Gyroplane questions – from Rotorcraft Commercial bank

(From Rotorcraft questions that obviously are either gyroplane or not helicopter)

FAA Question Number: **5.0.5.8**
FAA Knowledge Code: **B09**
To begin a flight in a rotorcraft under VFR, there must be enough fuel to fly to the first point of intended landing and, assuming normal cruise speed, to fly thereafter for at least

- **A.** 30 minutes.
- **B.** 45 minutes.
- X **C.** 20 minutes.

FAA Question Number: **5.0.4.6**
FAA Knowledge Code: **B07**
When operating a U.S.-registered civil aircraft, which document is required by regulation to be available in the aircraft?

- **A.** An Owner's Manual.
- **B.** A manufacturer's Operations Manual.
- X **C.** A current, approved Rotorcraft Flight Manual.

FAA Question Number: **5.0.6.7**
FAA Knowledge Code: **B11**
Approved flotation gear, readily available to each occupant, is required on each helicopter if it is being flown for hire over water,

- **A.** more than 50 statute miles from shore.
- **B.** in amphibious aircraft beyond 50 NM from shore.
- X **C.** beyond power-off gliding distance from shore.

FAA Question Number: **5.0.7.2**
FAA Knowledge Code: **B11**
What transponder equipment is required for helicopter operations within Class B airspace? A transponder

- X **A.** with 4096 code and Mode C capability.
- **B.** is required for helicopter operations when visibility is less than 3 miles.
- **C.** with 4096 code capability is required except when operating at or below 1,000 feet AGL under the terms of a letter of agreement.

FAA Question Number: **5.1.6.8**
FAA Knowledge Code: **H307**
For gyroplanes with constant-speed propellers, the first indication of carburetor icing is usually

A. engine roughness followed by a decrease in engine RPM.
B. a decrease in engine RPM.
X **C.** a decrease in manifold pressure.

FAA Question Number: **5.2.3.9**
FAA Knowledge Code: **H70**
When the angle of attack of a symmetrical airfoil is increased, the center of pressure will

A. move aft along the airfoil surface.
B. remain unaffected.
X **C.** have very limited movement.

Comment: The FAA's Rotorcraft Flying Handbook says for a symmetrical airfoil, "the center of pressure will remain virtually unchanged as the angle of attack changes." I wonder what answer the FAA wants! – Greg Gremminger
Comment: General aerodynamics. Rotor blades tend to be symmetrical airfoils because we don't want the centre of pressure to move around too much in a rotorcraft it would require a lot of extra work for the pilot to maintain flight attitude. If the centre of pressure changed to create more lift on the left side of the rotor disc for example the aircraft would turn to the right and the pilot would have to correct to keep flying straight. We want the centre of pressure to remain as still as possible during changes in angle of attack.
Comment: THIS ANSWER IS INCORRECT !!!! According to your book Flight/Ground Instructor Written Exam page 28 question 14: When the angle of attack of a symmetrical airfoil is increased, the center of pressure will- remain unaffected. I don't believe this changes just because the question is related to rotorcraft. Please let me know if there are any other incorrect responses that I am studying. Todd@Pollack.net

FAA Question Number: **5.2.4.0**
FAA Knowledge Code: **H71**
Coning is caused by the combined forces of

X **A.** lift and centrifugal force.
B. flapping and centrifugal force.
C. drag, weight, and translational lift.

FAA Question Number: **5.2.4.1**
FAA Knowledge Code: **H71**
The forward speed of a rotorcraft is restricted primarily by

A. transverse flow effect.
B. high-frequency vibrations.
X **C.** dissymmetry of lift.

Comment: Actually, forward speed is limited by the flapping range of the rotor to compensate for dissymmetry of lift. As long as there is flapping range still available, there is no dissymmetry of lift until that flapping range is maxed out! Probably just semantics, but there is a tendency with use of the term "dissymmetry of lift" to presume there is always less lift on the retreating blade and more lift on the advancing blade - not true until flapping becomes limited at higher airspeeds. This also leads to the assumption that a gyroplane rolls toward the retreating blade at higher airspeeds - it may do that, but for different reasons! – Greg Gremminger

FAA Question Number: **5.2.4.3**
FAA Knowledge Code: **H71**
The purpose of lead-lag (drag) hinges in a three-bladed, fully articulated helicopter rotor system is to compensate for

- **A.** blade flapping tendency.
- **B.** dissymmetry of lift.
- X **C.** Coriolis effect.

FAA Question Number: **5.2.4.5**
FAA Knowledge Code: **H71**
The unequal lift across the rotor disc that occurs in horizontal flight as a result of the difference in velocity of the air over the advancing half of the disc area and the air passing over the retreating half of the disc area is known as

- X **A.** dissymmetry of lift.
- **B.** disc loading.
- **C.** coning.

