



MERCER
COUNTY COMMUNITY COLLEGE

COURSE OUTLINE

Course Number AVI 231	Course Title Commercial Pilot III	Credits 3
Hours: 3 Lecture	Prerequisite: AVI 132 MAT115 Corequisite: MAT 115	Implementation Fall 2023

Catalog description:

Complements Flight III and Flight IV courses, with basic information to pass the FAA Instrument Pilot Examination. Subject areas include altitude instrument flying, instrument flight charts, IFR clearances, and IFR regulations.

General Education Category:
Not GenEd

Course coordinator:

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Required texts & Other materials:

1. Instrument Flying Handbook by FAA (FAA-H-8083-15) (Free to download)
2. Federal Aviation Regulations / Aeronautical Information Manual (FAR/AIM) by FAA (2023 by ASA ISBN 1644252112)
3. Gleim FAA Test Prep Online Software
Optional
1. Guided Flight Discovery Instrument/Commercial by Jeppesen (ISBN: 978-0-88487-278-8)
2. Instrument Procedures Handbook by FAA (FAA-H-8083-16) (Free to download)

Downloads available at https://www.faa.gov/regulations_policies/handbooks_manuals

Course Student Learning Outcomes (SLO):

The Course Student Learning Outcomes (SLO) are outlined in the requirements for the issuance of instrument rating for an airplane as described in CFR 141 Appendix C Section 3 b (1)-(10). The ground training must include the following aeronautical knowledge areas:

Upon successful completion of this course the student will be able to explain:

1. Applicable Federal Aviation Regulations for IFR flight operations. **(PLO 1,4,6) (ILG 1,4,9)**
2. Appropriate information in the "Aeronautical Information Manual". **(PLO 1,4,6) (ILG 1,4,9)**
3. Air traffic control system and procedures for instrument flight operations. **(PLO 1,4,5) (ILG1,4,10)**
4. IFR navigation and approaches by use of navigation systems. **(PLO 1,4,5) (ILG1,4,10)**
5. Use of IFR en route and instrument approach procedure charts. **(PLO 1,4,5) (ILG 1,2,4,11)**
6. Procurement and use of aviation weather reports and forecasts, and the elements of forecasting weather trends on the basis of that information and personal observation of weather conditions. **(PLO 1,4,5,6) (ILG 1,3,4,10,11)**

7. Safe and efficient operation of aircraft under instrument flight rules and conditions. **(PLO 1,4,5,6)**
(ILG 1,3,4,10,11)
8. Recognition of critical weather situations and wind shear avoidance. **(PLO 1,4,5,6)**
(ILG 1,3,4,10,11)
9. Aeronautical decision making and judgment. **(PLO 1,4,5,6)** **(ILG 1,4,5,9,10,11)**
Crew resource management, to include crew communication and coordination. **(PLO 1,4,5,6)**
(ILG 1,4,5,9,10,11)
10. Crew resource management, to include crew communication and coordination. **(PLO 1,4,5,6)**
(ILG 1,4,5,9,10,11)

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 1. Written and Oral Communication in English. Students will communicate effectively in both speech and writing.

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.

Institutional Learning Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

Institutional Learning Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Institutional Learning Goal 5. Social Science. Students will use social science theories and concepts to analyze human behavior and social and political institutions and to act as responsible citizens.

Institutional Learning Goal 9. Ethical Reasoning and Action. Students will understand ethical frameworks, issues, and situations.

Institutional Learning Goal 10. Information Literacy: Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.

Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Aviation Technology (PLO)

1. Demonstrate the knowledge and skills required to obtain the private and commercial certificates and instrument rating, including aeronautical technical skills and decision-making, while demonstrating safety as their primary focus
4. Demonstrate effective and correct written and verbal communication
5. Research and present information pertinent to their aviation discipline individually and in teams
6. Demonstrate an awareness of the ethical and professional issues associated with the aviation industry, including the importance of becoming a life-long learner in the aviation world

Instrument Ground Instruction Course Objectives

The purpose of this course is to have the student acquire the knowledge and information necessary to pass the FAA instrument computer examination. This course is designed to meet the requirements specified in the Code of Federal Regulations Part 141 that pertain to the instrument pilot certificate CFR 65 Section (1) – (10).

