Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

DEPARTMENT FAHRZEUGTECHNIK UND FLUGZEUGBAU

Prof. Dr.-Ing. Dieter Scholz, MSME

Aircraft Systems SS 2016

Part 1

Datum: 30.06.2016

90 minutes total time. Part 1: 60 minutes

Last Name: Matrikelnummer:	First Name:
Points from Part 1:	Grade of the examination:

Note:

- Please work on this examination without notes or books.
- Please return this sheet. In this way you will maintain a full document.
- For the Multiple-Choice-Tasks each and every answer may be right or also no answer. Mark the correct answers. Every combination of correct answers is possible!
- If not stated otherwise, each question yields one point.

Vocabulary (6 Punkte)

1.) Please translate to German.
Please write clearly! Unreadable text will not harvest points!

1. cargo compartment
2. crew rest compartment
3. ceiling panel
4. cabin lighting
5. divider
6. curtain
7. carpet
8. seat pitch
9. emergency evacuation
10. emergency exit
11. escape slide
12. ejection seat

2.) Please translate to English.
Please write clearly! Unreadable text will not harvest points!

1. Benzin
2. Schwerkraftversorgung
3. Bodenaggregat
4. Wärmetauscher
5. Hochauftriebssystem
6. Hochdruckwasserabscheider
7. Höhenleitwerk
8. Eisschutz
9. Wechselrichter
10. Kerosin
11. Fahrwerksschacht
12. Toilette

Aircraft Systems General

3.) Which requirement/specification defines Cabin Systems (Chapter 44)?

A Defined by FAR Part 25
B Defined by ATA iSpec 2200
C Defined by ATA 100

4.) What are <u>not</u> aircraft systems?

A Avionics
B Airframe
C Engines

5.) What portion do aircraft systems hold roughly among the Operating Empty Mass, among maintenance costs, among development costs, among purchase costs of an aircraft?

A 0.11
B 0.22
C 0.33
D 0.44

6.) Which number stands for the air conditioning system?

7.) Aircraft are not absulutely safe. The probability of an event which is characterized by the loss of the aircraft with multiple death has a probability of less than 10^{-9}. The probability increaes with flight time. On which flight time is the given probability of 10^{-9} based?

8.) What is redundancy?

9.) Which aircraft systems (among those listed) deliver secondary power?
- A autopilot
- B hydraulic power
- C pneumatic power
- D APU

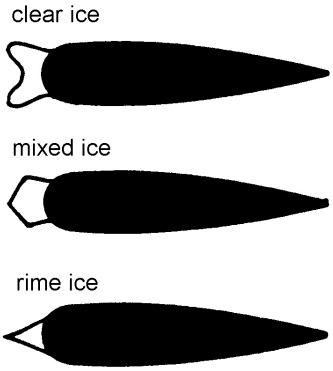
10.) What is a Common Cause Failure (CCF)?

11.) What is a Minimum Equipment List?

12.) What are the technical solutions to provide an electrical system on board an aircraft with alternating current with constant frequency?
- A battery supply
- B variable-speed constant-frequency, VSCF
- C Constant Speed Drive, CSD and generator called together Integrated Drive Generator, IDG

13.) A Small aircraft use 14 V or 28 V direct current.
- B Large aircraft use generators that produce alternating current, AC with 230 V and 50 Hz.

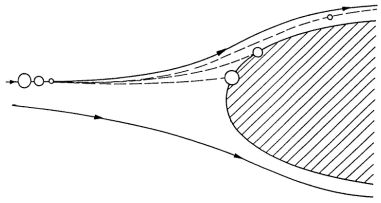
14.) We observe different forms of icing of aircraft:



- A Clear ice forms between -56 °C ... -20 °C
- B Clear ice forms between -10 °C ... 0 °C
- C Clear ice forms between 0 °C ... 7 °C when there is fog or a high level of humidity in the air.

15.) Supercooled water has a temperatur below ...
Please finish the sentence with a number and a unit!

16.) Not all droplets flying towards an airfoil will hit its surface. See picture.



If the droplets hit the surface depends on …

A … the spanwise length Δy of the wing or tail surface.

B … the speed of the aircraft.

C … the size of the droplet.

17.) There are two ice protection principles: antiicing and deicing. Please explain!

18.) Aircraft brakes:

A Very seldom we see multi-disc brakes.

B The brake disk(s) take the braking energy: $E = ½\ m_{aircraft}\ v^2 = m_{brake}\ c\ \Delta T$.

C During a rejected take-off the brakes will heat much and start to glow.

19.) There are three different flight control system principles:

A Reversible flight control system

B Irreversible flight control system with artificial feel

C Irreversible flight control system with FBW and EFCS (example: Airbus)

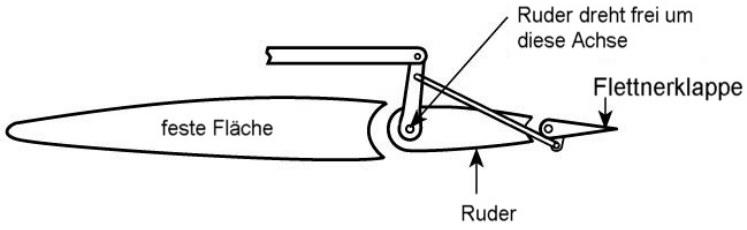
Link A, B, C to 1, 2, 3:

1 The control surfaces are kept force free with a trim tab or a spring.

2 The control surfaces are kept in position with actuators. There is no trimming any more.

3 The control surfaces are kept in position with actuators. To trim means to set the control force to zero with the artificial feel unit.

