

LABORATORIUM 7

Machining parameters

Lab objectives:

- List the key elements of the technological process of a mechanical product.
- Identify technological operations from the manufacturing drawing.
- Select appropriate cutting tools for basic turning and milling operations.
- Determine basic cutting parameters: a_p , f , f_z , v_c , n , v_f , t_c .
- Apply technological formulas to calculations related to conventional machining.
- Evaluate the correct selection of machine and parameters in relation to the type of operation and material.
- Perform initial optimisation of the machining process in terms of time and productivity.

Acronyms

Symbol	Explanations
a_p	Depth of cut - thickness of layer of material removed in one tool pass.. Unit: [mm]
f	Turning feed rate - tool displacement per workpiece revolution. Unit: [mm/obr]
f_z	Cutting feed - the amount of material removed by one cutter blade during one tool revolution. Unit: [mm/ostre]
v_c	Cutting speed - the linear speed between the tool and the workpiece. Calculated from: $v_c = (\pi \times D \times n)/1000$. gdzie: D – diameter of workpiece or tool [mm] n – revolutions [rpm] Unit: [m/min]
n	Speed - number of revolutions of the workpiece (in turning) or tool (in milling) per minute. Calculated from: $n = (1000 \times v_c)/(\pi \times D)$. Unit: [rpm]
v_f	Working feed - the linear speed of the tool's feed motion. Calculated from: $v_f = f_z \times z \times n$. gdzie: D – diameter of workpiece or tool [mm] n – revolutions [rpm] Unit: [mm/min]
t_c	Machining time - time taken to perform one operation. Calculated from:

	$t_c = L / (f \times n)$. L – machining length [mm] f – feed rate [mm/rev] n – speed [rpm] Unit: [min]
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Task 1 – Reminder: Elements of the technological process

Based on your knowledge from the previous class, list the elements to be considered when developing a technological process.

List at least 5 key elements of the technological process:

1.
2.
3.
4.
5.

Give an example of the application of a process to a simple workpiece:

.....
.....

Task 2 – Selection of tools and parameters: Turning (steel C45)

Based on the detailed drawing and the following list of procedures, plan the technological operations.

Lista zabiegów technologicznych:

1. Turn the face.
2. Turn diameter $\varnothing 34.5$ including face.
3. turn groove to diameter $\varnothing 30-0.15$.
4. turn $\varnothing 64$ to length 88.
5. make an A4 bevel.
6. chamfer $2 \times 45^\circ$.
7. chamfer $5 \times 45^\circ$.

For each treatment, specify:

- type of machining (roughing/finishing),
- type of turning tool,
- cutting parameters: a_p , f , v_c , n , t_c ,

- machine (e.g. TUR 50) and whether it allows the operation to be carried out.

Table to be completed:

Procedure	Type of machining	Turning tool	ap [mm]	f [mm/rev]	vc [m/min]	Remarks (n, tc)
1						
2						
3						
4						
5						
6						
7						

