I. Read the text below. What are the main components of the ILS system.

The ILS is an approach and landing aid that has been in widespread use since the 1960s and 1970s. The main elements of ILS include:

- A localizer antenna centred on the runway to provide lateral **guidance**. A total of 40 operating channels are available within the **band** 108.112 MHz. The localizer provides left and right lobe signals that are modulated by different frequencies (90 and 150 Hz) so that one signal or other will dominate when the aircraft is off the runway centre-line. The beams are arranged such that the 90 Hz modulated signal will predominate when the aircraft is to the left, while the 150 Hz signal will be strongest to the right. The difference in signal is used to drive a cross-pointer **deviation** needle so that the pilot is instructed to "fly right" when the 90 Hz signal is strongest, and "fly left" when the 150 Hz signal dominates. When the aircraft is on the centre-line, the cross-pointer deviation needle is positioned in the central position. This deviation signal is proportional to azimuth out to ±5º of the centre-line.

- A glide slope antenna located beside the **runway threshold** to provide vertical guidance. Forty operating channels are available within the frequency band 329.335 MHz. As for the localizer, two beams are located such that the **null position** is aligned with the desired glide slope, usually set at a nominal 3º. In the case of the glide slope, the 150 Hz modulated signal predominates below the glide slope and the 90 Hz signal is stronger above. When the signals are balanced, the aircraft is correctly positioned on the glide slope and the glide slope deviation needle is positioned in a central position. As for the localizer needle, the pilot is provided with "fly up" or "fly down" guidance to help him or her acquire and maintain the glide slope.[…]

- Marker beacons are located at various points down the approach path to give the pilot information as to what stage on the approach has been reached. These are the outer, middle, and inner markers. Location of the marker beacons are:
  - outer marker approximately 4.7 nm from the runway threshold,
  - middle marker ~3000 ft from touchdown,
  - inner marker ~1000 ft from touchdown.

The high approach speeds of most modern aircraft render the inner marker almost **superfluous** and it is seldom used.

- The marker beacons are all fan beams radiating on 75 MHz and provide different Morse code modulation tones that can be heard through the pilot's headset.[…] The overall audio effect of the marker beacons is to convey an increasing sense of urgency to the pilot as the aircraft nears the runway threshold.

A significant disadvantage of the ILS system is its **susceptibility** to beam distortion and **multipath effects**. This distortion can be caused by local terrain effects and large manmade structures, and even taxiing aircraft can cause unacceptable beam distortion, with the glide slope being the most sensitive. At times on busy airfields and during periods of limited visibility, this may preclude the movement of aircraft in sensitive areas, which in turn can lead to a reduction in airfield capacity. More recently, interference by high-power local FM radio stations has presented an additional problem, although this has been overcome by including improved **discrimination** circuits in the aircraft ILS receiver.[1]

II. Read the text again and decide if the statements below are true or false.

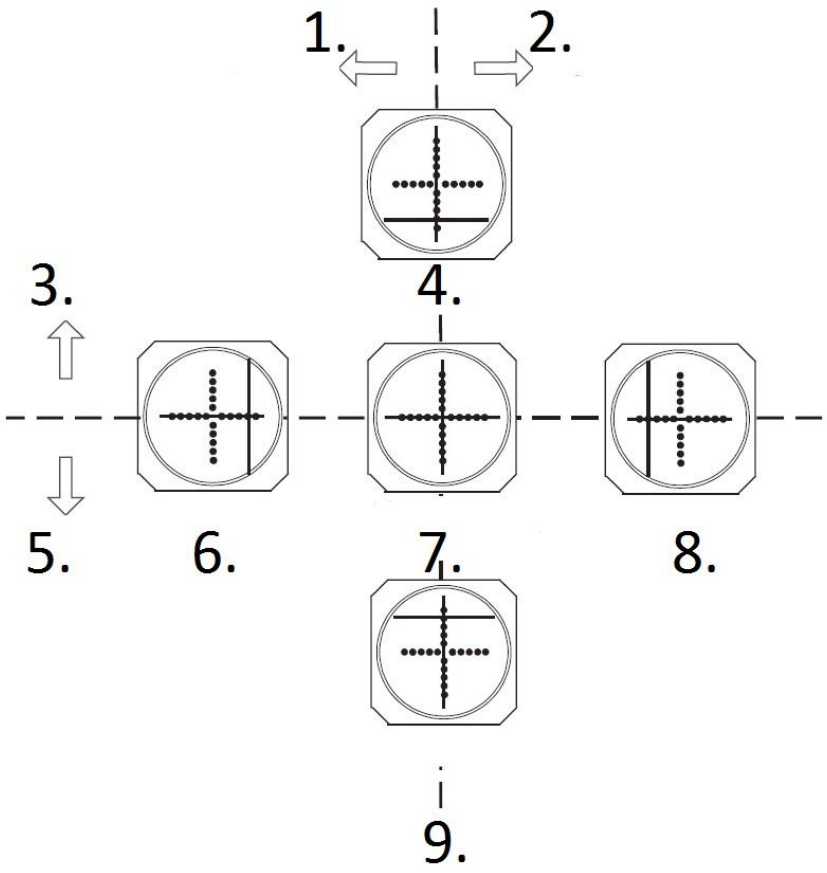
1. The localizer antenna is used to instruct the pilot if they should fly more to the right or the left while landing. T / F
2. Owing to the glideslope antenna the pilot knows if they are too high or too low. T / F
3. The middle marker beacon is indispensable for touchdown for modern airliner. T / F
4. The ILS is prone to various disturbances. T / F
5. The ILS may, in some cases, impede performance of airports. T / F

[1] Moir, Seabridge, *Civil Avionics Systems*

III. Label the ILS guidance display with appropriate phrases from the list.

above glideslope on centreline/on glideslope fly right fly up fly left
below glideslope fly downright of centerlineleft of centreline

ILS guidance display



III. Explain the words in bold in the text.

IV. Complete the sentences below with appropriate words from the text.

1. Tapes recovered from the airliner's cockpit voice recorder indicate that the crew were unaware that they were _____ course and violating Soviet airspace.
2. The increased demand for pilots is proportional _____ the increased volume of air travel.
3. We are now _____ the range of the ILS.
4. The ILS is susceptible _____ signal distortions.

Speaking:

Work in pairs and describe the aviation incidents involving ILS. Speculate on how the incident might have been avoided.

Student A: http://www.aviation-accidents.net/jet-2-boeing-b737-33a-g-celc/

Student B: http://www.aviation-accidents.net/ryanair-boeing-b737-800-ei-enl-flight-fr3531/