



Note:

- During the attendance check a sticker containing a unique code will be put on this exam.
- This code contains a unique number that associates this exam with your registration number.
- This number is printed both next to the code and to the signature field in the attendance check list.

CAD/TD for Aerospace Engineers

Exam: CADTD / LRG Master - Aptitude Assessment

Date: Thursday 22nd August, 2024

Examiner: Prof. Dr.-Ing. Fernaß Daoud

Time: 13:30 – 15:00

	P 1	P 2	P 3
I			

Working instructions

- This exam consists of **12 pages** with a total of **3 problems**. Please make sure now that you received a complete copy of the exam.
- The total amount of achievable credits in this exam is 60 credits.
- Detaching pages from the exam is prohibited.
- Allowed resources:
 - one **non-programmable pocket calculator**
 - one **analog dictionary** English ↔ native language
- **Answers are only accepted if the solution approach is documented.** Give a reason for each answer unless explicitly stated otherwise in the respective subproblem.
- Do not write with red or green colors nor use pencils.
- Physically turn off all electronic devices, put them into your bag and close the bag.

Left room from _____ to _____ / Early submission at _____

For multiple choice problems mark the correct answers as follows:

Mark correct answers with a cross

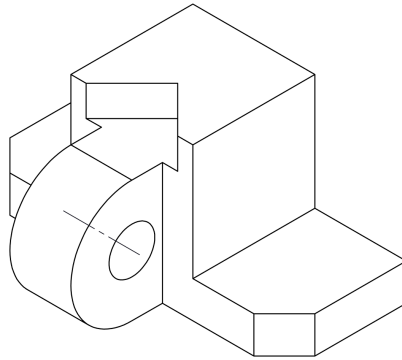
To undo a cross, completely fill out the answer option

To re-mark an option, use a human-readable marking



Problem 1 Technical Drawing (24 credits)

1.1 Which kind of view is shown in the following drawing ?



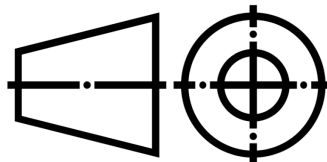
Partial view

Isometric view

Section view

Dimetric view

1.2 Which projection method is indicated by the following symbol ?



Projection method 2

Arrow method

Projection method 1

Projection method 3

1.3 Which projection method has to be used for partial views?

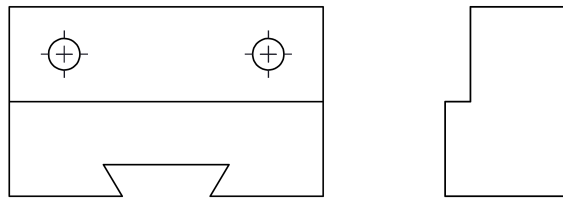
Projection method 2

Projection method 3

Depends on the projection method used for the remainder of the drawing.

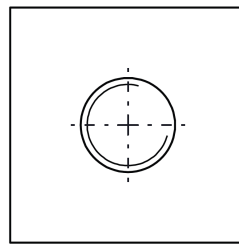
Projection method 1

1.4 Which projection method has been used in the following technical drawing?



- Projection method 2
- Projection method 1
- Arrow method
- Projection method 3

1.5 What does the following view represent ?



- A sphere
- An external thread
- An internal thread
- A hole

1.6 What does the following symbol in technical drawings mean?



- Identical surface properties of the outer contour of a part.
- The surface must be machined.
- For the surface removing material by machining is permitted.
- For the surface removing material by machining is not permitted.

