



UNIVERSITY
OF SKÖVDE

School of Engineering Science

WRITTEN EXAMINATION

Course: Alternative Manufacturing Methods, A1N

Sub-course: Written Examination

Course code: VP716A

Credits for written examination: 4 ECTS

Date: 2019-10-29

Examination time: 08.15-12.30

Examination responsible: Assoc. Professor, Dr Lennart Y. Ljungberg

Teachers concerned: Examiner, Dr Wei Wang

Aid at the exam/appendices: Only language dictionaries

Other: Assoc. Professor L.Y. Ljungberg 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: 20p

Not Passed < 8p

Grade E ≥ 8p

Grade C ≥ 12p

Grade A ≥ 16p

The intermediate grades will be determined by a formative assessment.

Examination results should be made public within 18 working days!

Good luck!

Part A. Short answers. Motivate your answers when possible. 1 p per task!

1. **Laser.** Explain two advantages of laser machining!
2. **Thermal Spraying.** Describe two areas where thermal spraying is of interest.
3. **Electrochemical Machining.** Describe the how electrochemical grinding is performed.
4. **CIM.** Explain the abbreviation CIM and how it works.
5. **EBM and PM.** Discuss briefly what can be important to think of in order to choose between EBM (Electronic Beam Machining) and PM (Powder Metallurgy).

Part B. Detailed answers. Motivate your answers when possible! If possible draw figures, even when this is not required! 3 p per task!

1. **EBM.** Explain the Electronic Beam Machining process with a schematic drawing. The following parts must be shown in the drawing: Positive anode, Magnetic lens, Deflection coils, workpiece, Electron stream and High Voltage cable!
2. **PM.** Explain and describe the following steps in Powder Metallurgy:
 - a. Powder production
 - b. Blending
 - c. Compaction
 - d. Sintering
 - e. Finishing operations
 - f. Example of PM-products (at least two types!)
3. **Hybrid Processes.** Mention 3 types of Hybrid processes and tell some details about every process respectively.
4. **Plastic Composites.**
 - a. Describe an old composite (some thousand years old) and some modern one.
 - b. Describe a typical Polymer Matrix material.
 - c. Describe how a typical Boron fiber is built up.
5. **Materials.**
 - a. Explain how a metallic crystal is built up with pictures.
 - b. What is typical for metal chemical bonds?
 - c. Explain why ceramics are typically brittle compared to e.g. metals.