

# Exam in Manufacturing Processes MPR 034

**Date:** 2012-01-16

**Time:** 14.00-18.00

**Examiner:** Gustav Holmqvist,

**Ass. Devices:** Approved calculator, pen, pencil, eraser, ruler, and written dictionary.

**Checking:** Contact Gustav

**Grading** Fail: 0-19,5p, 3: 20-29,5p, 4: 30-39,5p, 5: 40-50p

*General instructions: For full point you must make clear that you have understood the meaning of your answer. You must show the teacher that you have understood the question and it's answer. Write detailed answers and motivate and explain yourself. Write clearly and readable. Good Luck!*

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## 1. Surface Topography (4 p)

Describe two different measurement technologies for surface topography measurement. Describe in some detail, function, limitations, application.

## Metal forming

### 2. Drawing is one of the fundamental processes within sheet metal forming (5 p)

- a) What type of parts can be manufactured by this process? Exemplify! (1p)
- b) Explain the principle for a typical drawing operation (with a sketch!). (1p)
- c) Which material properties are the most important for the formability? (Explain) (3p)

### 3. Blanking (shearing) (4 p)

Describe the technology fine blanking. Describe some details on how it differs from ordinary blanking (shearing/punching). Think of different aspects yourself.

#### 4. Hydroforming (4 p)

- a) What are the *advantages* of hydroforming? Mention four different advantages or explain shortly two different advantages. (2 p)
- b) What are the *disadvantages* of hydroforming? (As above) (2 p)

### Unconventional machining methods

#### 5. Abrasive Waterjet Cutting

- a) Define and explain at least three geometrical defects one might find on an abrasive waterjet cut part. For two of the errors you should also explain its cause.  
(Explanation of *geometrical defect*: form errors or geometrical errors which are NOT part of the surface topography). (3 p)
- b) Describe how the abrasive waterjet is formed, using the traditional (injection) technique. Make a sketch of the cutting head. The pump unit does NOT need to be explained. Also shortly describe what constitutes the jet (what does it contain?) after leaving the nozzle. (2 p)

#### 6. Laser Cutting (5 p)

Laser light has to be transmitted from the laser source to the cutting head. There are two different laser types, commonly used for cutting, which use two different methods for transmission of the laser light.

- a) Which are the laser types (laser media)? (1 p)
- b) What two different methods (technologies) of transmission of the light do these laser types use, and how does this influence the possibility of automation? Also – what basic property of the laser light is the cause of this difference? (2,5 p)
- c) Why are pulsed laser used sometimes? (1,5 p)

#### 7. Electrical Discharge Machining (4 p)

Briefly compare RAM or Sink-EDM to HSM. For instance make an advantage-disadvantage list but be sure to explain things.

## **Metal Cutting**

### **8. Grinding (5 p)**

- a) What is difference between conventional grinding and creep-feed grinding? How can creep-feed grinding be more economical? (2 p)
- b) Define the grinding ratio,  $G$ . Why is it of economical importance? (1 p)
- c) Which of the two processes *grinding* and *hard turning* has the highest energy consumption per unit volume removed? In your motivation you should include chip thickness and specific cutting force. (2 p)

### **9. Metal Cutting Fluids and environment (5 p)**

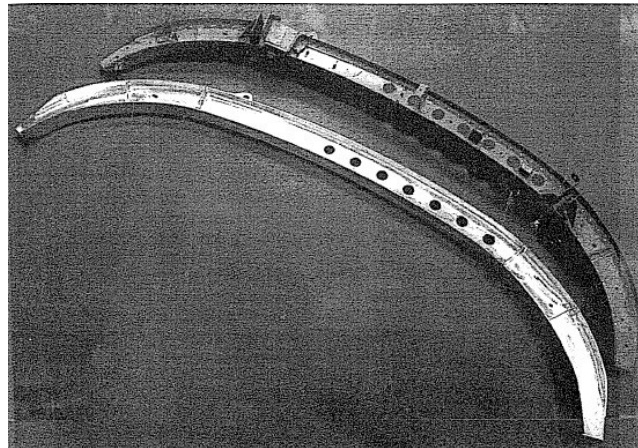
- a) What is an emulsion? What ingredients do you always find in an emulsion? (1 p)
- b) What different environmental aspects are there on metal cutting fluids? For instance if you were asked to make a report to analyse a certain fluid in terms of environmental aspects -what headlines would you have? Also comment briefly each "headline"! (4 p)

## 10. High-Speed Machining (5 p)

a) In HSM one can not just increase the rotational speed and hope for the best. Mention at least *three different things that have to be considered/changed – and how - before starting to work* with HSM. Think for example of the machine, the tool and of parameter settings. (1,5 p)

b) Which type of cooling is recommended for HSM? Explain why this is the case. (1,5 p)

c) Below pictures exemplify an advantage of HSM in aluminium. What is the advantage and how is this beneficial? (2 p)



## 11. Joining (4 p)

a) Draw a graph of the temperature distribution in a spot weld during welding (2 p)

b) Describe the spot welding cycle. What happens with force and current during the cycle. Draw a graph. (2 p)

SOLUTIONS: See Literature