Comment: This is the stock answer - but technically there is no dissymmetry of lift for a properly functioning rotor system. Any rotorcraft employs and requires cyclic blade AOA to compensate for the dissymmetry of relative wind over the advancing vs. retreating blades. For a rotorcraft to move horizontally, the cyclic action exactly compensates for the dissymmetry of relative wind so that the lift moment on both sides is the exactly the same - though the distribution of lift along each blade does vary around the rotation of the rotor. This distribution of lift along the blades is the only dissymmetry - the actual lift moment from blades on each side is the same on both sides. If there were any actual dissymmetry of lift between the advancing and retreating blades, precession causes the rotor disk to tilt aft creating the exact cyclic action that removes that dissymmetry of lift. The actual dissymmetry are in relative wind and blade AOA. – Greg Gremminger

FAA Question Number: **5.2.4.6**
FAA Knowledge Code: **H71**
The lift differential that exists between the advancing blade and the retreating blade is known as

  A. Coriolis effect.
  B. translational lift.
X **C.** dissymmetry of lift.

Comment: This is the stock answer - but technically there is no dissymmetry of lift for a proplerly functioning rotor system. Any rotorcraft employs and requires cyclic blade AOA to compensate for the dissymmetry of relative wind over the advancing vs retreating blades. For a rotorcraft to move horizontally, the cyclic action exactly compensates for the dissymmetry of relative wind so that the lift moment on both sides is the exactly the same - though the distribution of lift along each blade does vary around the rotation of the rotor. This distribution of lift along the blades is the only dissymmetry - the actual lift moment from blades on each side is the same on both sides. If there were any actual dissymmetry of lift between the advancing and retreating blades, precession causes the rotor disk to tilt aft creating the exact cyclic action that removes that dissymmetry of lift. The actual dissymmetries are in relative wind and blade AOA.
– Greg Gremminger

FAA Question Number: **5.2.4.8**
FAA Knowledge Code: **H72**
When a rotorcraft transitions from straight-and-level flight into a 30° bank while maintaining a constant altitude, the total lift force must

  A. increase and the load factor will decrease.
X **B.** increase and the load factor will increase.
  C. remain constant and the load factor will decrease.

FAA Question Number: **5.2.4.9**
FAA Knowledge Code: **H73**
Cyclic control pressure is applied during flight that results in a maximum increase in main rotor blade pitch angle at the "three o'clock" position. Which way will the rotor disc tilt?

X **A.** Aft.
  B. Left.
  C. Right.

Comment: This question is dependent on the direction of rotor rotation. The resultant effect is 90 degrees in the direction of rotation. Most U.U. helicopters rotate CCW as seen from above. Many European helicopters rotate CW from above. Most gyroplane rotors turn CCW when viewed from above.

FAA Question Number: **5.2.5.0**
FAA Knowledge Code: **H73**
Cyclic control pressure is applied during flight that results in a maximum decrease in pitch angle of the rotor blades at the "12 o'clock" position. Which way will the rotor disc tilt?

A. Aft.
X **B.** Left.
C. Forward.

Comment: This question is dependent on the direction of rotor rotation. The resultant effect is 90 degrees in the direction of rotation. Most U.U. helicopters rotate CCW as seen from above. Many European helicopters rotate CW from above. Most gyroplane rotors turn CCW when viewed from above.

FAA Question Number: **5.2.5.3**
FAA Knowledge Code: **H74**
The main rotor blades of a fully-articulated rotor system can

A. feather independently, but cannot flap or drag.
X **B.** flap, drag, and feather independently.
C. flap and feather collectively.

Comment: This question may be only a helicopter question, but some gyroplanes, such as the Air & Space 18A have fully articulated rotor systems that flap, drag and feather independently. – Greg Gremminger

FAA Question Number: **5.2.5.7**
FAA Knowledge Code: **H74**
The main rotor blades of a semirigid rotor system can

A. flap, drag, and feather independently.
B. feather independently, but cannot flap or drag.
X **C.** flap and feather as a unit.

FAA Question Number: **5.2.5.8**
FAA Knowledge Code: **H77**
Rotorcraft climb performance is most adversely affected by

A. higher than standard temperature and low relative humidity.
B. lower than standard temperature and high relative humidity.
X **C.** higher than standard temperature and high relative humidity.

FAA Question Number: **5.2.5.9**
FAA Knowledge Code: **H77**
The most unfavorable combination of conditions for rotorcraft performance is
A. low density altitude, low gross weight, and calm wind.
X **B.** high density altitude, high gross weight, and calm wind.
C. high density altitude, high gross weight, and strong wind.

