

Exam Production of Aerospace Systems

Code: AE 3321-II - **Closed Book Exam**

Date: Tuesday, April 17, 2018, 13.30-16.30; Sports Centre – Hall 1
4 Open questions and 16 Multiple Choice questions – total 100 points

Read carefully - write in clear script – give concise answers

Multiple Choice Questions

(1 alternative per question – 3 points per MC question)

Question 1.

During shearing operation often a burr is created. The burr height:

- a) Increases with the clearance (gap between punch and die) and the ductility of the metal
- b) Increases with the clearance and decreases with the ductility of the metal
- c) Decreases with the clearance and increases with the ductility of the metal
- d) Decreases with the clearance and the ductility of the metal

Question 2.

Which of the following processes are chip-removing processes?

- a) Milling, drilling, shearing, waterjet cutting, laser jet cutting
- b) Punching, shearing, grinding, waterjet cutting, reaming
- c) Reaming, drilling, waterjet cutting, grinding, sawing
- d) Milling, punching, laser jet cutting, chemical etching, sawing

Question 3

Which of the following statements about waterjet cutting is false?

- a) Waterjet cutting is applicable to food stock and for a wide range of engineering materials
- b) During waterjet cutting abrasive material is added to cut very large thicknesses
- c) A benefit of waterjet cutting is that no thermal stresses are induced in the material
- d) Waterjet cutting for laminates is not as easy as for monolithic sheets

Question 4

Which of the following statements about metal casting is true?

- a) Because of their reusable dies, die castings cannot be as complex as sand castings
- b) Metal casting relies on the low viscosity and the pressure applied during the process
- c) Features for a designer to deal with are draft angles, shrinkage, die material
- d) Increasing product series are feasible for sand casting, die casting and investment casting (in this order)

Question 5

Large thickness variations in cast products should be avoided because:

- a) Due to cooling differences internal pores and cracks occur
- b) Due to cooling differences warping of the product occurs
- c) The cooling time is increased significantly
- d) The removal from the die becomes troublesome

Which answer is correct?

Question 6

What is a knit line in an injection moulded thermoplastic part? The correct answer is:

- a) A line resulting from the die separation
- b) A line indicating the coalescence of two flow fronts
- c) A line indicating the interface between two different polymers

d) A line related to the fibre reinforcement in the product.

Question 7

Which of the following statements about product features is true?

- a) A product feature is used to select the right material for a component/part
- b) Product features are only used by the sales department
- c) Typical product features can be shape, thickness, price and product series
- d) Product features are used for the selection of an appropriate manufacturing process

Question 8.

The following statements are about Assembly of aircraft:

- I. The delivery interval of the aircraft program, dictates the speed (rhythm) of the (sub)assembly lines
- II. The structural breakdown of the aircraft can be recognised in the factory lay-out, both for the part manufacture as for the assembly.

- a) Both statements are true.
- b) Statement I is true but statement II is false
- c) Statement I is false, but statement II is true
- d) Both statements are false.

Question 9.

When we compare metals and composites, the following statements are made. Which statement is true?

- a) The accuracy in part manufacturing is more important for metals than for composites
- b) For weight comparisons we have to look at structural level not at material properties only
- c) The material transition from metals to composites is linked to World War II
- d) Numerical methods for metal technology are not fully developed whereas for composites they are

Question 10

A number of features for assembly jigs are: Accessible, Cheap, Simple, Easy to remove substructures, Small in size, Stable, High strength, High stiffness. Which one has the highest priority (is most important)?

- a) Accessible
- b) Cheap
- c) High strength
- d) High stiffness

Question 11

Metal welding as a joining technique is not often used in the assembly of aircraft because:

- a) Welding introduces a lot of thermal stresses.
- b) The microstructure of the material deteriorates too much
- c) Welding of thin sheets is too complicated
- d) The welding processes are too expensive

Question 12

When in a riveted joint the number of rows is increased from one to two rows, then

- a) The rivet pitch of the rivets in a row can be increased
- b) The rivet diameters should be increased
- c) The joint strength is increased by a factor of two
- d) The shear-out failure is unaffected

Question 13

Which of the following statements about manufacturing with thermoplastic and thermoset composites is correct?

- a) The solidification mechanism for thermoset and thermoplastic composites is different
- b) For both polymer systems the sequence of impregnation and shaping can be reversed
- c) Thermoplastic and thermoset composites can be manufactured with the same processes.
- d) After curing of thermoset composites, further processing is feasible above the glass transition temperature T_g

Question 14

The entrepreneurial risks involved in new aircraft programs increase, because:

- a) More industrial partners are involved
- b) The costs of the programs become higher and higher
- c) The influence of related governments increase
- d) The number of claims after incidents increase

Question 15

For resin infusion processes, which of the following parameters does not influence the in-situ infusion speed:

- a) Fibre orientation
- b) Type of fabric
- c) Size of the component
- d) Infusion temperature

Question 16

Which of the following non-destructive inspection methods can detect incomplete cure of the polymer in a composite

- a) Eddy Current
- b) X-ray
- c) Ultrasound
- d) Thermography
- e) None of them

Open Questions

(4 points each sub-question)

Question 17

Lay-up techniques combined with autoclave curing is the most frequently used combination for the manufacture of large composite skin structures.

- Describe briefly what tape-laying is and why it has increasing potential?
- What is autoclave curing and what are the key parameters of that process?
- Explain briefly that Resin Transfer Moulding can provide parts with a much higher accuracy than the “hand lay-up + autoclave curing sequence”.

Question 18

There are two ways to organise quality control: product focused and process focused.

- Describe the difference between these two concepts.
- What quality control activities can be performed during the manufacture of a composite wing panel (mention at least 3 activities).
- Describe briefly the role of the Airworthiness Authorities in the quality control process of the manufacturing of aircraft.

Question 19

Lean Manufacturing (LM) is a concept or philosophy for all kinds of industrial activity.

- Explain why LM is regarded “a philosophy”.
- “Lean Manufacturing is a concept that matches with sustainability”. Is this statement correct? Give your comments/explain your answer.
- Describe briefly if and how LM can be applied in an administrative environment (offices).

Question 20

Adhesive bonding is one of the joining methods used in aircraft production.

- “Adhesively bonded joints should be loaded in shear, not in tension”. True or false? Explain your answer.
- “Adhesively bonded joints are preferred for the joining of composites”. True or false? Explain your answer.
- “Increasing the overlap length is not very helpful in increasing the joint strength”. Explain this statement.
- Bonded joints show a bath-tub shape in the load transfer over the joint. How about riveted joints? Do they also show this “bath-tub curve”?

Success