1.7 Which information can you derive from the following surfaces specification?

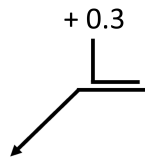


- The surface must be produced with cutting with a maximum average roughness value of $Rz \leq 16\mu m$
- The surface must be produced without cutting with a maximum averaged roughness depth of $Rz \leq 16\mu m$
- The surface must be produced with cutting with a maximum averaged roughness depth of $Rz \leq 16\mu m$
- The surface must be produced without cutting with a maximum average roughness value of $Rz \leq 16\mu m$

1.8 Which of the test body is used for the hardness specification measurement of Vickers?

- Three-sided pyramid
- Sphere
- Cone
- Four-sided pyramid

1.9 What does the following symbol in technical drawings mean ?



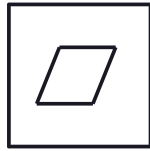
- Burring up to 0.3 mm allowed, burr direction vertical.
- Burring up to 0.3 mm allowed.
- Burring up to 0.3 mm allowed, burr direction horizontal.
- Without burring, removal up to 0.3 mm allowed

1.10 Which form tolerance is specified by the following symbol in technical drawings ?



- Roundness tolerance
- Coaxiality tolerance
- Profile form tolerance
- Cylinder form tolerance

1.11 Which form tolerance is specified by the following symbol in technical drawings ?



- Straightness tolerance
- Levelness tolerance
- Parallelism tolerance
- Runout tolerance

1.12 Determine the correct value of the dimension tolerance of the following dimension:

40^{+0,1}_{-0.05}

- 100 μm
- 150 μm
- 15 μm
- 50 μm

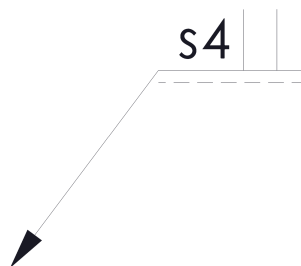
1.13 Assign the correct fit type for the following fit pair $\text{Ø}25 \text{ H}7/\text{f}7$.

- Interference Fit
- Clearance Fit
- Transition Fit
- Not Valid

1.14 Assign the correct fit type for the following fit pair $\text{Ø}25 \text{ H}7/\text{s}7$.

- Clearance Fit
- Interference Fit
- Transition Fit
- Not Valid

1.15 What does the following symbol denote in technical drawings?



- A fillet seam with a seam length of 4 mm
- An I-seam with a seam length of 4 mm
- A continuous fillet seam with a seam thickness of 4 mm
- A continuous I-seam with a seam thickness of 4 mm

Problem 2 CAD (16 credits)

2.1 What does the abbreviation CAD mean ?

- Computer Added Design
- Computer Aided Design
- Computer Aided Drawing
- Computer Added Dynamics

2.2 What does the abbreviation CAM mean ?

- Computer Added Management
- Computer Aided Manufacturing
- Computer Added Manufacturing
- Computer Aided Management

2.3 Which modeling technique has the highest information content of the model?

- Edge model
- Volume model
- Surface model
- Wireframe model

2.4 Which modeling techniques requires the least memory?

- Surface model
- Wireframe model
- Volume model
- Point model

2.5 What is the major benefit of neutral data formats?

- Data exchange among different CAD programs
- More precise
- Containing many additional information
- Less metadata as native formats

2.6 Curvature continuity of two curves at a common endpoint requires that ...

- the second derivatives of the curves are equal at this point.
- the third derivatives of the curves are equal at this point.
- the first and the second derivatives of the curves are equal at this point.
- the first derivatives of the curves are equal at this point.

2.7 Which of the following statements about splines is incorrect?

- NURBS is a mathematical model using basis splines.
- The term "B-spline" is short for basis spline.
- A NURBS curve is defined by its order, a set of weighted control points, and a knot vector.
- A basis spline is defined by its order, a set of weighted control points, and a knot vector.

2.8 Which of the following operation isn't a boolean operation?

- Subtract
- Add
- Extrusion
- Intersection

2.9 Given are the following functions of two curves:

$$y_1(x) = 3(x^2 - 1)^2 : x \in]-\infty, 1] \quad (2.1)$$

$$y_2(x) = 2(x^2 - 1)^2 : x \in [1, +\infty[\quad (2.2)$$

Check the continuities of the curves at $x = 1$ and decide which of the following statements is correct at $x = 1$.

