CFII GROUND PREP

Regulations

61.51	Logging Pilot in Command Time
	Logging Instrument Flight Time
61.57	Instrument Currency
	Instrument Proficiency Check
61.65	Aeronautical Experience Required for an Instrument Rating
91.167	Fuel Requirements for IFR Flight
91.169	IFR Flight Plan: Information Required
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91.171	VOR Equipment Check
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91.175	Take Off and Landing Under IFR (operation below DH)
91.177	Minimum IFR Altitudes
91.179	IFR Cruising Altitude of Flight Plan
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91.205	Equipment Required (b,c,d)

Gyroscopic instruments
Attitude indicator, heading indicator, turn coordinator

2 Laws of Gyros:

Rigidity in Space: wheel with a heavily weighted rim spun rapidly tends to remain fixed in the plane in which it is spinning.
*A spinning disk will remain rigid in its plane of rotation until acted upon by an outside force.

Precession: Outside force tries to tilt a spinning gyro, the gyro responds as if the force had been applied at a point 90 further around in the direction of rotation.

A. TASK: AIRCRAFT FLIGHT INSTRUMENTS AND NAVIGATION EQUIPMENT

Objective. To determine that the applicant exhibits instructional knowledge of aircraft

1. Flight instrument systems and their operating characteristics to include:
   a. Pitot Static System
   Airspeed indicator, vertical speed indicator, and altimeter

   Airspeed Indicator: Speed of airplane by comparing ram air pressure with static air pressure (indicated airspeed as basis for determining aircraft performance). Ram air pushes against a diaphragm inside the airspeed indicator; the airtight case is vented to the static ports. A mechanical linkage translates the expansion and contraction of the diaphragm into needle movement.

Altimeter
Aneroid wafers expand and contract as atmospheric pressure from static source changes. Mechanical linkage translates these changes into pointer movements on the indicator. A sensitive altimeter required for IFR flight.

Vertical speed indicator
Measures how fast the static pressure increases or decreases as airplane climbs or descends. Not legally required for instrument flight.

Diaphragm inside the VSI expands or contracts during changes in the static pressure. A mechanical linkage translates these changes into pointer movements on indicator. Any change in pressure is felt immediately inside the diaphragm by delayed outside, and it expands or contracts due to momentary pressure differential. When aircraft levels off, pressure outside the diaphragm equalizes with pressure inside diaphragm, indicating zero.

Pitot blockage
*Ram air input and drain holes are blocked, airspeed indicator will act as an altimeter increasing as altitude increases.
*Pitot is blocked, clear drain hole, will result in an airspeed indication of zero.
*Static block- airspeed indicator will continue to react to changes in airspeed operation at higher altitude, the airspeed will read lower than it should. Lower altitude, faster-than –actual airspeed will be displayed low static pressure trapped in the system. VSI will indicate zero.

Alternate static source
Altimeter will read a little higher and the airspeed a little faster than normal. VSI momentary climb. Close vent, close window, turn on hear to lower pressure differential.

b. Attitude Indicator
A substitute for natural horizon. The only instrument that gives you an immediate and direct indication of the airplane's pitch and bank attitude.

Airplane rotates around attitude indicator gyro which spins in a horizontal plane and remains rigid in space and parallel to the horizon.

c. Heading indicator
The gyro spins in a vertical plane. Rigidity in space keeps the gyro pointing in the same direction as the aircraft turns about its vertical axis.

d. Magnetic compass
Associated Errors:
Oscillation (turbulence)
Variation (difference between true north and magnetic north)
Deviation (errors caused by magnetic fields emitted from metal objects)
Magnetic Dip (ANDS...UNOS)

2. Navigation equipment and their operating characteristics to include:

a. VHF omnirange (VOR)
Ground based navigational system consisting of very high frequency omnidirectional range (VOR). Stations which provide course guidance.

b. Distance measuring equipment (DME)
Equipment (airborne and ground) to measure in nautical miles, the slant range distance of an aircraft from the navigation aid.