FAA Question Number: **5.2.6.0**
FAA Knowledge Code: **H77**
How does high density altitude affect rotorcraft performance?
A. Engine and rotor efficiency is increased.
X **B.** Engine and rotor efficiency is reduced.
C. It increases rotor drag, which requires more power for normal flight.

Comment: Not technically exactly the same for gyroplanes - rotor in autorotation. The gyroplane autorotating rotor automatically spins faster in thinner air - actually restoring its efficiency to normal. Takeoff performance and acceleration to climb true airspeeds are affected because it does take longer for the rotor and aircraft to achieve the RPM and airspeed required for lift-off and climb. But, this is not really a function of reduced efficiency of the rotor blade - its efficiency is normal once the higher airspeed and RRPM are achieved. Helicopter rotor efficiency is affected in thinner air because it requires more blade AOA - collective - if higher Rotor RPM is not available or allowed!
– Greg Gremminger

FAA Question Number: **5.6.4.4**
FAA Knowledge Code: **H130**
Figure 37 for this question
(Refer to figure 37.) GIVEN:

	WEIGHT		MOMENT
Gyroplane basic weight		1,315	150.1 (oil included)
Pilot weight	140	?	
Passenger weight	150	?	
27 gal fuel	162	?	

The CG is located
A. outside the CG envelope; the maximum gross weight is exceeded.
B. outside the CG envelope; the maximum gross weight and the gross-weight moment are exceeded.
X **C.** within the CG envelope; neither maximum gross weight nor gross-weight moment is exceeded.

FAA Question Number: **5.6.4.5**
FAA Knowledge Code: **H130**
Figure 37 for this question
(Refer to figure 37.)
GIVEN:

	WEIGHT		MOMENT
Gyroplane basic weight		1,315	154.0 (oil included)
Pilot weight	145	?	
Passenger weight	153	?	
27 gal fuel	162	?	

The CG is located

A. within the CG envelope; neither maximum gross weight nor gross-weight moment is exceeded.
B. outside the CG envelope; the maximum gross weight is exceeded.
X **C.** outside the CG envelope; but the maximum gross weight is not exceeded.

FAA Question Number: **5.6.7.1**
FAA Knowledge Code: **H745**
During the flare portion of a power-off landing, the rotor RPM tends to
A. remain constant.
B. decrease initially.
X **C.** increase initially.

FAA Question Number: **5.6.7.2**
FAA Knowledge Code: **H71**
Which would produce the slowest rotor RPM?
X **A.** Pushing over after a steep climb.
B. A vertical descent with power.
C. A vertical descent without power.

Comment: Answer A is correct BUT is a common way to initiate a buntover in an unstable gyro! G-Load statically stable gyroplanes are resistant to such buntovers, but all gyroplane pilots especially should be taught to never "push over" at the top of a zoom climb! Technically, the reduced RRPM may contribute to a buntover in a gyro, but G-Load static instability of some gyroplane configurations are the major cause of a buntover. I suggest that this question, in its current format should be limited to helicopter tests. This question included in gyroplane tests might suggest "pushing over" might be an acceptable maneuver. Knowledge of this is important, but I suggest the question should not suggest a "pushover" is an acceptable thing to do!

For Gyroplanes, rotor RPM is mostly a function of the load on the rotor. Engine power has little or no effect on RRPM. Airspeed has little effect on RRPM. Pushing over after a steep climb can severely reduce rotor load and slow the rotor. An unstable gyroplane, especially one that would be statically G-Load unstable at this airspeed, would be

dangerous to "push over" such as in Answer A. Gyroplane pilots should be taught to always avoid doing what answer A suggests might be allowed! What is knowledge code H71? The question should clarify what type of rotorcraft the question applies to. This question may apply to helicopters, but it has special significance for gyroplanes!
– Greg Gremminger

FAA Question Number: **5.7.2.9**
FAA Knowledge Code: **H743**
When conducting a confined area-type operation, the primary purpose of the high reconnaissance is to determine the

- **A.** power requirements for the approach.
- **B.** amount of slope in the landing area.
- X **C.** suitability of the area for landing.

Comment: This is probably only a helicopter question, but gyroplanes should also verify the suitability of any landing area. – Greg Gremminger

FAA Question Number: **5.7.3.3**
FAA Knowledge Code: **H767**
If ground resonance is experienced during rotor spin-up, what action should you take?

- **A.** Make a normal takeoff immediately.
- **B.** Taxi to a smooth area.
- X **C.** Close the throttle and slowly raise the spin-up lever.