- Positional, tangential and curvature continuity are fulfilled at $x = 1$.
- Positional, tangential and curvature continuity aren't fulfilled at $x = 1$.
- Positional continuity is fulfilled at $x = 1$. Tangential and curvature continuity aren't fulfilled at $x = 1$.
- Positional and tangential continuity are fulfilled at $x = 1$. Curvature continuity is not fulfilled at $x = 1$.

$$y_1(x) = 3(x - 1)^2; y_1(1) = 0$$

$$y_2(x) = 2(x - 1)^2; y_2(1) = 0$$

$$y_1'(x) = 6(x - 1); y_1'(1) = 0$$

$$y_2'(x) = 4(x - 1); y_2'(1) = 0$$

$$y_1''(x) = 6; y_1''(1) = 6$$

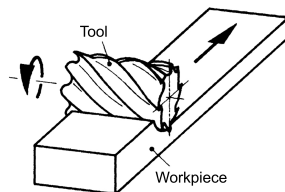
$$y_2''(x) = 4; y_2''(1) = 4$$

Problem 3 Design Theory (20 credits)

3.1 Fail Safe Design is an example of ...

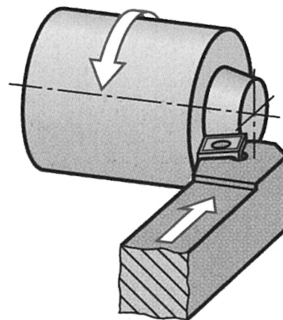
- | | |
|---|--|
| <input type="checkbox"/> Basic safety | <input type="checkbox"/> Illustrative safety |
| <input checked="" type="checkbox"/> Direct Safety | <input type="checkbox"/> Indirect Safety |

3.2 Which milling process is shown in the following picture ?



- | |
|---|
| <input type="checkbox"/> Face-circumference milling |
| <input type="checkbox"/> Circumference-face milling |
| <input checked="" type="checkbox"/> Circumference milling |
| <input type="checkbox"/> Face milling |

3.3 Which machining process is shown in the following picture ?



- | | |
|--|--|
| <input type="checkbox"/> Round turning | <input checked="" type="checkbox"/> Face turning |
| <input type="checkbox"/> Circumference turning | <input type="checkbox"/> Form turning |

3.4 The Bottom-Up design approach is considered beneficial, if ...

- a low number of variants with low degree of commonality is considered.
- a large number of variants with high degree of commonality is considered.
- the form/functionality is driven by the "outer shape".
- the detail design of the individual components is still unclear.

3.5 The Integral design approach ...

- reduces the weight efficiency of the component.
- divides large components in smaller single parts.
- reduces the number of single parts of a component.

increases the design space.

3.6 Which of the following basic guidelines for machining is correct?

- Planes or turning surfaces should not be parallel or vertical to the clamping surface.
- Provide blind holes if possible.
- Specify tolerances of holes only as deep as necessary
- Re-clamping of the workpiece doesn't increase the machine costs.

3.7 Which of the following statements about casting is correct?

- During machining the casted component tends to warp or crack due to changes in internal stress conditions.
- A homogenous temperature distribution during the casting process leads to less shrinkage and contraction.
- Different cooling speeds in the component avoids the formation of cavities.
- A Decrease in density caused by cooling results in a reduction of the volume.

3.8 Which of the following design rule for casting is correct?

- Large wall thickness changes aren't restricted for casted components.
- Choose the position of the separation planes in a way to avoid casting offsets in joints.
- Avoid ribs in casted parts.
- The use of so called "sand corners" improves the casting result.

3.9 Which of the following design rule for welding is correct?

- Avoid tensile stress in thickness direction.
- Avoid flattening and overhangs.
- Avoid concave fillet welds.
- Multiple seams and seam crossing increases the strength of the weld seam.