c. Instrument landing system (ILS)
4 Components:
- Horizontal Guidance (Localizer)
- Vertical Guidance (Glide slope)
- Aural Guidance (Marker Beacons..for distance information)
- Visual Guidance (Approach Lighting System)

What is the localizer? (according to AIM and Instrument Flying Handbook)
- Description
- Lateral signal volumes
- Vertical signal volumes
- Lateral Dimension
- Vertical Dimensions

What happens to the beam as we get closer? It narrows and becomes more sensitive
How wide is the beam at the threshold of the runway? How many feet per dot deflection?

What is the glide slope?
- Description
- Lateral dimension
- Vertical dimension
- Volumes

What happens as we get closer to the runway?

Where are the Marker Beacons located?

The placement of the OM varies from four to seven miles from the runway, depending on the installation.

The MM is usually located 3500 feet from the landing threshold, with its signal array intercepting a 3 degree glide slope at approximately 200 feet above touchdown zone.

The IM indicates the decision height on the CAT II glide slope and indicates progress on a CAT III approach.

Altitudes associated with each on the glide slope?

d.Turn Indicator

Turn and slip indicator: rate of turn
Turn coordiator: rate of turn and rate of roll
What enables the turn coordinator to measure both rate of turn and roll? The gimbal in the turn coordinator is canted.
Inclinometer: part of turn coordinator that contains the fluid and the ball.
Ball centered indicates using the correct angle of bank for rate of turn.

Slip: rate of turn is too slow for the angle of bank, and the ball moves to the inside of the turn
Skid: rate of turn is too great for the angle of bank, and the ball moves to the outside of the turn.

What indications does the turn coordinator give when slipping into a landing? The minature airplane's wings are level (because it measures rate of roll).

Execution of Compass Turn and Timed Turns
When do we start the time on a "timed turn"? When you start the roll in
When do we stop the turn? When time is up
What kind of turn must we maintain in these two maneuvers? Standard rate
How do we calibrate a turn coordinator? Calibrate using time and your heading indicator

Instrument Interpretation

	PITCH	BANK	POWER
Straight and level			
Primary	ALT	HI	ASI
Supporting	AI, VSI	AL,TC	MP and/or RPM
Airspeed changes in straight and level			
Primary	ALT	HI	MP and/or RPM initially
Supporting	AI, VSI	AI, TC	ASI desired airspeed is approached
Establishing a level standard rate turn			
Primary	ALT	AI	ASI
Supporting	AI, VSI	TC	MP and/or RPM
Stabilized standard-rate turn			
Primary	ALT	TC	ASI
Supporting	AI, VSI	AI	MP and/or RPM
Change of airspeed in level turn			
Primary	ALT	TC	MP and or RPM
Supporting	AI, VSI	AI	ASI
Transitioning from straight and level to constant airspeed climb			
Primary	AI	HI	MP and/or RPM
Secondary	ASI, VSI	AI, TC	ASI
Straight constant airspeed climb			
Primary	ASI	HI	MP and/or RPM
Secondary	AI, VSI	AI, TC	ASI
As power is increased to enter a straight, constant-rate climb			
Primary	AI	HI	MP and/or RPM
Secondary	ASI, VSI	AI, TC	
Straight, constant-rate, stabilized climb			
Primary	VSI	HI	ASI
Secondary	AI	AI, TC	MP and/or RPM

How do they coincide with 91.175?
Describe how the Approach Lighting Systems fits in with the ILS?
Distances?
Lights?
Colors?

What does the approach lighting system afford a pilot to do with respect to descent blow DH or MDA? (part 3 of 91.175)

d. Marker beacon receiver/indicators (See above)

e. Automatic direction finder (ADF)

f. Global positioning system (GPS)

3. Anti-ice/deicing and weather detection equipment and their operating characteristics to include

a. airframe
b. propeller or rotor
c. air intake
d. fuel system
e. pitot-static system
radar/lighting detection system

2 Types of icing: structural and induction

Four types of Structural Ice

Clear ice- forms when large drops strike the aircraft surface and slowly freeze
Rime ice-small drops strike the aircraft and freeze rapidly
Mixed ice-combination of the above; supercooled water drops varying in size
Frost-Ice crystal deposits formed by sublimation when temperature/dew point is below freezing.