Course Completion Standards

The student must demonstrate through oral and written testing, attendance, and classroom activities that they have gained the knowledge and understanding necessary to pass the FAA instrument rating airplane knowledge test with a minimum grade of 70%. All quizzes and unit tests, whether written or oral, must be corrected to 100% upon review by the student.

Units of study in detail – Unit Student Learning Outcomes:

Unit 1 Flight Instruments [Supports Course SLO #3] 160 minutes

Learning Objectives

Six basic flight instruments will be discussed in this lesson. The student will be informed about the construction, operation, and peculiarities and limitations of these instruments. In addition to the basic six, other types of instruments will be discussed.

Lesson Content

Flight Instruments and System Errors

1. Pilot Static Instruments
2. Altitude and Height Measurements
3. Pressure Altimeter
4. Encoding Altimeter, Radar Altimeter
5. Vertical-speed Indicator
6. Airspeed Indicator, Types of Airspeed
7. True Airspeed Indicator, Mach Indicator
8. Gyroscopic Instruments and Principles
9. Sources of Power for Gyro Operation
10. Attitude Indicator
11. Turn Coordinator, Turn and Slip Indicator
12. Heading Indicators
13. Compass and Compass Errors
14. Remote Indicating Compass
15. RMI, HSI, Flight Director System
16. Primary Flight Display / G1000
17. Multi-function Display / G1000

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 2 Attitude Instrument Flying and Aeromedical Factors [Supports Course SLO #3] 160 minutes

Learning Objectives

This lesson details the basic concepts of IFR Flight Operations. Major topics include the basic four; climbs, turns, descents, and fundamental skills. Appropriate sources for information involving scan will also be reviewed. Flight problems such as unusual attitudes, wake turbulence, turbulence and collision avoidance concludes this lesson.

Lesson Content

1. Attitude Instrument Flying
 - a. Straight and Level
 - b. Turns, Rate of Turns, Standard Rate of Turns
 - c. Load Factor in Turns
 - d. Relationship of Airspeed and Bank Angle for a Standard Rate Turn
 - e. Attitude Indicator Use in Turn
 - f. Half Standard Rate Turns
 - g. Climbs and Descents
 - h. Leveling off from a Climb or Descent
 - i. Six Configurations – Power Setting Chart
 - j. Instrument Cross Check, Instrument Interpretation, Airplane Control
 - k. Appropriate Instruments for IFR, Scan
 - l. Unusual Attitudes
 - m. Key Instrument in an Unusual Attitude
 - n. Wake Turbulence
 - o. Turbulence
 - p. Wind Shear
 - q. Collision Avoidance
2. Aeromedical Factors
 - a. Hypoxia and Hyperventilation
 - b. Spatial Disorientation
 - c. Vision and Visual Illusions
 - d. Fatigue

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 3 Airports, ATC, and the AIM [Supports Course SLOs #2 and #3]
240 minutes

Learning Objectives

This lesson is concerned with detailing information about IFR airport structure and functions. Air Traffic Control is also discussed. In addition, this lesson is designed to provide the student with basic instrument flight information and Air Traffic Control procedures covered in the AIM. This material contains the fundamentals required to fly in the United States National Airspace System.

Lesson Content

1. Airports and ATC
 - a. Structure and Functions of Air Traffic Control System
 - b. Airport Traffic Control Towers
 - c. Air Route Traffic Control Centers
 - d. Flight Data Center
 - e. IFR Clearance Procedures
 - f. Precision Instrument Runway Markings
 - g. VASI, PAPI
 - h. IFR Flight Planning Information
 - i. IFR Flight Plan
 - j. ATC Clearances
 - k. ATC Communication Failure
 - l. Radio Communication Failure
 - m. Navigation Radio Failure
 - n. Types of Airspace
2. Aeronautical Information Manual (AIM)
 - a. Air Navigation Radio Aids
 - b. Radar Services and Procedures
 - c. Airport Lighting Aids
 - d. Air Navigation and Obstruction Lighting
 - e. Airport Marking Aids
 - f. Airspace (General, Class A, B, C, D, E, G, Special Use Airspace)
 - g. ATC Services available to Pilots
 - h. Radio Communications
 - i. Airport Operations
 - j. ATC Clearances/Separation
 - k. Pre-Flight Actions
 - l. Departure Procedures
 - m. En Route Procedures
 - n. Arrival Procedures
 - o. Pilot/Controller Roles and Responsibilities
 - p. Emergency Procedures – Services available to pilots and two way radio failure
 - q. Safety of Flight – Altimeter Setting Procedures

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%. In addition, students will complete a quiz given by the instructor and will be required to score 70% or better.

