



EAST AFRICAN SCHOOL OF AVIATION FINAL EXAMINATION

IATA/SAFETY SECTION

SUBJECT: MASS AND BALANCE

Stream: Flight Dispatch EWAC01

Duration: 2Hrs

DATE: 15th Feb 2017

TIME: 0900AM –1100PM.

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. Maximum marks are indicated on each question**
- 5. Total marks= 70**

STUDENT'S NAME: -----

STUDENT'S NUMBER: -----

SECTION 1 :

1. The actual 'landing Mass' is equivalent to: (1Mark)

- A* Actual Zero Fuel Mass plus the traffic load
- B* Dry Operating Mass plus the take-off fuel
- C* Actual Landing Mass plus the take-off fuel minus trip fuel
- D* Dry Operating Mass plus take-off fuel and the traffic load minus trip fuel

2. The Zero Fuel Mass and the Dry Operating Mass

- A* Differ by the mass of usable fuel
- B* Differ by the value of the traffic load mass.
- C* Are the same value.
- D* Differ by the sum of the mass of usable fuel plus traffic load mass

3. Given the following :

- Maximum structural take-off mass 76 000 kg
- Maximum structural landing mass: 68 000 kg
- Maximum zero fuel mass: 61 000 kg
- Dry operating mass: 41000kg
- Taxi fuel: 600 kg
- Contingency fuel: 2100 kg
- Alternate fuel: 1700 kg
- Final reserve fuel: 1 200 kg
- Trip fuel: 9 000 kg
- Holding fuel 1000kg

Determine the maximum take-off mass and the maximum allowed traffic load respectfully: (2Mark)

- A* 57 800 kg and 45000kg
- B* 51 700 kg and 14000kg
- C* 53 200 kg and 31000kg
- D* 76 000 kg and 16 000kg

4. The actual 'Zero Fuel Mass' is equal to the: (1Mark)

- A* Basic Empty Mass plus the fuel loaded.
- B* Actual Landing Mass plus trip fuel.
- C* Dry Operating Mass plus the total traffic load.
- D* Operating Mass plus the entire traffic load.

5. Prior to departure the medium range twin jet airplane is loaded with maximum fuel of 20100 litres at a fuel density (specific gravity) of 0.78. Using the following data -

- Performance limited take-off mass 67200 kg
- Performance limited landing mass 54200 kg
- Dry Operating Mass 34930 kg
- Taxi fuel 250 kg
- Trip fuel 9250 kg
- Contingency and holding fuel 850 kg
- Alternate fuel 700 kg

The maximum permissible traffic load is (2Mark)

- A* 16470 kg
- B* 18040 kg
- C* 12840 kg
- D* 13090 kg.

6 On an airplane without central fuel tank, the maximum Zero Fuel Mass is related to:

- A* Maximum Structural Take-Off Mass
- B* Wing loaded trip fuel.
- C* Variable equipment for the flight.
- D* The bending moment at the wing root

7. The position of the center of gravity can always be determined by:

- A* Dividing the total moment by the total force
- B* Subtracting the total moment from the total mass
- C* Subtracting the total mass from the total moment
- D* Dividing the total mass by the total moment

(1Mark)

8. The crew of a transport airplane prepares a flight using the following data:

- Dry operating mass: 90 000 kg
- Block fuel: 30 800 kg
- Taxi fuel: 800 kg
- Maximum take-off mass: 140 000 kg

The traffic load available for this flight is:

(2Mark)

- A* 55 000 kg
- B* 55 800 kg
- C* 25 800 kg
- D* 20 000 kg

9. What determines the longitudinal stability of an airplane?

(1Mark)

- A) The relationship of thrust and lift to weight and drag
- B) The dihedral, angle of sweepback and the keel effect
- C) The location of the centre of gravity with respect to the neutral point
- D) The effectiveness of the horizontal stabilizer, rudder and rudder trim

10: The weight of an airplane, which is in level non accelerated flight, is said to act:

- A Vertically through the centre of pressure
- B Vertically through the centre of gravity
- C Always along the vertical axis of the airplane
- D Vertically through the datum point

11. The crew of a transport airplane prepares a flight using the following data:

- Block fuel: 48 800 kg
- Trip fuel: 30 000 kg
- Taxi fuel: 800 kg
- Maximum take-off mass: 170 000 kg
- Maximum landing mass: 148 000 kg
- Maximum zero fuel mass: 112 000 kg
- Dry operating mass: 80 000 kg

The maximum traffic load for this flight is:

(2Mark)

- A* 32 100 kg
- B* 32 900 kg
- C* 40 000 kg
- D* 40 400 kg

12. Which is true of the airplane empty mass?

(1Mark)

- A* It is a component of dry operating mass.
- B* It is dry operating mass minus fuel load.
- C* It is dry operating mass minus traffic load.
- D* It is the actual take-off mass, less traffic load.

