



## EAST AFRICAN SCHOOL OF AVIATION SUPPLEMENTARY EXAMINATION

### SAFETY SECTION

SUBJECT: Principles of Flight

Stream:

Duration: 2Hrs

DATE:

TIME:

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Instructions to Candidate:

1. This paper consist of two sections
2. Answer all the questions in both sections
3. Examination rules and regulations should be adhered to.
4. Total marks= 70

STUDENT'S NAME: -----

STUDENT'S NUMBER: -----

1. *wing span is the distance as measured:*
  - a. *from leading edge to trailing edge*
  - b. *from wing tip to wing tip*
  - c. *from wing root to wing tip*
  - d. *along the longitudinal axis*
  
2. *In a stationery subsonic streamline flow pattern, if streamline converge, in this part of the pattern, the static pressure(I) will....and the velocity(II) Will...:*
  - a. *(i)decrease (ii)increase*
  - b. *Increase (ii) increase*
  - c. *Increase(ii)decrease*
  - d. *Decrease (ii)decrease*
  
3. *Comparing the lift coefficient and drag coefficient at normal angle of attack:*
  - a. *CL is much lower than CD*
  - b. *CL is lower than CD*
  - c. *CL is much higher than CD*
  - d. *CL is approximately the same value as CD*
  
4. *The location of the centre of pressure of a positive cambered wing at increasing angle of attack will:*
  - a. *Not shift*
  - b. *Shift aft*
  - c. *Shift forward*
  - d. *Shift in span wise direction*
  
5. *The angle of attack of a wing profile is defined as the angle between:*
  - a. *The local airflow and the chord line*
  - b. *The undisturbed airflow and the mean camber line*
  - c. *The undisturbed airflow and the chord line*
  - d. *The local airflow and the mean camber line*
  
6. *Directional control is provided by:*
  - a. *The rudder*
  - b. *The elevators*
  - c. *The ailerons*
  - d. *Landing gears*
  
7. *Wing loading is:*
  - a. *The ratio of lift to aircraft*
  - b. *The ratio of wing weight to wing area*
  - c. *The ratio of total aircraft weight to wing area*
  - d. *The ratio of lift to drag*
  
8. *which one of the following statements about Bernoulli's theorem is correct.*
  - a. *The pressure decreases as static pressure decreases*
  - b. *The total pressure is zero when the velocity of the stream is zero*
  - c. *The dynamic pressure increases as static pressure decreases*

9. in a two dimensional flow pattern ,where the streamline converge the static pressure will be:
- not change
  - increase
  - decrease
  - increase initially, the decrease

10. The taper ratio is:

- the ratio of root incidence to tip incidence
- the ratio of root thickness to tip thickness
- the ratio of tip chord length to root chord length
- ratio of dihedral angle to root chord length

11. Drag is in the direction of –and lift is perpendicular to the:

- chord line*
- longitudinal axis*
- horizon*
- relative wind/airflow*

12. The difference between IAS and TAS will :

- Increase with decreasing temperature*
- Decrease with decreasing altitude*
- Increase with increasing air density*
- Decrease with increasing speed*

13. winglets

- decrease the static lateral stability*
- decrease the induced*
- increase the manoeuvrability*
- create an elliptical lift distribution*

14. longitudinal control is provided by:

- Rudder*
- Ailerons*
- Elevators*
- flaps*

15. When the aircraft is in straight and level flight the normal axis is:
- Horizontal
  - Vertical
  - Wing tip to wing tip
  - longitudinal
16. Which of the following statement, about a venturi in a sub –sonic airflow are correct? 1. the dynamic pressure in the undisturbed flow and in the throat are equal. 2. The total pressure in the undisturbed flow and the in the throat are equal
- 1 is incorrect and 2 is correct
  - 1 and 2 are correct
  - 1 is correct and 2 is incorrect
  - 1 and 2 are incorrect
17. If the indicated airspeed of an aircraft is increased from 80kts to 160kts, parasite drag will be:
- Four times greater
  - Six times greater
  - One quarter as much
  - Half as much
18. An aircraft whose weight is 237,402N stalls at 132kts ,At a weight of 356,103N it would stall at :
- 162kts
  - 88kts
  - 172kts
  - 108kts
19. The angle of attack of two dimensional wing section is the angle between:
- The fuselage centre line and the free stream direction
  - The chord line of the aerofoil and the fuselage centre line
  - The chord line and the camber of the aerofoil
  - The chord line of the aerofoil and the free stream direction
20. The aircraft drag in straight and level flight is lowest when the :
- Induced drag is lowest
  - Induced drag is equal to zero
  - Parasite drag equals twice the induced drag
  - Parasite drag is equal to induced drag

21. With increasing angle of attack, the stagnation point will move (i).....and the point of lowest pressure will move(ii).....respectively (i ) and n(ii) are:
- (i) down, (ii) forward
  - (i) up, (ii) aft
  - (i)down, (ii)aft
  - (i) up,(ii) forward
22. The resistance ,or skin friction, due to viscosity of air as it passes along the surface of a wing is a type of::
- Interference drag
  - Form drag
  - Parasite drag
  - Induced drag
23. For an aircraft with a 1g stalling speed of 60kts IAS ,the stalling speed in a steady 60° turn would be:
- 60kt
  - 43kts
  - 84kts
  - 120kts
24. When the angle of attack of a symmetrical aerofoil is increased, the centre of pressure will:
- Have very limited movement
  - Is unaffected
  - Move forward to the leading
  - Move aft along the aerofoil
25. On an airfoil the centre of pressure will be most forward
- at the optimum angle
  - at the stalling angle
  - just above the stalling angle
  - just above the stalling angle
26. The angle of attack of an aerofoil section directly controls:
- Amount of airflow above and below the section
  - Angle of incidence of the section
  - Distribution of positive and negative pressure acting on the section

- d. The angle relative to the horizontal datum
27. At zero angle of attack, the pressure along the upper surface of a symmetrical aerofoil section would be:
- a. Greater than atmospheric pressure
  - b. Equal to atmospheric pressure
  - c. Less than atmospheric pressure
  - d. Non existent
28. To maintain altitude, what must be done as indicated airspeed(IAS)is reduced:
- a. Decrease angle of attack to reduce the drag
  - b. Increase angle of attack to maintain the correct lift force
  - c. Deploy the speed brakes to increase drag
  - d. Reduce thrust
29. The purpose of leading edge droop is:
- e. To give a more cambered section for high speed flight
  - f. To increase the wing area for takeoff and landing
  - g. To increase wing camber, and delay separation of the airflow when trailing edge flaps are lowered
  - h. To decrease the lift during the landing run
30. If more lift force is required because of greater operating weight, what must be done to fly at the angle of attack which corresponds to CLMAX:
- a. Increase the angle of attack
  - b. Nothing, the angle of attack for CLMAX is constant
  - c. Increase the indicated airspeed(IAS)
  - d. It is impossible to fly at the angle that corresponds to CLMAX
31. 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.
32. With flaps lowered ,the stalling speed will:
- a. Increase
  - b. Decrease
  - c. Increase ,but occurs at a higher angle of attack
  - d. Remain the same
33. 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.

34. *The movement of an aircraft is defined along three axes which all pass through;*

- a. *the centre of pressure*
- b. *the centre of gravity*
- c. *the intersection of the centerlines of the fuselage and wings*
- d. *the intersection of the normal vertical*

35. Which of the following decreases induced Drag?

- a. wing fences
- b. Anhedral
- c. Winglets
- d. Low aspect ratio plan form

36. Bernoulli's law state:

Rho: is the mean sea level density under ISA conditions

Pstat: is static pressure

Pdyn: is dynamic pressure

Ptot : is total pressure

- a.  $P_{dyn} + \frac{1}{2}\rho v^2 = \text{constant}$
- b.  $P_{tot} + \frac{1}{2}\rho v^2 = p_{stat}$
- c.  $P_{stat} + \frac{1}{2}\rho v^2 = \text{constant}$
- d.  $P_{stat} + \frac{1}{2}\rho TAS^2 = \text{constant}$

