



EAST AFRICAN SCHOOL OF AVIATION FINAL EXAMINATION

SAFETY SECTION

SUBJECT: PRINCIPLES OF FLIGHT

Stream: Flight Dispatch

Duration: 2Hrs

DAY/DATE:

TIME: 9:00-11:00.

Instructions to Candidate:

- 1. There are Eleven (11) printed pages**
- 2. There are Two Sections: Section A (40 Marks) and Section B (30 Marks)**
- 3. Answer all the questions**
- 4. Examination rules and regulations should be adhered to.**

STUDENT'S NAME:

STUDENT'S NUMBER:

SECTION A (40 Marks)
ANSWER ALL QUESTIONS

1. The relative thickness of an aerofoil is expressed in:

- A* camber.
- B* meters.
- C* degrees cross section tail angle.
- D* % chord.

2. One disadvantage of the swept back wing is it's stalling characteristics. At the stall:

- A* wing root stall will occur first, which produces a rolling moment
- B* tip stall will occur first, which produces a nose-down moment
- C* leading edge stall will occur first, which produces a nose down moment
- D* tip stall will occur first, which produces a pitch-up moment.

3. An aircraft at low subsonic speed will never stall:

- A* as long as the CAS is kept above the power-on stall speed
- B* as long as the IAS is kept above the power-on stall speed
- C* as long as the maximum angle of attack is not exceeded
- D* as long as the pitch angle is negative

4. Force on the tail and its effect on V_S due to CG movement:

- A* if rearward movement of the CG gives a reduced down-force on the tail, V_S will be higher
- B* if forward movement of the CG gives a reduced down-force on the tail, V_S will be higher
- C* if rearward movement of the CG gives a reduced down-force on the tail, V_S will be reduced.
- D* if rearward movement of the CG gives an increased down-force on the tail, V_S will be reduced

5. Which of these definitions of propeller parameters is correct?

- A* Propeller angle of attack = angle between blade chord line and propeller vertical plane
- B* Critical tip velocity = propeller speed at which risk of flow separation at some parts of propeller blade occurs.
- C* geometric propeller pitch = the theoretical distance a propeller blade element is traveling in forward direction in one propeller revolution
- D* Blade angle = angle between blade chord line and propeller axis

6. Which one of the following systems suppresses the tendency to "Dutch roll"?

- A* Rudder limiter.
- B* Yaw damper.
- C* Roll spoilers.
- D* Spoiler mixer.

7. A swept wing aircraft stalls and the wake contacts the horizontal tail. What would be the stall behavior?

- A* nose down
- B* nose up and/ or elevator ineffectiveness
- C* tendency to increase speed after stall
- D* nose up

8. Which of the following decreases induced Drag?

- A* wing fences
- B* Anhedral
- C* winglets
- D* Low aspect ratio plan form

9. "A line connecting the leading- and trailing edge midway between the upper and lower surface of an aerofoil". This definition is applicable for :

- A* the mean aerodynamic chord line
- B* the upper camber line
- C* the camber line
- D* the chord line

10. Differential aileron deflection:

- A* is required to achieve the required roll-rate.
- B* equals the drag of the right and left aileron.
- C* is required to keep the total lift constant when ailerons are deflected.
- D* increases the CLmax.

11. Compared with level flight prior to the stall, the lift (1) and drag (2) in the stall change as follows:

- A* (1) increases (2) decreases.
- B* (1) decreases (2) increases.
- C* (1) decreases (2) decreases.
- D* (1) increases (2) increases.

12. The centre of gravity moving aft will:

- A* increase the elevator up effectiveness.
- B* decrease the elevator up effectiveness.
- C* not affect the elevator up or down effectiveness.
- D* increase or decrease the elevator up effectiveness, depending on wing location.