Unit 4 Federal Aviation Regulations and NTSB [Supports Course SLO #1] 160 minutes

Learning Objectives

The purpose of this lesson is to convey to the student the Federal Aviation Regulations (FAR) that pertain to the instrument rating. Once this information is explained, the student will apply it to IFR situations.

Lesson Content

Federal Aviation Regulations and NTSB

1. IFR, FARs Part 61

- 61.3 Requirements for Certificate Ratings and Authorizations
- 61.23 Medical Certificate: Requirements and Duration
- 61.51 Pilot Logbooks
- 61.57 Recent Flight Experience: Pilot in Command
- 61.65 Instrument Rating Requirements
- 61.113 Private Pilot Privileges and Limitations: PIC
- 61.133 Commercial Pilot Privileges and Limitations
- 61.129 Airplane Rating: Aeronautical Experience

2. IFR, FARs Part 91

- 91.3 Responsibility and Authority of Pilot in Command
- 91.21 Portable Electronic Devices
- 91.103 Pre-flight Action
- 91.109 Flight Instruction: Simulated Instrument Flight and Certain Flight Tests
- 91.123 Compliance with ATC Clearances and Instructions
- 91.129 Class "D1" Airspace
- 91.131 Class "B" Airspace
- 91.135 Class "A" Airspace
- 91.155 Basic VFR Minimums
 - 1) VFR-on-Top Clearance on IFR Flights
 - a) Controlled airspace
 - i. Less than 10,000' MSL
 - ii. At or above 10,000' MSL
 - b) Uncontrolled airspace
 - i. 1200' AGL or less
 - ii. 1200' AGL but less than 10,000' MSL
 - iii. 1200' AGL at or above 10,000' MSL
- 91.157 Special VFR Minimums
- 91.167 Fuel Requirements for Flight in IFR Conditions
- 91.169 IFR Flight Plan; Information Required
- 91.171 VOR Equipment Check for IFR Operations
- 91.173 ATC Clearance and Flight Plan Required
- 91.175 Takeoff and Landing under IFR
- 91.177 Minimum Altitudes for IFR Operations
- 91.179 IFR Cruising Altitudes or Flight Level
- 91.180 Operations within Airspace Designated as Reduced Vertical Separation Minimum Airspace
- 91.181 Courses to be Flown
- 91.183 IFR Communications
- 91.185 IFR Operations: Two-way Communication Failure

- 91.187 Operation under IFR in Controlled Airspace: Malfunction Reports
- 91.189 Category II and Category III Operations: General Operating Rules
- 91.191 Category II and Category III Manual
- 91.193 Certificate of Authorization for Certain Category Operations
- 91.205 Instrument and Equipment Requirements
- 91.211 Supplemental Oxygen
- 91.213 Inoperative Instruments and Equipment
- 91.215 ATC Transponder and Altitude Reporting Equipment and Use
- 91.219 Altitude Alerting System or Device: Turbojet Powered Civil Airplanes
- 91.221 Traffic Alert Collision Avoidance System Equipment and Use
- 91.223 Terrain Awareness and Warning System
- 91.225 ADS-B Out Equipment and Use
- 91.227 ADS-B Out and Equipment Performance Requirements
- 91.411 Altimeter System and Altitude Reporting Equipment Tests and Inspections

3. NTSB Part 830

Part 830 and NTSB Regulations

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 5 Navigation [Supports Course SLO #4]
240 minutes

Learning Objectives

In order for an IFR pilot to be competent in his/her navigation, he/she must understand and be able to utilize the radio equipment to its fullest. The student will be given information about radio principles, VOR, DME, Area navigation, and GPS. The student will be able to use and interpret these systems.

