



EAST AFRICAN SCHOOL OF AVIATION EXAMINATION

END - TERM I

ENGINEERING SECTION

EXAMINATION FOR THE AWARD OF DIPLOMA IN AERONAUTICAL ENGINEERING

SUBJECT: FLIGHT MECHANICS

TREAM: TEP YEAR 3

Duration: 3 Hrs.

INSTRUCTIONS TO CANDIDATE:

1. *This paper consists of **THREE (3)** printed pages.*
2. *All questions carry equal marks.*
3. *Maximum marks for each part of a question are as shown*
4. *Attempt all **FIVE** questions.*
5. *Cheating will lead to exam cancellation.*
6. *You should have the following:-*
 - *Mathematical Tables*
 - *Scientific Calculator.*

- 1 (a) Differentiate between the following aircraft terms:
- (i) Dynamic stability and control
 - (ii) Downwash and wash out
 - (iii) Sweepback and dihedral angle (6 marks)
- (b) Outline the factors that contribute to longitudinal instability on an aircraft in flight (5 marks)
- (c) With the aid of sketches, explain the term dihedral angle and how it brings about lateral stability on an aircraft in flight (9 marks)
- 2 (a) Outline the FIVE phases considered on an aircraft in flight (5 marks)
- (b) Explain the conditions of each type of each type of the FOUR forces acting on an aircraft to enhance equilibrium (8 marks)
- (c) (i) Differentiate between between the terms center of gravity and center of pressure and state the location of each on an aircraft in flight
 - (ii) An airplane weighs 20,000N, the drag in normal horizontal flight is 2,500N, the center of pressure is 50mm behind the center of gravity and the drag is 300mm above the line of thrust. Determine the load required on the Tail plane , which is 10m behind the center of gravity to maintain balance in normal horizontal flight (7 marks)
- 3 (a) Outline the functions of an aircraft trailing edge flaps (5 marks)
- (b) Explain each of the following high lift devices:
- (i) Leading edge flaps
 - (ii) Trailing edge flaps
 - (iii) Vortex generators (6 marks)
- (c) with the aid of sketches discuss the effects of each of the following types of aircraft flaps
- (i) split
 - (ii) double slotted
 - (iii) fowler
- 4 (a) Differentiate between each of the following fluid flow characteristics and state how each occurs

- (i) Lamina and turbulent boundary layer
 - (ii) Compressible and incompressible flow
- (b) With the aid of sketches discuss each of the following types of drag and state how each is minimized (9 marks)
- (i) Induced drag
 - (ii) Skin friction
 - (iii) Form drag
- (c) Outline the factors that determine the magnitude of drag on an aerofoil. (3 marks)
- 5 (a) Explain Six characteristics an aerofoil section should possess to achieve maximum lift characteristics (6 marks)
- (b) Find lift, drag and pitching moments per unit span (about the aerodynamic centre) of an airfoil of this section of chord 2 metres at 6 degrees angle of attack and flying at 100 knots at sea level conditions

Take : $C_l=0.6$

$C_d=0.028$

$C_m= -0.09$ about aerodynamic center (9 marks)

- (c) Explain the following methods of thrust generation of an aircraft (5 marks)
- (i) Aerodynamic action
 - (ii) Jet reaction