13. After take-off, the slats (when installed) are always retracted later than the flaps. Why?

- a) Because SLATS EXTENDED gives a large decrease in stall speed with relatively less drag.
- b) Because SLATS EXTENDED provides a better view from the cockpit than flaps FLAPS EXTENDED.
- c) Because FLAPS EXTENDED gives a large decrease in stall speed with relatively less drag.
- d) Because VMCA with SLATS EXTENDED is more favourable compared with the FLAPS EXTENDED situation.

14. Which of the following statements about stall speed is correct?

- A* Decreasing the angle of sweep of the wing will decrease the stall speed.
- B* Increasing the angle of sweep of the wing will decrease the stall speed.
- C* Use of a T-tail will decrease the stall speed..
- D* Increasing the anhedral of the wing will decrease the stall speed.

15. The lift- and drag forces, acting on a wing cross section:

- A* depend on the pressure distribution about the wing cross section.
- B* are normal to each other at just one angle of attack.
- C* are proportional to each other, independent of angle of attack.
- D* vary linearly with the angle of attack.

16. With flaps deployed, at a constant IAS in straight and level flight , the magnitude of the tip vortices;

- A* increases or decreases depending upon the initial angle of attack.
- B* increases
- C* decreases
- D* remains the same

17. When the trailing edge flaps are deflected in level flight, the change in pitch moment will be:

- A* nose up.
- B* zero.
- C* dependent on c.g. location.
- D* nose down.

18. Increasing the number of propeller blades will:

- A* decrease the torque in the propeller shaft at maximum power.
- B* increase the maximum absorption of power.
- C* increase the propeller efficiency.
- D* increase the noise level at maximum power.

19. The angle of attack (aerodynamic angle of incidence) of an aerofoil is the angle between the:

- A* bottom surface and the chord line.
- B* chord line and the relative undisturbed airflow.
- C* bottom surface and the horizontal
- D* bottom surface and the relative airflow.

20. After a disturbance about the lateral axis, an Aeroplane oscillates about the lateral axis at a constant amplitude. The aeroplane is:

- A* Statically unstable - Dynamically stable
- B* Statically stable - Dynamically unstable
- C* Statically unstable - Dynamically neutral
- D* Statically stable - Dynamically neutral

21. The continuity equation states: If the area of a tube is increasing, the speed of the subsonic and incompressible flow inside is

- A* increasing.
- B* sonic.
- C* decreasing.
- D* not changing.

22. Bernoulli's theorem states:

- A* Dynamic pressure increase, Static pressure increase
- B* Dynamic pressure increase, Static pressure decrease
- C* Dynamic pressure is maximum at stagnation point
- D* Zero pressure at Zero dynamic pressure.

23. Which of the following are the correct SI Units?

- A* Density is Kilograms per cubic metre, Force is Newtons.
- B* Density is Newtons per cubic metre, Force is Kilograms
- C* Density is Kilograms per Newton, Force is Newtons – metres squared.
- D* Density is Kilograms per square metre, Force is Kilograms

24 How do Vortex generators work?

- a) Re-direct spanwise flow
- b) Take energy from free stream and introduce it into the boundary layer
- c) Reduce kinetic energy to delay separation
- d) Reduce the adverse pressure gradient

25 Which is one of the disadvantages of increasing the number of propeller blades?

- A* Increased noise
- B* Less power can be absorbed by the propeller
- C* Higher tip-speed
- D* decrease propeller efficiency

26 A symmetrical aerofoil at $CL=0$ will produce?

- A* A negative (nose down) pitching moment
- B* A positive (nose up) pitching moment
- C* Zero pitching moment
- D* No aerodynamic Force.

27 What increases the stalling angle of attack? Use of:

- A* flaps
- B* spoilers
- C* fuselage mounted speed-brakes
- D* slats

28 The trailing edge flaps when extended:

- A* significantly increase the angle of attack for maximum lift
- B* significantly lower the drag
- C* worsen the best angle of glide
- D* increase the zero lift angle of attack

29 When an aeroplane with the C.G forward of the centre of pressure of the combined wing / fuselage is in straight and level flight , the vertical load on the tail plane will be:

- a) Downwards because it is always negative regardless of the position of the centre of gravity.
- b) Upwards
- c) Downwards
- d) Zero because in steady flight all loads are in equilibrium.

