PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester 1   Academic Year: 2005

Date: October 4, 2005   Time: 9:00-12:00

Subject: 226-401 Machining Technology   Room: R300

Instructions

- There are 7 questions in 11 pages.
- Answer all questions in this exam paper.
- All notes, materials, and calculators are allowed. (Open-book exams)
- Total score is 80.

Name:	Student ID....................

Question #	Full Score	Assigned Score
1	10	
2	15	
3	15	
4	10	
5	10	
6	10	
7	10	
Total	80	

Asst. Prof. Somchai Chuchom

Question #1 (10 marks)

Analyze and compare the principal concepts, process components and its applications of the following machining techniques.

1.1 Ultrasonic Machining (UM) VS Electrochemical Machining (ECM)

1.2 Abrasive Jet Machining (AJM) VS Water Jet Machining (WJM)

1.3 Electric Discharge Machining (EDM)VS Electron Beam Machining (EBM)

Question #2 (15 marks)

Give a short answer for each following question.

2.1 Most accepted laser types for industrial material cutting are:

a)..

b)..

2.2 The main problems of applying continuous mode lasers when compared to pulsed mode lasers are ....
....
....

2.3 The lasant gas for Ion-laser which can generate high power pulse for metal cutting is ....

2.4 The main problems of applying CO_2 laser on *Al* workpieces are ....
.
....
....

2.5 Laser that is generated from organic materials and can be tuned for several wave lengths is ....

2.6 Nd-YAG laser : advantages are ....
....
....

2.7 Nd-glass laser : limitations are ....
....
....

2.8 Excimer laser : suitable work applications are...................
....
....

2.9 Why cutting forces in laser assisted machining are lower than those of conventional cutting processes? ....
....
....
....
....

2.10 In academic point of view, discuss the potential success and development of Nd-Glass laser.
....
....
....
....
....

Question #3 (15 marks)

An order of 1200 pieces of AISI 1020 carbon steel is to be produced by fine turning. Only one pass of cut per piece is required. The finished part is 100 mm in diameter and 300 mm long. Apply the cermet tool of tool life follows the equation $T = 1.65 \times 10^8 v^{-2.9}$, where T = tool life (min) and v = cutting speed (m/min).

The tool costs 450 Baht per tip, the operating cost (include labor cost) is 115 Baht/hr. The machine depreciation is calculated at 275 Baht per one hour of machining. Other expense is assumed negligible. The loading time per piece is 0.5 min, The unloading time per piece is 0.75 min. Tool change per tip is 2.25 min.

a) calculate the optimum cutting speed;
b) calculate the appropriate spindle speed;
c) calculate the tool life;
d) calculate the total machining time of the order;
e) calculate the total cutting cost of the order.

Question #4 (10 Marks)

In order to gain the optimum solutions for metal cutting, the OCT software was developed at PSU and applied in the research laboratory. Use information received during the Lab. session on OCT software to answer the followings:

4.1 Explain the concepts or main ideas applied in this software.

4.2 Comment on the obtained results and suggest on what should be further developed.

4.3 Demonstrate how to make use of the OCT software starting with what input information should be provided, till obtaining the required solutions.

Question #5 (10 Marks)

5.1 The objectives of material cutting research has changed from the past till now, specify each of them.

5.2 Why the Salomon Curve was mentioned and interested by the researchers in 1930s?
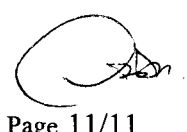
5.3 How to identify or separate high cutting speed operations from normal cutting operations?

5.4 How CIM and FMS are related? Comment on their roles in the present manufacturing systems.

Question #6 (10 Marks)

An order of 750 pieces of AISI 1045 carbon steel is to be produced by a heavy roughing cut and a light finish cut. Each AISI 1045 bar with 80 mm in diameter and 350 mm long must be turned down to 60 mm diameter for 150 mm of their length. The roughing cut is to be taken at maximum power. The light finishing cut is to be taken at a feed of 0.17 mm, a cutting speed of 1.7 m/s. and at maximum power. If the lathe has a 2 kW motor and an efficiency of 80 percent, assume that the specific cutting energy for the AISI 1045 carbon steel is 2.73 GJ/m, the time taken to return the tool to the beginning of the cut is 20 s, and the loading and unloading time per piece is 100 s. Other expenses are assumed negligible. Calculate the total production time in kiloseconds (ks) for the batch of work.

Question #7 (10 Marks)

When steel was machined by a cermet tool, it was found that the tool life of the cermet is 10 minutes at the cutting speed of 230 m/min. Tool life of the cermet could be extended to 20 minutes when the cutting speed was used at 200 m/min.

7.1 Calculate V_{30} of the cermet tool based on the result above.

7.2 If aluminium is known to have the "Machinability Rating" of 0.6 of steel, compute V_{30} of aluminium.