

2506/302

FLIGHT MECHANICS

Oct./Nov. 2023

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)

MODULE III

FLIGHT MECHANICS

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.

Answer FIVE questions in the answer booklet provided.

Maximum marks for each question are as shown.

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.

1. (a) Explain the tests conducted before certifying an altimeter fit to use in flight. (9 marks)
- (b) Discuss the function, construction and operation of a pressure altimeter. (11 marks)
2. (a) A twin-engined aircraft, with propellers of 3 m diameter, is flying at 10,000 ft at an airspeed of 350 knots. If the aircraft have a mass of 10,000 kg, and has a lift/drag ratio of 5 to 1 in these conditions:
 - (i) determine thrust being produced; (5 marks)
 - (ii) speed of the slip stream relative to the aircraft. (5 marks)
- (b) With the aid of a P-V diagram, explain how Bryton cycle operates. (10 marks)
3. With the aid of labeled sketches, explain the development of shockwaves at increasing mach numbers. (20 marks)
4. (a) Highlight the factors considered when conducting an elective maintenance test flight. (14 marks)
- (b) Outline the items that should be completed in a post flight reporting. (6 marks)
5. An aircraft lavatory system pipe is connected to a 45° reducing bend of 600 mm and 300 mm diameters at the inlet and outlet respectively. Calculate the force exerted by water at the bend if the intensity of pressure at inlet is 8.829 N/cm and the rate of flow of water is 600 litres per second. (20 marks)
6. With reference to satellites, explain each of the following types of orbits:
 - (a) Geosynchronous; (2 marks)
 - (b) Geostationary; (3 marks)
 - (c) Polar; (6 marks)
 - (d) Walking; (4 marks)
 - (e) Sun synchronous. (5 marks)

7. (a) Given:
Radius of the earth = 6371 km
Gravitational constant = $6.67 \times 10^{-11} Nm^2$
Mass of earth = $5.977 \times 10^{24} kg$

Determine the:

- (i) acceleration of gravity g , at the surface of the earth; (3 marks)
- (ii) Velocity necessary for a rocket to escape from the gravitational field of the earth. (4 marks)
- (b) With the aid of a labelled sketch, describe the sequence of launching a space craft to the moon. (13 marks)
8. (a) Highlight **five** effects of each of the following types of shockwaves on supersonic flow:
- (i) Normal;
(ii) Oblique;
(iii) Expansion. (15 marks)
- (b) Highlight **five** experimental methods used to investigate problems associated with transonic flight. (5 marks)

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