13. The mass of an airplane is 1950 kg. If 450 kg is added to a cargo hold 1.75 metres from the loaded centre of gravity (cg). The loaded cg will move by: (2Mark)

- A 33 cm.
- B 40 cm.
- C 30 cm.
- D 34 cm.

14. Which of the following is not true regarding a certified transport category aircraft of less than 10 passengers (1Mark)

- A May accept verbal mass from or on behalf of each passenger while computing traffic load
- B May estimate total mass of the passengers and add a predetermined constant to account for carryon bag
- C May estimate the cargo mass and add predetermined constant to cater for errors
- D May compute actual mass of passengers and baggage through actual weighing

15. For a large aircraft where the main and nose landing gears retract forward, the effect on the CG on lowering the gear is: (1Mark)

- A to move forward
- B to remain static
- C to move forward then aft
- D to move aft

16. The mass displacement caused by landing gear extension: (1Mark)

- A creates a pitch-down longitudinal moment
- B creates a pitch-up longitudinal moment
- C creates a longitudinal moment in the direction (pitch-up or pitch-down) determined by the type of landing gear
- D does not create a longitudinal moment

17. With the centre of gravity on the forward limit which of the following is to be expected? (1Mark)

- A A tendency to yaw to the right on take-off
- B A decrease in range
- C A decrease in the landing speed
- D A decrease of the stalling speed

18. The maximum zero fuel mass is a mass limitation for the: (1Mark)

- A allowable load exerted upon the wing considering a margin for fuel tanking
- B total load of the fuel imposed upon the wing
- C strength of the wing roots
- D strength of the fuselage

19. Which of the following is unlikely to have any effect on the position of the centre of gravity on an airplane inflight? (1Mark)

- A Lowering the landing gear.
- B Movement of cabin attendants going about their normal duties
- C Normal consumption of fuel for a swept wing airplane
- D Changing the tail plane (horizontal stabilizer) incidence angle

20. Given that the total mass of an airplane is 112 000 kg with a centre of gravity position at 22.62m aft of the datum. The centre of gravity limits are between 18m and 22m. How much mass must be removed from the rear hold (30 m aft of the datum) to move the centre of gravity to the middle of the limits: (2Mark)

- A 8 680 kg
- B 43 120 kg
- C 29 344 kg
- D 16 529 kg

21. For the purpose of completing the Mass and Balance documentation, the Operating Mass is considered to be Dry Operating Mass plus (1Mark)

- A** Ramp Fuel Mass
- B** Trip Fuel Mass
- C** Ramp Fuel Mass less the fuel for APU and run-up.
- D** Take-off Fuel Mass.

22. For the purpose of completing the Mass and Balance Documentation, the Dry Operating Mass is defined as: (1Mark)

- A** The total mass of the airplane ready for a specific type of operation excluding all usable fuel and traffic load.
- B** The total mass of the airplane ready for a specific type of operation excluding all usable fuel
- C** The total mass of the aero plane ready for a specific type of operation excluding all traffic load
- D** The total mass of the airplane ready for a specific type of operation excluding crew and crew baggage

23. An additional baggage container is loaded into the aft cargo compartment but is not entered into the load and trim sheet. The airplane will be heavier than expected and calculated take-off safety speeds (1Mark)

- A** will give reduced safety margins.
- B** will not be achieved.
- C** will be greater than required.
- D** are unaffected but V1 will be increased

24. An airplane is weighed and the following recordings are made:

- nose wheel assembly scale 5330 kg
- left main wheel assembly scale 12370 kg
- right main wheel assembly scale 12480 kg

If the 'operational items' amount to a mass of 1780 kg with a crew mass of 545 kg, the empty mass, as entered in the weight schedule, is (2Mark)

- A** 32505 kg
- B** 30180 kg
- C** 28400 kg
- D** 31960 kg

25. After weighing a helicopter the following values are noted:

- forward point: 350 kg
- aft right point: 995 kg
- aft left point: 1 205 kg

What is the longitudinal CG-position in relation to the datum situated 4 m in front of the rotor axis, knowing that the forward point is at 2.5 m forward of the rotor axis and the aft points are 1 m aft of the rotor axis?

