positive rate of climb has been established.
- 9.17 Trim the airplane and climb at V_Y , ± 5 knots, and maintain the proper ground track in the traffic pattern.
- 9.18 Exhibit commercial pilot knowledge by explaining the elements of a short-field approach and landing, including airspeeds, configurations, and related safety factors.
- 9.19 Consider obstructions, landing surface, and wind conditions.
- 9.20 Select a suitable touchdown point.
- 9.21 Establish the recommended short-field approach and landing configuration and adjust power and pitch, as required.
- 9.22 Maintain a stabilized descent angle, precise control of the descent rate, and recommended airspeed.
- 9.23 Maintain a precise ground track on final approach.
- 9.24 Recognize and promptly correct deviations during approach or landing.
- 9.25 Make smooth, timely, and precise control application during the transition from approach to landing round-out (flare).
- 9.26 Touch down smoothly beyond and within 100 feet of a specified point, no drift, and with the airplane longitudinal axis aligned with the runway centerline.
- 9.27 Maintain positive directional control during the after-landing roll.
- 9.28 Apply smooth braking, as necessary, to stop in the shortest distance consistent with safety.



BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: ATF 2400

- 9.29 Complete the after-landing checklist in a timely manner. Exhibit commercial pilot knowledge by explaining the after-landing procedure, including taxiing, parking, shutdown, securing, and post-flight inspection
- 9.30 Exhibit commercial pilot knowledge by explaining the after-landing procedure including taxiing, parking, shutdown, securing, and post-flight inspection.
- 9.31 Select and taxi to the designated or suitable parking area considering wind conditions and obstructions.
- 9.32 Park the airplane properly.
- 9.33 Follow the recommended procedure for engine shutdown, cockpit securing, and deplaning passengers.
- 9.34 Secure the airplane properly.
- 9.35 Perform a satisfactory post-flight inspection.