Lesson Content

1. Navigation
 - a. Basic Radio Principles
 - b. Static Disturbance
 - c. VOR Facilities
 - d. VOR Accuracy Checks and Signal Strength
 - e. Interpreting VOR Indicators
 - f. Bracketing/Intercepting
 - g. Time and Distance
 - h. VOR Limitations
 - i. DME
 - j. HIS
 - k. RMI
 - l. DME Arcs
 - m. Common Errors in the Use of Navigation Instruments
 - n. GPS

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 6 Holding and IFR Approaches [Supports Course SLO #5]
320 minutes

Learning Objectives

In this lesson the student will become familiar with the ILS, GPS and VOR procedures. We will discuss the various ground components of the instrument landing system and how they are used. We will also utilize approach charts and extract the information needed. Other areas that will be included are inoperative components, straight-in landings, and circling approaches

Lesson Content

IFR Approaches

1. ILS Approaches
 - a. Localizer
 - b. Glide slope
 - c. ILS marker beacons
 - d. Compass locators
 - e. ILS with DME
 - f. ILS visual aids
 - g. ILS categories - Cat I, Cat II, Cat III
2. Flying the ILS Approach
 - a. Non-radar ILS Procedures
 - b. Approach Chart Review
 - c. Setting up the Approach
 - d. Transition via DME-ARC
 - e. Approach Procedures
3. Back Course Approaches
 - a. Interpretation
 - b. Flying with HSI
4. VOR Approaches
 - a. Approach Clearance
 - b. VOR Approach Procedures
 - c. Off Airport Facility
 - d. On Airport Facility
 - e. VOR DME Procedures
 - f. RNAV Approach Procedures
5. GPS Approaches
 - a. Accuracy
 - b. Equipment Requirements and Self-testing
 - c. RAIM
 - d. Entering Routes
 - e. Final Approach Way Point
 - f. Stand-alone Approach
 - g. WAAS Approaches – LNAV, LNAV+V, LNAV/VNAV, LPV
6. Additional Approaches and Procedures
 - a. SDF
 - b. LDA
 - c. LOC
 - d. Vectored Approaches
 - e. DME Arc

- f. Circling
 - g. Missed Approach Procedures
 - h. STARS
 - i. Procedure Turns
 - j. Timed Approaches from a Fix
 - k. Side Step Maneuver
 - l. No Procedure Turns
7. Holding Patterns
- a. Standard vs. Non-Standard
 - b. Timing
 - c. Crosswind Correction
 - d. Holding Speeds
 - e. Types of Holding Pattern Entries – Direct, Teardrop, Parallel
 - f. ATC Holding Instructions, EFC Times
 - g. Radio Procedures

Lesson Completion Requirements

The student must pass the unit test on Gleim AVLearn software with a minimum grade of 84%. In addition, students will complete the Hold Pattern assignment with a grade of 70% or better.

Unit 7 IFR En Route [Supports Course SLO #5]
320 minutes

Learning Objectives

Instrument flight covering the en route phase will be discussed in this lesson. The IFR en route chart interpretation will be taught. The student will also learn how to write and accept departure clearances. This lesson will conclude with information about takeoff and alternate minimums, standard instrument departures, IFR cruising altitudes and communication loss.

Lesson Content

IFR En Route

1. *En Route Charts*
 - a. *Low Altitude En Route Charts – Victor Airways/ T Routes*
 - b. *High Altitude En Route Charts – Jet Routes*
 - c. *Navigation Aids Symbols*
 - d. *Victor Airways*
 - e. *Mileage Breakpoint*
 - f. *Intersections*
 - g. *Compulsory Reporting Points*
 - h. *Non-compulsory Reporting Points*
 - i. *Minimum En Route Altitude*
 - j. *Minimum Obstruction Clearance Altitude*
 - k. *Maximum Authorized Altitude*
 - l. *Minimum Reception Altitude*
 - m. *Minimum Crossing Altitude*
 - n. *Changeover Point*
 - o. *Communications*
 - p. *Remote Communications Outlet*
 - q. *Airports*
 - r. *Airspace*
 - s. *Area Charts*
2. *Standard Instrument Departure Procedures*
 - a. *Initial set of instructions*
 - b. *Transition routes*
 - c. *Radar vector segment*
3. *Vector*
 - a. *Initial set of instructions*
 - b. *Minimum climb gradient*
4. *IFR Clearances*
 - a. *Elements of an IFR Clearance CRAFT*
 - b. *Cruise Clearance*
 - c. *VFR on Top*
 - d. *To VFR on Top*
 - e. *VFR Restrictions to and IFR Clearance*
 - f. *Composite Flight Plan*
 - g. *Tower En Route Control Clearance*
 - h. *Hold for Release*
 - i. *Clearance Void Time, RVITa*
 - j. *Clearance Readback*
 - k. *Clearance Shorthand*
5. *Communication Failure*