37. By what percentage does the lift increase in level turn at 45° angle of bank, compared to straight and level flight?

- a. 31%
- b. 19%
- c. 41%
- d. 75%

38. *In a stationery subsonic streamline flow pattern, if streamline converge, in this part of the pattern, the static pressure(I) will....and the velocity(II) Will...:*

- a. *(i)decrease (ii)increase*
- b. *Increase (ii) increase*
- c. *Increase(ii)decrease*
- d. *Decrease (ii)decrease*

39. A 50 twin engine aeroplane performs a straight, steady, wings level climb. If the lift/drag ratio is 12 and the thrust is 60,000N per engine, the climb gradient is:
- 24%
  - 3.7%
  - 15.7%
  - 12%
40. The static pressure is acting:
- Only in direction of flow
  - In all directions
  - Only perpendicular to the direction of flow.
  - Only in the direction of total pressure
41. Consider a certain streamline tube. The velocity of streamline in the tube is  $V$ . An increase of temperature of the stream at constant value of  $v$  will:
- Increase the mass flow when the tube is divergent in the direction of flow
  - Increase the mass flow
  - Not affect the mass flow
  - Decrease the mass flow
42. Which one of the following statements about Bernoulli's theorem is correct
- The dynamic pressure is maximum in stagnation point]
  - The pressure decreases as static pressure decreases
  - The total pressure is zero when the velocity of the stream is zero
  - The dynamic pressure increases as static pressure decreases
43. How is stall warning presented to the pilots of a large transport aircraft?
- Stick pusher
  - Stall warning light only
  - Aural warning only
  - Stick shaker and/or aerodynamic buffet
44. Excluding constants, the coefficient of induced drag ( $C_{Di}$ ) is the ratio of:
- $C_L$  and  $C_D$
  - $C_L$  and  $b$  (wing span)
  - $C_L^2$  and  $AR$  (aspect ratio)
  - $C_L^2$  and  $S$  (wing surface)



45. A high aspect ratio wing produces:
- An increase in induced drag
  - A decrease in stall speed
  - A decrease in induced drag
  - A decrease in indicated airspeed
46. If an aircraft with a gross weight of 2000kg were subjected to a total load of 6,000kg in flight, the load factor would be :
- 9G's
  - 2G's
  - 6G's
  - 3G's
47. As bank angle is increased in a turn at a constant IAS , the load factor will:
- Remain the same
  - Decrease
  - Increase at an increasing rate
  - Increase in direct proportional to bank angle
48. A wing which is inclined downwards from root to tip is said to have :
- Anhedral
  - Sweep
  - Taper
  - Wash out
49. When the angle of attack of a positively cambered aerofoil is increased, the centre of pressure will:
- Have very little movement
  - Move forward along the chord line
  - Remain unaffected
  - Move back along the chord
50. Aspect ratio of the wing is defined as the ratio of the:
- Wingspan to wing root
  - Square of chord to wingspan
  - Square of wing area to span
  - Wing span to the average chord

**PART 2 (20mks)**

1. Define the following terms
  - a. Aspect ratio
  - b. Wash out
  - c. Wash in
  - d. Load factor
  - e. Fineness ratio
  - f. Taper ratio

**(6mks)**
  
2. Consider air flowing at 250kts with a density of  $1.008\text{kg/m}^3$ , what will be the dynamic pressure.

**(5mks)**
  
3. If a force of 75 Newton's moves body 8 metres along its line of action, it does how many Newton metres of work?

**(4mks)**
  
4. Given the following details calculate the lift force that will be generated by a wing with these specifications  
Air density:  $1.105\text{kg/m}^3$   
Surface area: 115metres  
TAS: 250KTS  
Aerodynamic lift co-efficient: 0.008

**(5mks)**