What conditions are necessary for structural icing to occur? Visible moisture and below-freezing temperatures at the point moisture strikes the aircraft are necessary.

C. TASK: REGULATIONS AND PUBLICATIONS RELATED TO IFR OPERATIONS
Objective. To determine that the applicant exhibits instructional knowledge of the elements related to regulation and publications, (related to instrument flight and instrument flight instruction) their purpose, general content, availability, and method of revision by describing:

1. **14 CFR parts 61,91,95, and 97**
   - 61 Certification: Pilots, Flight Instructors, and Ground Instructors
   - 91 General Operating and Flight Rules
   - 95 IFR Altitudes
   - 96 Standard Instrument Approach Procedure

2. **Instrument Flying Handbook**
   Issued by the FAA -a guide to teach instruments

3. **Aeronautical Information Manual (AIM)**
   It gives pilots safe operating practices. AIM (pg iii) Changes affecting the regulations take place daily. AIM changes twice a year. ASA tracks all changes and posts them as Updates on the ASA website and www.faa.gov
4. **Practical Test Standards**
5. **Airport Facility Directory**-guide for IFR preferred routes
6. **Standard Departures/Terminal Arrivals**-Arrival and departures. Where are they located? Expire every 56 days.
7. **En route Charts** Expire every 56 days
8. **Standard Instrument Approach Procedure Charts** Approach plates. Expire every 56 days

B: TASK: CROSS-COUNTRY FLIGHT PLANNING

Objective. To determine that the applicant exhibits instructional knowledge of cross-country flight planning by describing the:

1.Regulatory requirements for instrument flight with various types of airspace

Generator or alternator
Radio
Altimeter
Ball (slip/skip indicator of turn coordinator
Clock (second sweeping hand)
Attitude Indicator
Rate of Turn
Directional Gyro

What is the definition of the term "ceiling"? Ceiling is defined as the height above the earth's surface of the lowest layer of clouds or obscuring phenomena reported as "broken," "overcast," or "obscuration."

2.Computation of estimated time en route and total fuel requirement for an IFR cross-country flight

Total fuel requirements-Have enough fuel to fly to the first airport of intended landing, the alternate airport and 45 minutes at normal cruise power. If an alternate is not required, enough fuel must be carried to fly to the destination airport and land with 45 minutes of fuel remaining.

1-2-3 Rule
1 Hour before to 1 Hour after your planned ETA at the destination airport, the weather must be 2,000 foot ceilings and 3-mile visibilities, no alternate is required. If less than 2,000 and 3, an alternate must be filed:

Non-precision- ceiling 800 feet and 2 statue miles
Precision- ceiling 600 feet and 2 statue miles

If there is not an published approach, you must file an alternate.

What minimums are to be used on arrival at the alternate? The published minimums specified on the approach.

3. Selection and correct interpretation of the current and applicable en route charts, DP's STAR's, and standard instrument approach procedure charts.