- a. *Alerting ATC*
- b. *Route*
- c. *Altitude*
- d. *Leaving Clearance Limit*
- 6. *Takeoff and Alternate Minimums*
 - a. *FAR Regulations*
- 7. *IFR Cruising Altitudes*
 - a. *Low Level*
 - b. *Jet Routes*

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 8 Weather [Supports Course SLOs #6, #7, and #8]
320 minutes

Learning Objectives

This lesson explains the major concepts regarding weather appropriate to IFR flight operations. Weather theory, hazards and avoidance will be discussed. Weather reports, forecasts, and charts will also be reviewed. The unit will end with high altitude aspects of meteorology.

Lesson Content

Weather Factors and Hazards

1. Weather Factors
 - a. Layers of the Atmosphere
 - b. Atmosphere Circulation
 - c. Moisture
 - d. Atmospheric Stability
 - e. Clouds
 - f. Air Masses
2. Weather Hazards
 - a. Thunderstorms
 - b. Thunderstorm Avoidance
 - c. Turbulence
 - d. Low Visibility
 - e. Restrictions to Visibility
 - f. Icing
 - g. Estimating Freezing Level
 - h. Avoiding Ice
 - i. Hydroplaning
 - j. Cold Weather Operations
3. Printed Reports and Forecasts
 - a. Routine Aviation Weather Report (METAR)
 - b. Terminal Aerodrome Forecasts (TAF)
 - c. Area Forecasts
 - d. Wind and Temperatures Aloft
 - e. Severe Weather Reports and Forecasts
 - f. In-Flight Weather Services
 - g. AWOS
4. Graphic Weather Reports
 - a. Surface Analysis Reports
 - b. Weather Depiction Chart
 - c. Constant Pressure Charts
 - d. Freezing Level Chart
 - e. Low-level Significant Weather Prognostic Chart
 - f. Severe Weather Outlook
5. High Altitude Considerations
 - a. Jet Stream and Jet Stream Turbulence
 - b. Winds Aloft
 - c. Tropopause Data Chart
 - d. High Level Significant Weather Prognostic

Lesson Completion Requirements

The student must pass the unit test on the Gleim AVLearn Software with a minimum grade of 84%.

Unit 9 Crew Resource Management [Supports Course SLOs #9 and #10]
160 minutes

Learning Objectives

The purpose of this unit is to detail the human factors that apply to each phase of flight. Aeronautical decision making, crew resource management, single-pilot resource management and the decision making process are elements that will be discussed.

Lesson Content

Advanced Human Factors Concepts

1. IFR Decision Making
2. Human Factors – SHELL Model
3. Applying the Decision Making Process
 - a. Reactive
 - b. Proactive
 - c. Decide Model
4. Assessing risk
5. Pilot in Command Responsibility
6. Self-Assessment
7. Team Assessment
8. Communications
9. Resource Use – Internal/External
10. Workload Management
11. Situational Awareness
12. Conflict Resolution

Lesson Completion Requirements

The student must pass a quiz given by instructor with a minimum grade of 70%.

Unit 10 IFR Review [Supports Course SLOs #1 - #10]
160 minutes

Learning Objectives

The purpose of this lesson is to utilize all information covered in the class thus far and complete a flight scenario given by the instructor.

Lesson Content

IFR Trip Review

1. The student will plan an IFR trip when supplied with the following information:
 - a. Description of Flight
 - b. Partially Completed IFR Flight Plan
 - c. Aircraft Equipment Status List
 - d. Partially Completed Flight Log
 - e. Sid and Stars
 - f. Airport/Facility Directory Excerpts
 - g. Instrument Approach Charts
 - h. Low Altitude En Route Chart

Lesson Completion Requirements

The student must complete the assignment given by instructor with a minimum grade of 70%.

Evaluation of student learning:

Grading Criteria:

Unit Tests	30%
In-Class Quizzes	30%
FAA Knowledge Test*	20%
Class Work**	20%
Total	100%

* A score of less than 70 on the FAA Knowledge Test will result in a failure for AVI 231

** Projects, Homework, Participation