**2507/304**
**AIRCRAFT COMMUNICATION, SURVEILLANCE AND NAVIGATION SYSTEMS**
**Oct./Nov. 2023**
**Time: 3 hours**

**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

# DIPLOMA IN AERONAUTICAL ENGINEERING (AVIONICS OPTION)

## MODULE III

AIRCRAFT COMMUNICATION, SURVEILLANCE AND NAVIGATION SYSTEMS

**3 hours**

## INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*
*Answer booklet;*
*Drawing instruments;*
*Mathematical tables/Non programmable scientific calculator.*
*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 part of a question are indicated.*
***Candidates should answer the questions in English.***

**This paper consists of 3 printed pages.**

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



**Turn over**

## SECTION A: NAVIGATION

*Answer **THREE** questions from this section.*

1. (a) Explain **two** reasons and **three** benefits for using global positioning area navigation systems. (5 marks)

   (b) Table 1 shows the inputs required for a pilot to define RNAV route SND to NEW using available and sensibly placed VOR/DME. Using the data, draw the route plan.

| WAYPOINT | STATION | FREQUENCY | RADIAL | DISTANCE | APPLICATION |
|---|---|---|---|---|---|
| 10 | BTM | 116.4MHz | 067 | 42 | En-route Nav. |
| 11 | KAP | 112.1MHz | 066 | 29 | En-route Nav. |
| 12 | NEW | 114.25MHz | 218 | 26 | En-route Nav. |
| 13 | NEW | 114.25MHz | 251 | 4 | Holding LOM |
| 14 | L-NC | 111.5MHz | N/A | N/A | ILS |

**Table 1** (15 marks)

2. With reference to instrument landing system:

   (a) describe the operation of a marker beacon. (7 marks)

   (b) using a labelled block diagram, describe the operation of a localizer. (13 marks)

3. (a) Explain **three** basic requirements of an aircraft communication system receiver. (6 marks)

   (b) Outline **six** pieces of information contained in radar equipment systems cable coding. (6 marks)

   (c) Highlight the procedure for inspecting HF antenna installation for cracks and general condition. (8 marks)

4. (a) With the aid of a labelled sketch, explain the principle of operation of marconi quarter wave aerials. (6 marks)

   (b) With the aid of labelled block diagram, explain the function of each basic component of an automatic direction finding system. (14 marks)

## SECTION B: AIRCRAFT COMMUNICATION

*Answer **ONE** question from this section.*

5. (a) An aircraft flying at 96,000 ft receives a transmission from a station at 1200 ft. Determine the maximum distance communications can be made between the two stations. (4 marks)

(b) With reference to aircraft maintenance procedures, outline the responsibilities of a radio engineer. (16 marks)

6. (a) Explain the characteristics of a typical aircraft attendant's handset. (3 marks)

(b) Highlight the main components of a modern aircraft flight management system. (4 marks)

(c) Outline the procedure for performing full functional checks on the CVR during routine maintenance. (13 marks)

## SECTION C: SURVEILLANCE

*Answer **ONE** question from this section.*

7. (a) Explain the information transmitted to a rescue team from an emergency locator beacon fitted on an aircraft. (4 marks)

(b) Describe the operation of an underwater locator beacon used on aircraft surveillance system. (8 marks)

(c) Discuss the installation requirements for emergency locator transmitter on fixed and rotary wing aircraft. (8 marks)

8. (a) Outline the requirements of a secondary surveillance radar. (4 marks)

(b) (i) State **four** functions of an aircraft surveillance transponder.

(ii) Draw and label typical layout and signal flow of an aircraft surveillance transponder. (16 marks)

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