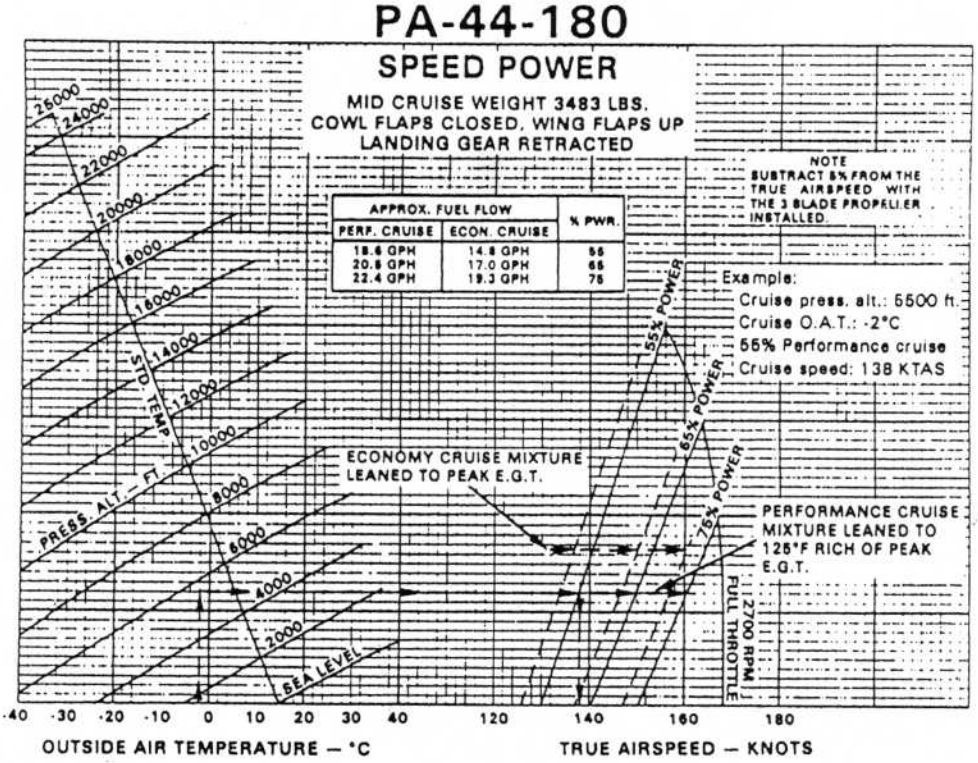
4. Procurement and interpretation of the applicable NOTAM information.

5.Preparation and filing of an actual or simulated IFR flight plan

Endorsements Required for an Instrument Rating Applicant
Written, Ground, 60-Day, 61.65, 8710

Endorsements Required for a CFII Instrument Rating Applicant
Written, Ground, 60-Day, 61.65, 8710

Endorsements Required for a CFII give to students?
ATP Re-training, CFII, Instrument Written, Instrument Practical, IPC



SPEED POWER
Figure 5-31

FUEL AND POWER CHART - LYCOMING (L) O-360-E SERIES (PER ENGINE)

Press. Alt. Feet	Std. Alt. Temp. °C	99 BHP - 55% Rated Power Approx. Fuel Flow-9.3 Gal/Hr.* RPM AND MAN. PRESS. 2100	2200	2300	2400	117 BHP - 65% Rated Power Approx. Fuel Flow-10.3 Gal/Hr.* RPM AND MAN. PRESS. 2100	2200	2300	2400	135 BHP - 75% Rated Power Approx. Fuel Flow-11.2 Gal/Hr.* RPM AND MAN. PRESS. 2200	2300	2400	Press. Alt. Feet
SL	15	22.2	21.7	21.2	20.7	24.5	24.0	23.4	22.9	26.4	25.8	25.2	SL
1000	13	21.9	21.4	21.0	20.4	24.2	23.7	23.1	22.6	26.1	25.5	24.9	1000
2000	11	21.6	21.1	20.7	20.2	23.9	23.4	22.9	22.3	25.8	25.2	24.6	2000
3000	9	21.3	20.8	20.4	19.9	23.6	23.1	22.6	22.1	25.4	24.9	24.4	3000
4000	7	21.0	20.6	20.1	19.7	23.2	22.7	22.3	21.8	FT	24.7	24.1	4000
5000	5	20.8	20.3	19.9	19.4	22.9	22.4	22.0	21.5	—	FT	23.8	5000
6000	3	20.5	20.2	19.6	19.2	22.6	22.1	21.7	21.3	—	—	FT	6000
7000	1	20.2	19.7	19.3	18.9	FT	21.8	21.5	21.0				7000
8000	-1	19.9	19.5	19.1	18.6		FT	21.2	20.7				8000
9000	-3	19.6	19.2	18.8	18.4	—	—	FT	20.5				9000
10,000	-5	19.3	18.9	18.5	18.1	—	—	—	FT				10,000
11,000	-7	FT	18.6	18.3	17.9								11,000
12,000	-9	—	FT	18.0	17.6								12,000
13,000	-11	—	—	FT	17.4								13,000
14,000	-13	—	—	—	FT								14,000

