THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)
DIPLOMA IN AERONAUTICAL ENGINEERING
(AVIONICS OPTION)

MODULE I

AIRFRAME STRUCTURES AND AIRFIELD SAFETY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Drawing instruments;
Non-programmable scientific calculator.

This paper consists of EIGHT questions in THREE sections; A, B and C.
Answer THREE questions in section A and ONE question each from sections B and C in the answer booklet provided.
Maximum marks for each part of a question are as shown.
Candidates should answer the questions in English.

This paper consists of 4 printed pages.
Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

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SECTION A: AIRFRAME STRUCTURES

Answer THREE questions in this section.

1. (a) Explain five aircraft station numbering systems. (10 marks)
   (b) With the aid of a labelled sketch, show the structural construction of aircraft tail fin. (5 marks)
   (c) Outline five factors that determine the size of an aircraft tail plane. (5 marks)

2. With reference to aircraft landing gear, highlight:
   (a) three advantages of tricycle landing gear arrangement; (3 marks)
   (b) the procedure for charging nose landing gear oleo strut; (11 marks)
   (c) six requirements of landing gear system. (6 marks)

3. (a) Differentiate between each of the following properties of aircraft materials:
      (i) strength and hardness; (6 marks)
      (ii) ductility and elasticity;
      (iii) malleability and conductivity.
      (b) Outline eight advantages of composite materials in aircraft structural construction. (8 marks)
      (c) With the aid of a labelled sketch, illustrate a typical aircraft structural insertion repair method. (6 marks)

4. (a) Outline three aspects considered when adjusting aircraft control cable movement. (3 marks)
   (b) With the aid of sketches, explain the function of each of the following control system components:
      (i) pulleys;
      (ii) bellcranks;
      (iii) push pull rods;
      (iv) turn buckles;
      (v) torque tube. (10 marks)
   (c) Highlight the procedure of swaging control cable terminals. (7 marks)
5. (a) With the aid of labelled sketches, show the difference between angle of incidence and angle of attack. 

(b) With the aid of a labelled sketch, differentiate between effective and geometric pitch of an aircraft propeller. 

(c) Table 1 represents the coefficients of lift at various angles of attack. 

<table>
<thead>
<tr>
<th>Angle of attack</th>
<th>0°</th>
<th>2°</th>
<th>4°</th>
<th>6°</th>
<th>8°</th>
<th>10°</th>
<th>12°</th>
<th>14°</th>
<th>16°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of lift for symmetrical aerofoil</td>
<td>0</td>
<td>0.2</td>
<td>0.55</td>
<td>0.55</td>
<td>0.75</td>
<td>0.91</td>
<td>1.15</td>
<td>1.25</td>
<td>1.1</td>
</tr>
<tr>
<td>Coefficient of lift for asymmetrical aerofoil</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.78</td>
<td>0.95</td>
<td>1.15</td>
<td>1.3</td>
<td>1.45</td>
<td>1.2</td>
</tr>
</tbody>
</table>

(i) Draw the symmetrical and asymmetrical graphs. 
(ii) Explain the lift curves. 

6. (a) With the aid of labelled sketches, differentiate between lamina and turbulent boundary layers. 

(b) (i) With reference to aircraft performance, explain two effects of each of the following: 

(I) skin friction; 
(II) induced drag. 

(ii) Explain three methods of reducing induced drag.
SECTION C: AIRFIELD AND SAFETY PROCEDURES

Answer ONE question in this section.

7. (a) List four determinants of a safe working aircraft maintenance environment. (4 marks)

(b) Outline eight safety precautions to be observed prior to fueling an aircraft. (8 marks)

(c) Outline eight objectives of ICAO in international air navigation. (8 marks)

8. (a) With reference to ICAO risk management system (RMS):

(i) explain three essential elements; (12 marks)

(ii) draw a flow diagram of risk management process.

(b) Explain four of each of the following stressors of aircraft maintenance personnel:

(i) psychological; (8 marks)

(ii) physiological.