(2Mark)

- A** 4.52 m
- B** 4.09 m
- C** 4.21 m
- D** 4.15 m

26. With respect to airplane loading in the planning phase, which of the following statements is always correct?

**LM = Landing Mass, TOM = Take-off Mass, MTOM = Maximum Take-off Mass
ZFM = Zero Fuel Mass, MZFM = Maximum Zero Fuel Mass, DOM = Dry Operating Mass**

(1Mark)

- A** LM = TOM - Trip Fuel
- B** MTOM = ZFM + maximum possible fuel mass
- C** MZFM = Traffic load + DOM
- D** Reserve Fuel = TOM - Trip Fuel

27. Which is true of the airplane empty mass?

(1Mark)

- A** It is a component of dry operating mass.
- B** It is dry operating mass minus fuel load.
- C** It is dry operating mass minus traffic load.
- D** It is the actual take-off mass, less traffic load

28. Total mass: 7500 kg. Centre of gravity (cg) location station: 80.5

Aft cg limit station: 79.5. How much cargo must be shifted from the aft cargo compartment at station 150 to the forward cargo compartment at station 30 in order to move the cg location to the aft limit?

(2Mark)

- A** 65.8 kg.
- B** 68.9 kg.
- C** 73.5 kg.
- D** 62.5 kg.

29. An airplane is to depart from an airfield at a take-off mass of 302550 kg. Fuel on board at take-off (including contingency and alternate of 19450 kg) is 121450 kg. The Dry Operating Mass is 161450 kg. The useful load will be

(2Mark)

- A** 19650 kg
- B** 121450 kg
- C** 39105 kg
- D** 141100 kg

30. The following results were obtained after weighing a helicopter:

- mass at front point: 300 kg
- mass at right rear point : 1 100 kg
- mass at left rear point : 950 kg

It is given that the front point is located 0.30 m left of the longitudinal axis and the rear points are symmetrically located 1.20 m from this axis.

The helicopter's lateral CG-position relative to the longitudinal axis is:

(2Mark)

- A** 4 cm left
- B** 11 cm right
- C** 11 cm left
- D** 4 cm right

31. At a given mass the CG position is at 15% MAC. If the leading edge of MAC is at a position 625.6 inches aft of the datum and the MAC is given as 134.5 inches determine the position of the CG in relation to the datum.

(2Mark)

- A** 228.34 inches aft of datum
- B** 645.78 inches aft of datum
- C** 20.18 inches aft of datum
- D** 605.43 inches aft of datum

32. The floor limit of an aircraft cargo hold is 5 000 N/m². It is planned to load-up a cubic container measuring 0,4m of side. It's maximum gross mass must not exceed: (1Mark)

(assume $g=10\text{m/s}^2$)

- A 32 kg
- B 320 kg
- C 80 kg
- D 800 kg

33. The maximum load per running metre of an airplane is 350 kg/m. The width of the floor area is 2 metres. The floor strength limitation is 300 kg per square metre. Which one of the following crates (length x width x height) can be loaded directly on the floor? (2Mark)

- A A load of 400 kg in a crate with dimensions 1.2 m x 1.2 m x 1.2 m.
- B A load of 500 kg in a crate with dimensions 1.5 m x 1 m x 1m.
- C A load of 400 kg in a crate with dimensions 1.4 m x 0.8 m x 0.8 m.
- D A load of 700 kg in a crate with dimensions 1.8 m x 1.4 m x 0.8 m.

34. A location in the airplane which is identified by a number designating its distance from the datum is known as: (1Mark)

- A Station.
- B Moment.
- C MAC.
- D Index.

35. Loads must be adequately secured in order to: (1Mark)

- A Avoid unplanned centre of gravity (cg) movement and aircraft damage.
- B Avoid any centre of gravity (cg) movement during flight.
- C Prevent excessive 'g'-loading during the landing flare.
- D Allow steep turns

36. The following data applies to an airplane which is about to take off: (1Mark)

Certified maximum take-off mass 141500 kg
Performance limited take-off mass 137300 kg
Dry Operating Mass 58400 kg
Crew and crew hand baggage mass 640 kg
Crew baggage in hold 110 kg
Fuel on board 60700 kg

From this data calculate the mass of the useful load. (2Mark)

- A 17450 kg
- B 78900 kg
- C 78150 kg
- D 18200 kg

37. The mass and balance information gives :

Basic mass : 1 200 kg ; Basic balance arm : 3.00 m

Under these conditions the Basic centre of gravity is at 25% of the mean aerodynamic chord (MAC). The length of MAC is 2m.

