

2507/304

**AIRCRAFT COMMUNICATION, NAVIGATION  
AND SURVEILLANCE SYSTEMS**

**June/July 2023**

**Time: 3 hours**



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

**DIPLOMA IN AERONAUTICAL ENGINEERING  
(AVIONICS OPTION)**

**MODULE III**

**AIRCRAFT COMMUNICATION, NAVIGATION AND SURVEILLANCE SYSTEMS**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Mathematical tables/Non programmable calculator;*

*Drawing instruments.*

*This paper consists of EIGHT questions in THREE sections; A, B and C.*

*Answer THREE questions from section A, ONE question from section B and ONE question from section C.*

*All questions carry equal marks.*

*Maximum marks for each question are as indicated.*

*Candidates should answer the questions in English.*

**This paper consists of 5 printed pages.**

**Candidates should check the question paper to ascertain that  
all the pages are printed as indicated and that no questions are missing.**



## SECTION A: AIRCRAFT NAVIGATION SYSTEMS.

*Answer THREE questions from this section.*

1. (a) With reference to hyperbolic radio navigation systems:
  - (i) explain how the system is used to determine exact location; (8 marks)
  - (ii) draw and label a block diagram of a simple loran C. (8 marks)
- (b) With reference to an aircraft GPS navigation system, highlight **eight** functions of a typical receiver data processor. (4 marks)
2. (a) Describe the aircraft instrument landing system. (5 marks)
- (b) With reference to airborne instrument landing system, draw a labelled schematic diagram and show the flow of signals received from various associated equipment. (7 marks)
- (c) With reference to microwave landing system, explain each of the following:
  - (i) elevation guidance;
  - (ii) range guidance. (8 marks)
3. (a) With reference to aircraft radio and navigation equipment maintenance, testing and safety:
  - (i) discuss cable coding and its application; (8 marks)
  - (ii) highlight **six** rules to be observed when operating the weather radar on the ground. (6 marks)
- (b) With the aid of a labelled sketch, describe a cardioid as applied to aeriols. (6 marks)
4. (a) Highlight **three** ways of minimizing errors arising due to a change in phase offset in hyperbolic radio navigation. (3 marks)
- (b) Describe Doppler shift as applied in aircraft navigation. (3 marks)
- (c) Explain the Doppler measurement of ground speed using a single beam system. (5 marks)
- (d) Draw and label a typical VOR installation on an aircraft. (9 marks)



**SECTION B: AIRCRAFT COMMUNICATION SYSTEM.**

*Answer ONE question from this section.*

5. (a) Using a labelled block diagram, show the operation of a simplified aircraft radio receiver. (10 marks)
- (b) Discuss a dipole antenna used in aviation. (6 marks)
- (c) With the aid of sketches, explain the difference between analogue and digital signal. (4 marks)
6. Discuss the construction, operation and safety of a typical cockpit voice recorder system shown in figure 1. (20 marks)



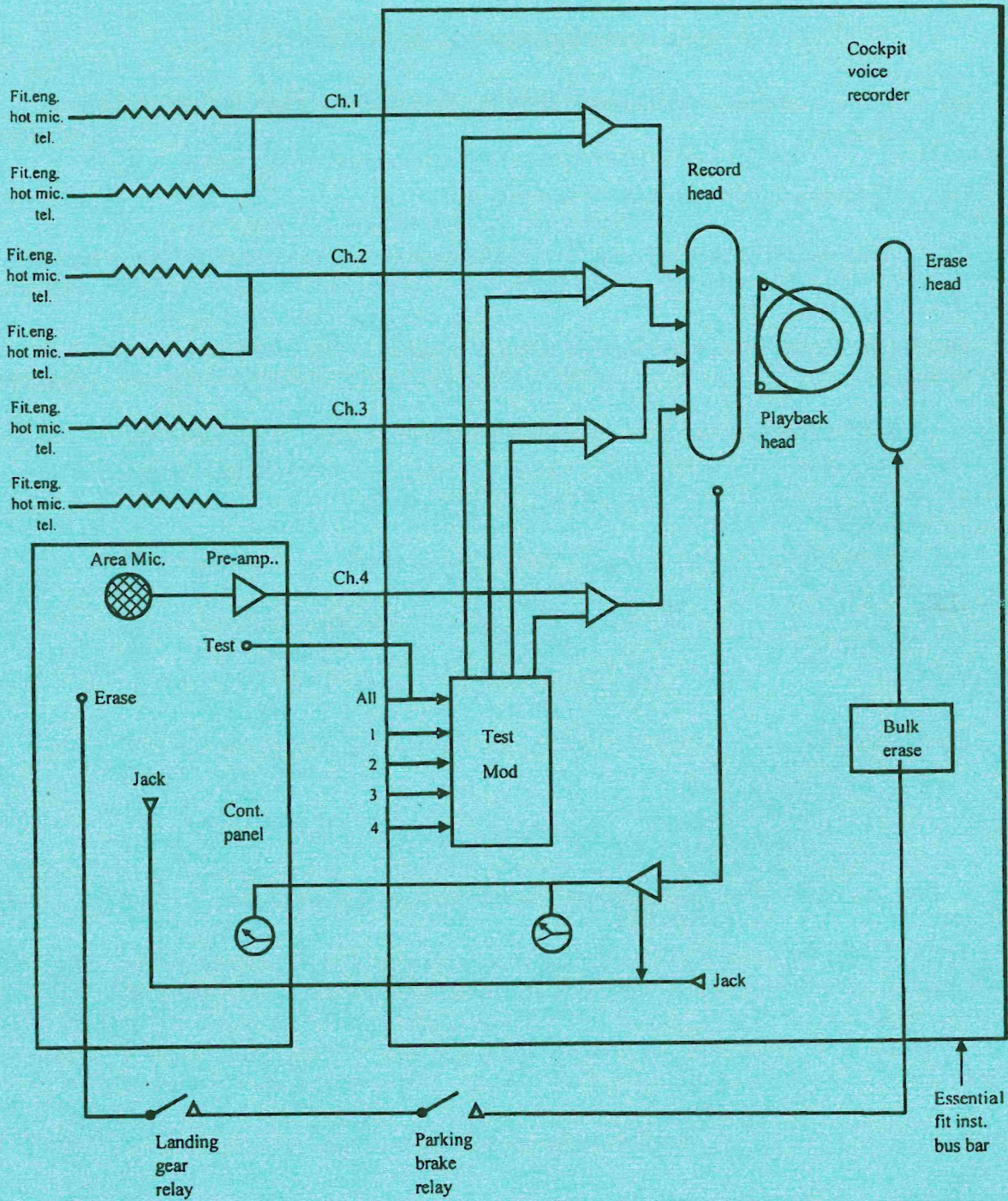


Fig. 1



**SECTION C: AIRCRAFT SURVEILLANCE SYSTEM.**

*Answer ONE question from this section.*

7. (a) Outline the procedure of carrying out operational test of an underwater locator beacon. (12 marks)
- (b) With reference to TCAS immediate actions after a resolution advisory by the system, explain the behaviour of the aircraft and the action of the pilot. (8 marks)
8. (a) Outline the installation requirements for emergency locator transmitter on fixed wing aircraft. (8 marks)
- (b) With the aid of a labelled block diagram, draw the layout and signal flow for a simple transponder. (12 marks)

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