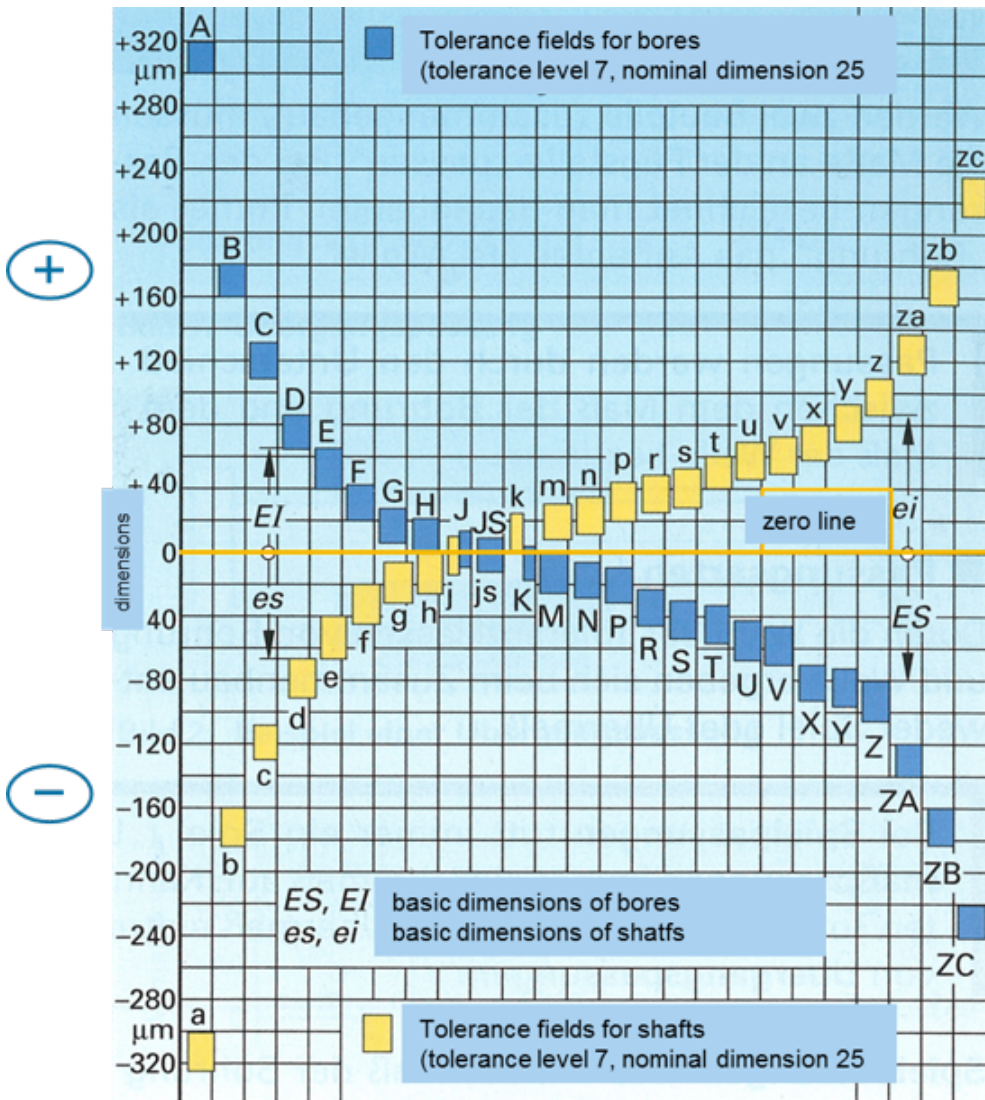
3.10 Which of the following design rule for soldering is correct?

- Use as less area as possible for the solder connection.
- Avoid pressure.
- Avoid shear stresses.
- Avoid tensile and bending stresses.

3.11 Which of the following assembly design guideline is correct?

- A differential design leads to shorter assembly time.
- Don't combine assembly operations.
- Combine components by integral and composite construction.
- Multiple simultaneous fitting operations improve the assembly sequence.

ISO Tolerance field



Sample

Recommended edge dimensions "a" in mm

1) + 2,5 + 1 + 0,5 + 0,3 + 0,1	For burred edges or transition
+ 0,05 + 0,02	
- 0,02 - 0,05	For burr-free edges or removal
- 0,1	
- 0,3	
- 0,5	
- 1	
- 2,5 - 2)	

1) Other dimensions as required

Sample

Additional space for solutions—clearly mark the (sub)problem your answers are related to and strike out invalid solutions.