30 Which of the following statements about the spin is correct?

- A* In the spin, airspeed continuously increases.
- B* Every aeroplane should be designed such that it can never enter a spin.
- C* During spin recovery the ailerons should be kept in the neutral position.
- D* An aeroplane is prone to spin when the stall starts at the wing root.

31 Which of the following statements about the difference between Krueger flaps and slats is correct

- a) Deploying a slat will increase the critical angle of attack, deploying a Krueger flap does not.
- b) Deploying a Krueger flap will form a slot, deploying a slat will not.
- c) Deploying a Krueger flap will increase critical angle of attack, deploying a slat will not.
- d) Deploying a slat will form a slot, deploying a Krueger flap does not.

32 Comparing the lift coefficient and drag coefficient at normal angle of attack:

- A* CL is much lower than CD
- B* CL is much greater than CD
- C* CL has approximately the same value as CD
- D* CL is lower than CD

33 Which statement about induced drag and tip vortices is correct?

- A* The flow direction at the upper and under side of the wing, both deviate in wing tip direction.
- B* The wing tip vortices and the induced drag decrease at increasing angle of attack.
- C* The flow direction at the upper side of the wing has a component in wing root direction, the flow at the underside of the wing in wing tip direction.
- D* Tip vortices can be diminished by vortex generators.

34. When considering the lift and Drag Forces on an aerofoil section:

- A* They are only Normal to each other at one angle of attack
- B* They both depend on the pressure distribution on the aerofoil section
- C* they vary linearly
- D* Lift is proportional to Drag.

35. The angle between the aeroplane longitudinal axis and the chord line is the:

- A* angle of incidence.
- B* glide path angle.
- C* angle of attack.
- D* climb path angle.

36. The effects of very heavy rain (tropical rain) on the aerodynamic characteristics of an aeroplane are:

- A* decrease of CLmax and increase of drag.
- B* decrease of CLmax and decrease of drag.
- C* increase of CLmax and increase of drag.
- D* increase of CLmax and decrease of drag.

37 Two identical aircrafts of the same weight fly at different altitudes. All other important factors remaining constant, assuming no compressibility and ISA Conditions, what is the TAS of each aircraft?

- A* The same
- B* Greater in the higher aircraft
- C* Greater in the lower aircraft
- D* Less in the higher aircraft

38 The static pressure is acting:

- A* only perpendicular to the direction of the flow.
- B* only in the direction of the total pressure.
- C* in all directions.
- D* only in direction of the flow.

39. Winglets

- A* decrease the induced drag.
- B* decrease the static lateral stability.
- C* increase the manoeuvrability.
- D* create an elliptical lift distribution.

40 Which of the following statements about the stall of a straight wing aeroplane is correct?

- a) Just before the stall, the aeroplane will have a nose- down tendency.
- b) Buffeting is the result of flow separation on the tail plane.
- c) The nose-down effect is the result of increasing down-wash due to flow separation.
- d) The horizontal tail will stall at a higher speed than the wing.

SECTION B (30 Marks)

1) Using a diagram, explain the generation of LIFT.

(6 MARKS)

2) Using a diagram, explain the difference in the generation of LIFT by:

(4 Marks)

- a) A symmetrical aerofoil
- b) Assymmetrical aerofoil

3) a) What is Drag?

(2 Marks)

b) List the different types of Drag.

(3 marks)

c) Using a well-illustrated drag curve diagram, explain the effect of Weight and Flap deployment

(9 marks)

- 4) Using diagrams, explain the difference in:
- a) A split flap
 - b) A plain flap
 - c) A fowler flap

(6 Marks)

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