Name: _____ Index No: _____/_____

2107/304
FLIGHT MECHANICS
Oct./Nov. 2014
Time: 3 hours

Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING (AIRFRAMES AND ENGINES OPTION)

FLIGHT MECHANICS

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have the following for this examination:
Drawing instruments;
Mathematical tables/Calculator.
*This paper consists of **EIGHT** questions.*
*Answer any **FIVE** questions in the spaces provided in this question paper.*
Maximum marks for each part of a question are as shown.
*Do **NOT** remove any pages from this booklet.*
Candidates should answer the questions in English.

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	TOTAL SCORE
Candidate's Score									

This paper consists of 20 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

1. (a) Explain each of the following atmospheric terms:

(i) relative humidity;
(ii) dew point temperature;
(iii) frost point temperature.

(6 marks)

(b) Explain the effects of head wind and tail wind on the relationship between the ground and airspeed of an aircraft.
(5 marks)

(c) (i) Describe each of the **three** temperature lapse-rates according to I.C.A.O. requirements.

(ii) Outline the **three** pressure "Q" codes for altimeter settings.

(9 marks)

2. (a) Explain each of the following terms as applied to an aerofoil:

(i) angle of incidence;
(ii) wash-out;
(iii) longitudinal dihedral.

(6 marks)

(b) With the aid of labelled sketches, differentiate between high lift and high speed aerofoils.
(6 marks)

(c) Using a labelled sketch, explain how Bernoullis principle is applied in the generation of lift by an aerofoil.
(8 marks)

3. (a) Describe each of the following helicopter movements and state **one** way of minimising the motion:

(i) drift;
(ii) pendular action.

(6 marks)

(b) Discuss the causes and remedy of lift on a helicopter dysemmetry of lift during translational flight.
(8 marks)

(c) A helicopter of mass 12 tonne climbs vertically at a steady speed of 18 km/hr against a dow-gust of 6 KN. If the rotor efficiency is 70 per cent, calculate the thrust and shaft horse power required. Take air density = 1.2 kg/m^3.
(6 marks)

4. (a) Explain a launch window as applied in launching of missiles and space crafts.
(2 marks)

(b) With the aid of a labelled sketch, discuss a re-entry corridor of a space craft.
(12 marks)

(c) Explain **three** reasons as to why the Astraunants float and do not fall from the moon to the earth once outside their vessels. (6 marks)

5. (a) Differentiate between spiral stability and spiral divergence as applied to an aircraft in flight. (4 marks)

(b) With the aid of a sketch, discuss why aircrafts are fitted with tail planes. (16 marks)

6. (a) Using labelled sketches, explain the difference between a normal and an oblique shock waves. (6 marks)

(b) With the aid of labelled sketches, describe the significance of some barrier in high speed flight. (6 marks)

(c) With the aid of a labelled sketch, explain how a swept back wing increases the aircraft critical mach number. (8 marks)

7. (a) Describe a nozzle and explain how it achieves its function. (5 marks)

(b) Using a sketch, show how a nozzle produces pressure differential in operation. (3 marks)

(c) (i) With the aid of sketch, show the design geometry of an Orifice.

(ii) Highlight **eight** types of Orifices.

(12 marks)

8. (a) With the aid of a sketch, explain how an aircraft turn developes centripetal force required to maintain it on the curve path. (8 marks)

(b) With the aid of labelled sketches, explain the relationship between the forces acting on an aircraft in the following phases of flight:

(i) climbing steadily;
(ii) descending steadily without power.

(6 marks)

(c) An aircraft of mass 8 tonne makes a controlled gliding descent under power in a straight path at an angle of 10^0 to the horizontal. If it has an acceleration of 2 m/s^2 with a thrust of 10 kN, calculate the lift to drag ratio.
Take $g = 9.8\ m/s^2$

(6 marks)