Comment: Knowledge Code H767 identifies this as a GYROPLANE question. Gyroplanes don't refer to a "spin up lever", but they often do have a "prerotator lever" which clutches the engine to the rotor for spin up prior to takeoff! This question probably refers to a specific model gyroplane - the Air and Space 18A which has a 3-bladed rotor and sits on wheels and tuned landing gear struts! As such it is highly prone to ground resonance and the FAA's answer may be based on specific guidance in that aircraft's operating manual! The 18A, or any other 3+ rotor bladed gyroplanes are no longer in production and are getting very rare in service. Test questions ought to better identify the aircraft type, if not the specific model! Questions probably should be more real world appropriate! – Greg Gremminger

FAA Question Number: **5.7.3.4**
FAA Knowledge Code: **H762**
The principal factor limiting the never-exceed speed (VNE) of a gyroplane is

- X **A.** lack of sufficient cyclic stick control to compensate for dissymmetry of lift or retreating blade stall, depending on which occurs first.
- **B.** turbulence and altitude.
- **C.** blade-tip speed, which must remain below the speed of sound.

Comment: I like this answer better than some of the other "dissymmetry of lift" questions. This is the traditionally simplistic answer. But it is not cyclic stick control that compensates for dissymmetry of lift. The cyclic stick range must simply allow enough pitch control range to properly flare, nose-over, etc. at the various allowed loadings of the gyroplane. The limiting factor related to compensation of "dissymmetry of relative wind " to maintain symmetrical lift is the flapping (teeter) range of the rotor. Rotor flap is not compensating for "dissymmetry of lift", it is compensating for dissymmetry of relative wind to maintain symmetry of lift!!!! It may be semantics, but it can be argued that there is no "retreating blade stall" - suggesting the blade is fully stalled. Actually, the stalled area increases at higher airspeeds until the flapping range is not sufficient to compensate for the increasing stalled area on the retreating blade(s). – Greg Gremminger

FAA Question Number: **5.7.3.5**
FAA Knowledge Code: **H765**
Why should gyroplane operations within the cross-hatched portion of a Height vs. Velocity chart be avoided?
X **A.** Sufficient airspeed may not be available to ensure a safe landing in case of an engine failure.
B. The rotor RPM may build excessively high if it is necessary to flare at such low altitudes.
C. Turbulence near the surface can dephase the blade dampers causing geometric unbalanced conditions on the rotor system.

FAA Question Number: **5.7.3.6**
FAA Knowledge Code: **H765**
The principal reason the shaded area of a Height vs. Velocity chart should be avoided is
X **A.** insufficient airspeed would be available to ensure a safe landing in case of an engine failure.
B. rotor RPM may decay before ground contact is made if an engine failure should occur.
C. rotor RPM may build excessively high if it is necessary to flare at such low altitudes.

FAA Question Number: **5.7.3.7**
FAA Knowledge Code: **H766**
During the transition from pre-rotation to flight, all rotor blades change pitch
A. to the same degree at the same point in the cycle of rotation.
X **B.** simultaneously but to different angles of incidence.
C. simultaneously to the same angle of incidence.

Comment: This question addresses understanding of the cyclic AOA of the rotor blades as they rotate to different points in the rotation. However, it could be argued that answer A is also correct! In forward flight at steady conditions, each rotor blade does change

pitch to the same degree at the same point around the cycle of rotation. The only reason that answer A might not be correct is that the question specifies the TRANSITION to flight, where flight is not a steady state and the blade AOA might not be exactly the same for each successive blade at a particular point in the cycle do to transitional loads on the rotor. As with a lot of FAA questions, tricky words can result in wrong answers, that do not verify actual mis-understanding of the important principles involved! Alright, answer B may be MORE correct fro tricky reasons, but does it verify real understanding!
– Greg Gremminger

FAA Question Number: **5.7.3.8**
FAA Knowledge Code: **H766**
Select the true statement concerning gyroplane taxi procedures.
X **A.** Avoid abrupt control movements when blades are turning.
B. The cyclic stick should be held slightly aft of neutral at all times.
C. The cyclic stick should be held in the neutral position at all times.

Comment: Confusing and likely mis-informed answers! Gyroplanes rotors should be stopped when taxiing. Taxiing with the rotors spinning can lead to severe bumping - but true if taxiing with the rotors turning slowly, any movement of the cyclic will be a handful for the pilot to handle as the rotor flaps against its flapping limits. The more correct answer, IMHO, would be C. Even if the rotor is turning, a neutral position would reduce the possibility of the rotor flapping to hit the prop or something else, and the minimal blade AOA that a neutral cyclic presents reduces the effects of gusty winds while taxiing. Answer C is the only answer similar to choices in Private (3.3.3.9) and Instructor (7.0.9.2) similar test questions. **For this reason, I think C is the answer the FAA expects!** The more correct answer would be to taxi with the rotor stopped, aligned fore/aft, and with the stick near full forward in the laterally neutral position. This results in a mostly level rotor, well clear of the prop and other aircraft components, presenting minimal blade AOA to gusty winds, and avoiding inadvertently hitting things with the rotor while taxiing.