NOTE: To maintain constant power, add approximately 1% manifold pressure for each 6°C above standard, subtract approximately 1% for each 6°C below standard.

*Best Power

POWER SETTING TABLE
Figure 5-29

INSTRUMENT LANDING SYSTEM

GROUND COMPONENTS:

LOCALIZER: To provide horizontal guidance to the airport runway.
Located at far end of runway. (course width 3-6*, ~700ft runway threshold), (VHF).

GLIDE SLOPE: Provides vertical guidance along the correct descent angle to the proper 'touchdown' point on the runway. (middle marker 200ft, outer 1,400ft), (UHF).

MARKER BEACONS: Provide accurate radio fixes along the approach path of the runway, (VHF).

Outer Marker - on front course, 4-7 miles from runway.
- indicates position where, if on localizer, aircraft will intercept glideslope.
- 400Hz.
- (- - -, Blue).

Middle Marker- 3,500ft from runway.
- 1300Hz.
- (. - . -, Amber).

Inner Marker - Cat II, DH.
- 3000Hz.
(. . . . , White).

BackCourse Marker - back course final approach fix.
- 3000Hz.
- (. .).

Compass Locators - NDB in conjunction with O.M. & M.M.
- 200-415Hz.

APPROACH LIGHTING SYSTEM: To provide enough lighting that will penetrate the atmosphere far enough from touchdown to give you directional, distance and glide path information for safe visual transition.

Runway End Identifier Lights - (REIL).
- for rapid & positive identification of the approach end of the instrument runway.
- consists of a pair of synchronized flashing lights.

Visual Approach Slope Indicator - (VASI).
- gives visual descent guidance info during approach to runway, (3-4.5*).

LESSON 54 NOTES

ILS Components:

- Localizer: course guidance using a VOR receiver
- Glideslope: this makes and ILS a precision approach; provides vertical guidance to DH (200AGL); intercept from below(to avoid false signal)
- Outer marker: 4-7 miles from threshold; blue light on panel; low pitch – per second
- Middle marker: 3500 ft from threshold; amber light on panel; medium pitch -.-.-. per second

Substitutes for Outer and Middle Markers (FAR 91.175 (k))

- Outer marker may be replaced by a compass locator, VOR- DME or a radar fix (ASR or PAR)
- Middle marker may be replaced by a compass locator or radar fix (PAR only)

Visual Components: (FAR 91.175 (c))

- Used to transition from instrument to visual
- elements necessary to descend below DH
    - be in a position to make a normal landing
    - visibility must be ≥ or = to approach minimums
    - approach lights visible to descend 100ft above TDZE
- elements necessary to land
    - threshold marking and lighting
    - REIL
    - VASI
    - TDZ (markings and lighting)
    - Runway(lights and marking)

Landing minimums are raised to the highest minimum of any single one inoperative component.

Flying the Approach:

- Transition segment- ATIS, Stack check, approach brief, pre-landing check list (ASAP)
- Initial segment- turn outbound and intercept localizer outbound, start time outbound
- Intermediate segment- procedure turn inbound and intercept localizer and be ready to talk to tower
- Final segment- Glideslope intercept, 5T's, look for airspeed, maintain glideslope and airspeed, maintain localizer, continue down to DH and decide whether to land or go missed
- Missed segment- follow ATC instructions or do published missed

GPS SENSITIVITY & SCALING OVERHEAD VIEW