School of Engineering Science

WRITTEN EXAMINATION

Course: Material Processing Technology

Sub-course: Written Examination

Course code: MT508G   Credits for written examination: 2 ECTS

Date: 2025-02-21   Examination time: 08.15-12.30

Examination responsible: Dr Lennart Y. Ljungberg (Assoc. Professor)

Teachers concerned: Mahdi Eynian

Aid at the exam/appendices: A "mathematical formula table" or a "table for mathematics combined with chemistry and/or physics" and a "language dictionary"

The answers to the questions can be found in the related areas in the course book or the handouts given in the brackets after each question.

Note: L.Y. Ljungberg and M. Eynian can be contacted by telephone through the examination attendants.

Instructions:		
	☐	Take a new sheet of paper for each teacher.
	☐	Take a new sheet of paper when starting a new question.
	☒	Write only on one side of the paper.
	☒	Write your name and personal ID No. on all pages you hand in.
	☒	Use page numbering.
	☒	Don´t use a red pen.
	☒	Mark answered questions with a cross on the cover sheet.

Grade points:

Maximum: 18p

Passed (G): 10 p or more

Not Passed < 10p

Examination results should be made public within 18 working days!

Good luck!

Total number of pages 4

Part A. Quantitative problems. Motivate and show your calculations. 3 p per task! See the formulas in the end of this examination!

1. Tool life tests were carried out by turning normalized steel 1045 using an experimental tool material which shows

Condition	V	T (min)
1	100	120
2	200	15

Calculate n and C in the Taylor equation for tool wear for this tool material and obtain the value of C . (S3)

2. Mean temperature in cutting is found to be proportional to the powers of feed (per revolution) and Cutting speed in turning of titanium with a tungsten carbide cutting tool with following parameters:

$$T_{mean} \propto V^a f^b$$

Cutting Tool Material	a	b
Tungsten-Carbide	0.2	0.125

Initially machining is done with a cutting speed of 45 m/min and feed of 0.070 mm/rev.
a) What cutting speed should be used if the feed was increased to 0.100 mm/rev to keep the same mean temperature?
b) What will be the impact of this change on Material Removal Rate? (S3)

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Part B. Qualitative problems. Motivate your answers and if possible draw figures, even when this is not required! 3 p per task!

3. Explain how you can calculate the Material removal rate, MRR and write down a typical unit for the rate. (Chapter 23.2 in the course book!)

4.
    a) Draw a simple figure and briefly explain how a laser beam is generated. (2p)
    b) Explain how Photochemical etching is performed (1p) (Handout 2)

5. Give three examples how Machine Tool Vibrations can arise (develop). (Handout 3)

6. Give three common examples of materials used in cutting tools and describe the typical properties of the materials and possible problems to be aware of during the cutting process. (Handout no 4 and Chapter 22.1-22.11 in the course book)

APPENDIX:

SOME FORMULAS AND FIGURES RELATED TO MATERIAL PROCESSING

Taylor tool life equation $VT^n = C$

Mean temperature increase considering workpiece material properties:

$$T = 3.8 \frac{Y_f}{\rho c} \sqrt[3]{\frac{V t_0}{K}}$$

(with units: $T = 3.8 \dfrac{Y_f[\text{Pa}]}{\rho c\left[\frac{\text{N}}{\text{m}^2 \text{°C}}\right]} \sqrt[3]{\dfrac{V\left[\frac{\text{m}}{\text{s}}\right] t_0[m]}{K\left[\frac{\text{m}^2}{\text{s}}\right]}}$)

Mean temperature vs. feed and cutting speed $T_{mean} \propto V^a f^b$

Cutting Tool Material	a	b
Tungsten-Carbide	0.2	0.125
High-Speed Steel	0.5	0.375