20.) You see the input to a control surface (rudder) via a servo tab:



What moves the rudder?

A Levers and push rods.

B The actuator connected to the control surface (not shown here).

21.) *Allocate the name of the high lift systems (1, 2, 3) to the pictures (A, B, C)!*

A 

B 

C 

D 

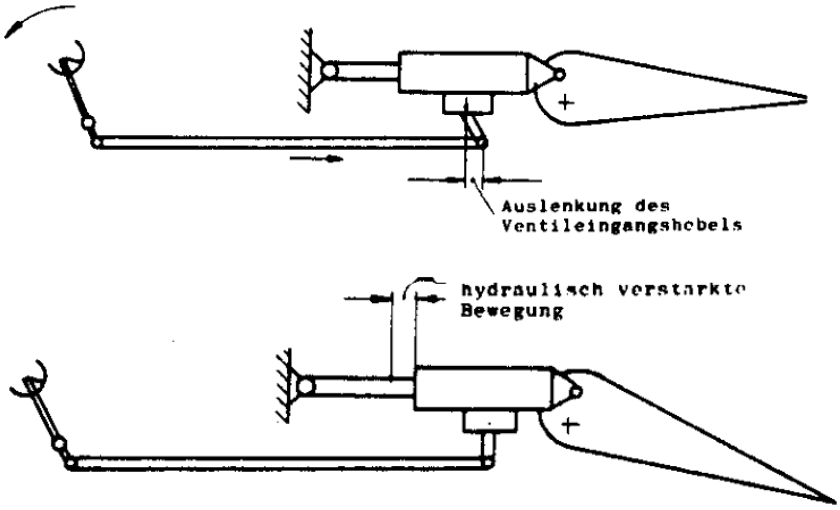
E 

F 

1 slotted flap
2 double slotted flap
3 plain flap
4 triple slotted flap
5 split flap
6 Fowler flap

22.) What are the advantages of a Fly-By-Wire flight control system?

23.) Please explain how a Moving Body Actuator functions!



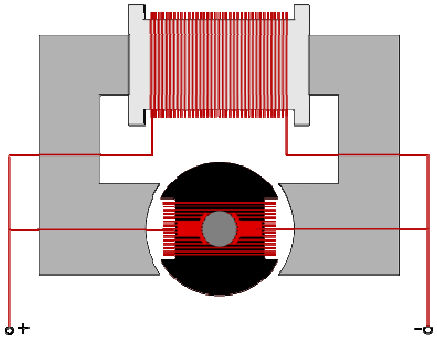
24.) What is a Power Transfer Unit?

25.) Why is it important to know the density of the fuel on board?

26.) What is or can be the task of a fuel system?
- A fuel storage
- B fuel distribution
- C fuel jettison
- D fuel consumption
- E indicating fuel parameters

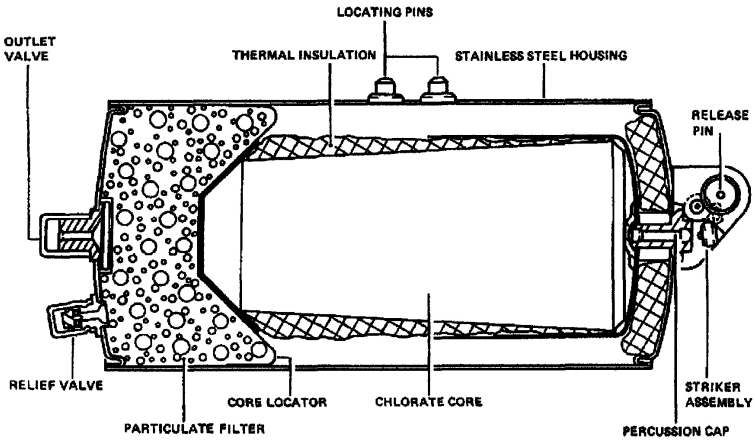
27.) Why is it important to avoid the accumulation of water in the fuel system?

28.) What are (correctly operating) examples of the Bootstrap Principle?
- A The generator as shown below.
- B The Bootstrap Reservoir as part of the hydraulic system.



Wolfgang S. at the German language Wikipedia CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0/) via Wikimedia Commons

29.) Please explain the chemical oxygen generator shown!



Questions from the Evening Lecture Series

30.) Why does Airbus concentrate on research of passenger aircraft based on hybrid-electric propulsion (in contrast to pure electric propulsion)?

31.) The advantage of Fly-By-Wire is added safety by means of the so-called „Flight Envelope Protection“. What is it? What are the flight parameters involved?