In the mass and balance section of the flight manual the following information is given :

Position	Arm
front seats :	2.5 m
rear seats :	3.5 m
rear hold :	4.5 m
fuel tanks :	3.0 m

The pilot and one passenger embark; each weighs 80kg. Fuel tanks contain 140 litres of petrol with a density of 0.714. The rear seats are not occupied. Taxi fuel is negligible.

The position of the centre of gravity at take-off (as %MAC) is : (2Mark)

- A** 29 %
- B** 34 %
- C** 45 %
- D** 22 %

38. The centre of gravity of an airplane is that point through which the total mass of the airplane is said to act. The weight acts in a direction (1Mark)

- A** at right angles to the flight path
- B** governed by the distribution of the mass within the airplane.
- C** parallel to the gravity vector
- D** always parallel to the airplane's vertical axis

39. In mass and balance calculations which of the following describes the datum? (1Mark)

- A** It is the most forward position of the centre of gravity.
- B** It is the most aft position of the centre of gravity.
- C** It is the distance from the centre of gravity to the point through which the weight of the component acts.
- D** It is the point on the airplane designated by the manufacturers from which all centre of gravity measurements and calculations are made.

40. The maximum floor loading for a cargo compartment in an airplane is given as 750 kg per square metre. A package with a mass of 600 kg. is to be loaded. Assuming the pallet base is entirely in contact with the floor, which of the following is the minimum size pallet that can be used? (1Mark)

- A** 30 cm by 200 cm
- B** 40 cm by 300 cm
- C** 40 cm by 200 cm
- D** 30 cm by 300 cm

41. The loaded centre of gravity (cg) of an aeroplane is 713mm aft of datum. The mean aerodynamic chord lies between station 524 mm aft and 1706 mm aft. The cg expressed as % MAC (mean aerodynamic chord) is: (2Mark)

- A** 60 %
- B** 10 %
- C** 16 %
- D** 41 %

**42. Length of the mean aerodynamic chord = 1 m. Moment arm of the forward cargo: -0,50 m
Moment arm of the aft cargo: + 2,50 m. The aircraft mass is 2 200 kg and its centre of gravity is at 25% MAC. To move the centre of gravity to 40%, which mass has to be transferred from the forward to the aft cargo hold?** (2Mark)

- A** 183 kg
- B** 165 kg
- C** 104 kg
- D** 110 kg

43. An airplane with a two wheel nose gear and four main wheels rests on the ground with a single nose wheel load of 500 kg and a single main wheel load of 6000 kg. The distance between the nose wheels and the main wheels is 10 meter. How far is the centre of gravity in front of the main wheels? (2Mark)

- A** 41.6 cm.
- B** 40 cm.
- C** 25 cm.
- D** 4 meter

44. Given:

Aeroplane mass = 36 000 kg. Centre of gravity (cg) is located at station 17 m
What is the effect on cg location if you move 20 passengers (total mass = 1 600 kg) from station 16 to station 23?

- A** It moves aft by 0.157 m.
- B** It moves aft by 0.31 m.
- C** It moves forward by 0.157 m.
- D** It moves aft by 3.22 m.

- 45.** The Dry Operating Mass of an aircraft is 2 000 kg. The maximum take-off mass, landing and zero fuel mass are identical at 3500 kg. The block fuel mass is 550kg, and the taxi fuel mass is 50 kg. The available mass of payload is:
A 1 000 kg B 950 kg C 1 500 kg D 1 450 kg **(2Mark)**
- 46.** To measure the mass and CG-position of an aircraft, it should be weighed with a minimum of:
A 1 point of support B 4 point of support
C 3 points of support D 2 points of support **(1Mark)**
- 47.** When preparing to carry out the weighing procedure on an airplane, which of the following is not required?
A drain all engine tank oil.
B drain all useable fuel.
C drain all chemical toilet fluid tanks.
D removable passenger services equipment to be off-loaded. **(1Mark)**
- 48.** An airplane must be re-weighed at certain intervals. Where an operator uses 'fleet masses' and provided that changes have been correctly documented, this interval is
A whenever a major modification is carried out.
B 9 years for each airplane
C 4 years for each airplane
D whenever the Certificate of Airworthiness is renewed **(1Mark)**
- 49.** The stalling speed of an aeroplane will be highest when it is loaded with a:
A low gross mass and forward centre of gravity.
B low gross mass and aft centre of gravity.
C high gross mass and aft centre of gravity.
D high gross mass and forward centre of gravity **(1Mark)**
- 50.** The centre of gravity location of the aeroplane is normally computed along the:
A horizontal axis. B longitudinal axis. C lateral axis. D vertical axis. **(1Mark)**

END