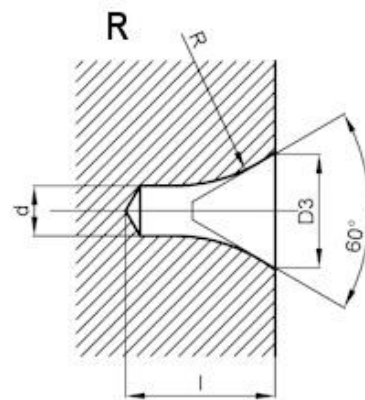
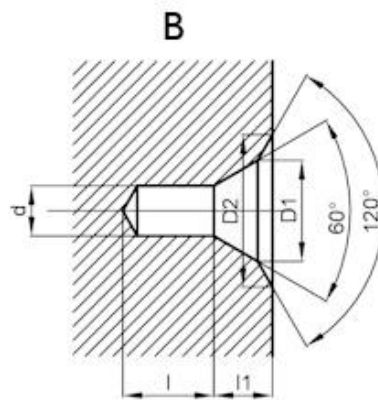
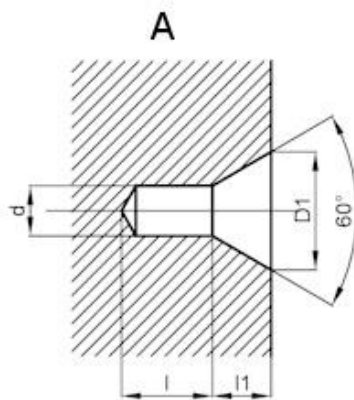
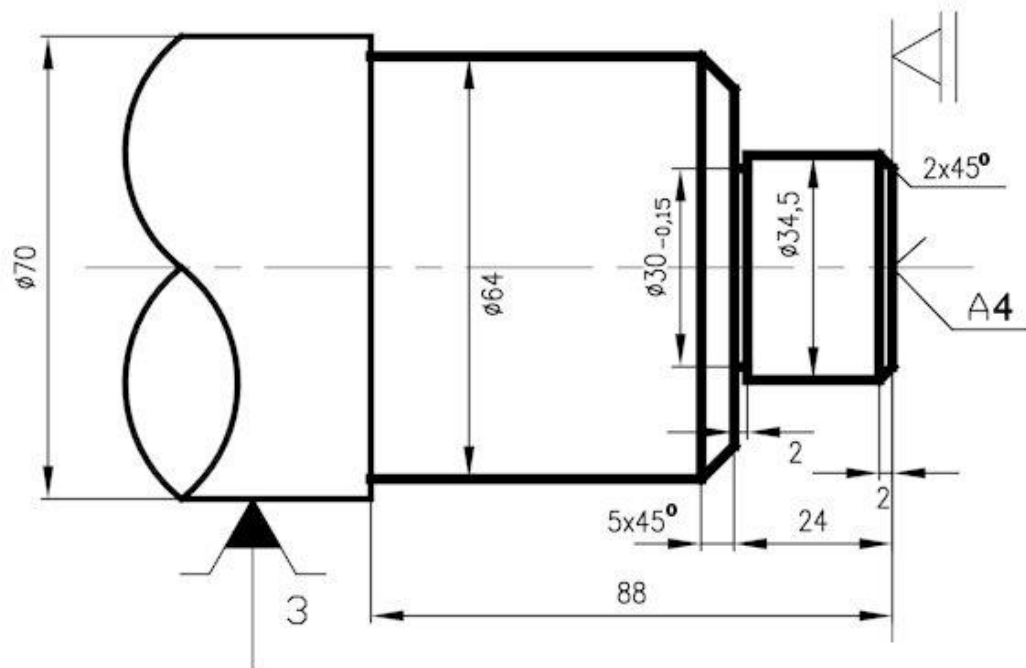
Formulas:

$$n = (1000 \times vc) / (\pi \times D)$$

$$tc = L / (f \times n)$$

Additional links:

- Machining: <http://anamesin.lecture.ub.ac.id/files/2015/09/Machining.pdf>
- Turning tools: <https://cutting-tools24.com/lathe-knives-with-solder-plate.html>
- Sandvik knowledge base: <https://www.sandvik.coromant.com/en-gb/knowledge/general-turning/external-turning>
- Turning operations: <https://msvs-dei.vlabs.ac.in/mem103/Unit5lesson4.html>



Task 3 – Milling (steel C45)

Based on the detailed drawing, design a plan for milling.

Steps to follow:

1. describe the technological procedure (e.g. face planning, groove milling, side planes, edges).
2. select the cutter (type, material, number of blades).
3. determine the cutting parameters:
 - a_p [mm]
 - f_z [mm/blade]
 - v_c [m/min]
 - n [rpm].
 - v_f [mm/min]

Formulas:

$$n = (1000 \times v_c) / (\pi \times D)$$

$$v_f = f_z \times z \times n$$

Additional links:

- Milling tools: <https://cutting-tools24.com/end-mills.html>

