

**PRINCE OF SONGKLA UNIVERSITY**  
**FACULTY OF ENGINEERING**

Midterm Examination: Semester II

Academic Year: 2005

Date: December, 15 2005

Time: 9:00-12:00

Subject: 226-308 Modern Manufacturing Processes

Room: A400

**Instructions**

- Write your answer in this paper exam only, show your work clearly and legibly.
- Write your name and student ID on every page.
- There are 8 problems and total score is 100.
- Carefully read the problems and answer all questions in each problem.
- Double sides of A4, dictionary, and calculator are allowed.

ทฤษฎีในการสอบ โทษขั้นต่ำ คือ พักการเรียน 1 ภาคการศึกษา และปรับตกในรายวิชาที่ทฤษฎี

Name .....

Student ID .....

Question #	Full Score	Assigned Score
1	10	
2	10	
3	15	
4	15	
5	20	
6	10	
7	10	
8	10	
<b>Total</b>	<b>100</b>	

**Good Luck**

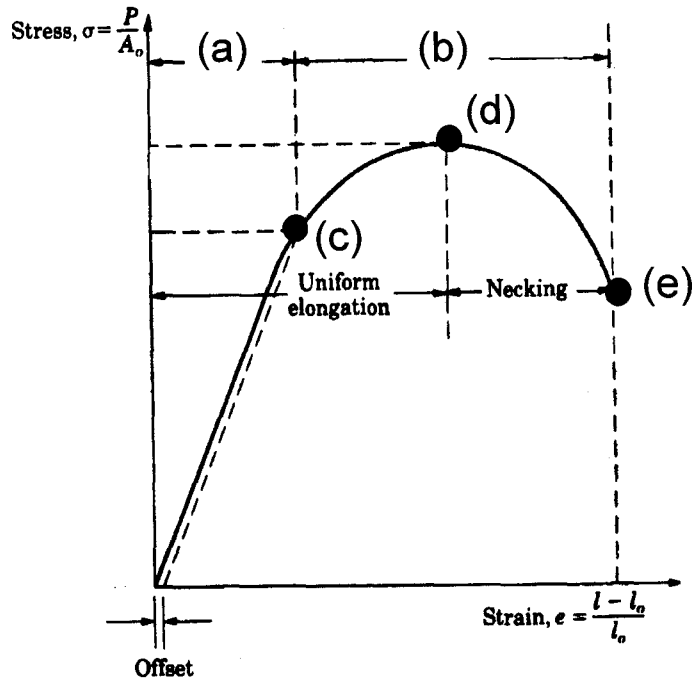
**Thanate Ratanawilai**



Name .....

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**Problem 1. (10 points)** From the stress-strain curve below, give the name and explain the meaning of each point.



Region (a) Name: \_\_\_\_\_  
Meaning: \_\_\_\_\_

Region (b) Name: \_\_\_\_\_  
Meaning: \_\_\_\_\_

Position (c) Name: \_\_\_\_\_  
Meaning: \_\_\_\_\_

Position (d) Name: \_\_\_\_\_  
Meaning: \_\_\_\_\_

Position (e) Name: \_\_\_\_\_  
Meaning: \_\_\_\_\_

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**Problem 2. (10 points)** A bar 1.5 inch diameter and 10 inch long must be turned down to 1 inch diameter for 8 inch of their length. The machining is to be taken at a feed of 0.01 inch and depth of cut 0.05 inch. Calculate

2.1 How many cycles have to be machined?

2.2 If same spindle speed of 250 rpm was used for each cycle in Question 2.1, what is the total machining time?

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**Problem 3. (15 points)** In an orthogonal cutting test on mild steel, the following results were obtained:

Width of chip = 2.0 mm,      Undeformed chip thickness = 0.45 mm,

Chip thickness = 0.50 mm,      Working normal rake =  $0^\circ$ ,

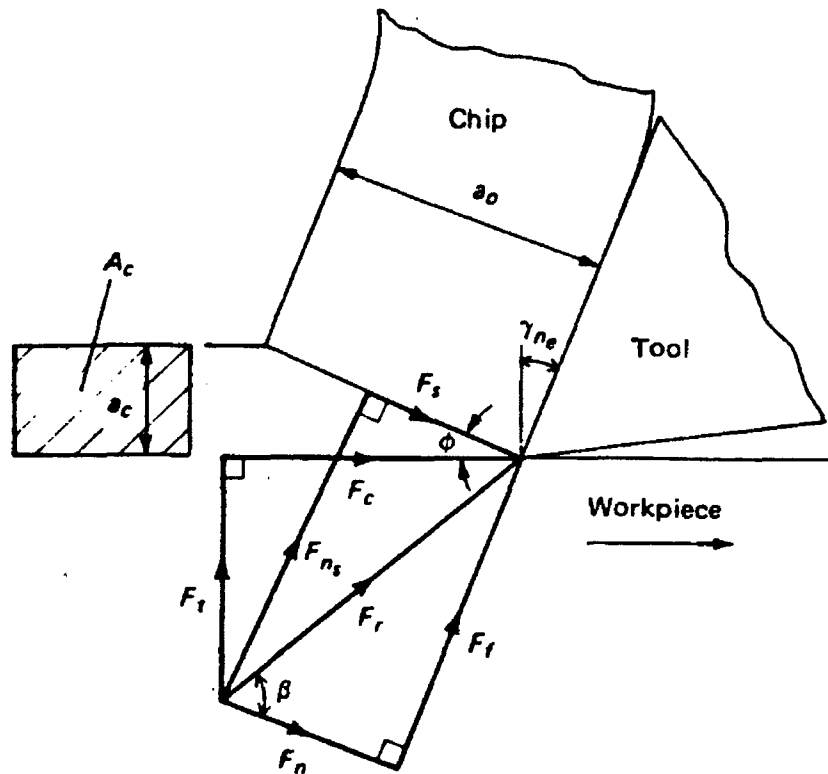
Cutting force = 900 N,      Thrust force = 600 N

Calculate

3.1 The shear angle

3.2 The mean angle of friction of the tool face

3.3 The mean shear strength of the work material, in meganewtons per square metre ( $\text{MN/m}^2$ )



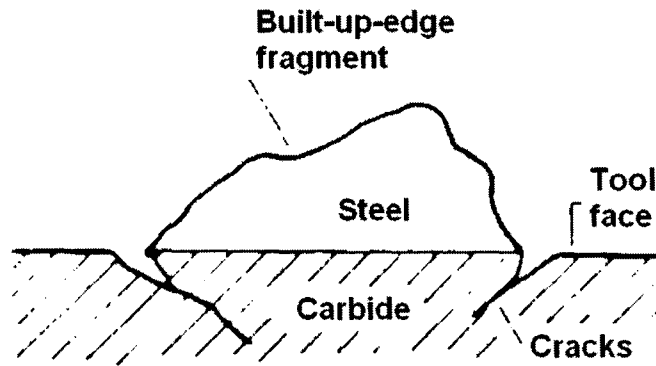
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**Problem 4. (15 points)** A machining operation is being carried out.

- 4.1 Explain three main mechanisms of tool wear
- 4.2 Explain the effects of tool wear
- 4.3 From figure below, why are cracks on the tool face occurred?



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**Problem 5. (20 points)** Explain the effects of the following variables on surface roughness when an aluminium alloy is machined using high speed steel (HSS) tool. Best to draw figure along with your answer.

5.1 Cutting speed

5.2 Feed

5.3 Depth of cut

5.4 Tool nose radius

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**Problem 6. (10 points)**

6.1 Discuss forms, cause, and effect of tool wear in metal cutting and draw figure to demonstrate your answer.

6.2 Indicate forms of wear to determine the life of cutting tool under the following conditions:

6.2.1 Very high speed cutting condition

6.2.2 Economical cutting condition



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**Problem 7. (10 points)** 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.


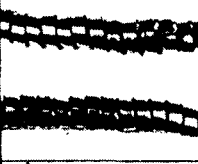

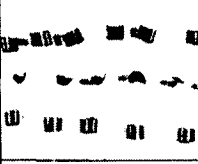


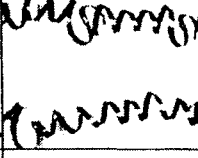
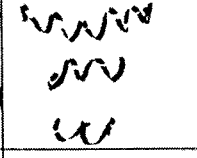
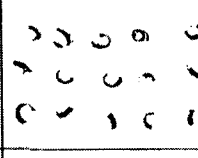
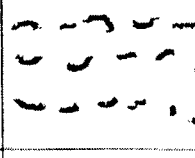


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**Problem 8. (10 points)** Explain types of chip formation and their effects on the machining

8.1 Based on the classification of chip shape by Sumitomo Electric (Figure below), please indicate favourable and unfavourable chips (A, B, C, D, and E) and give the reasons to support your answer.

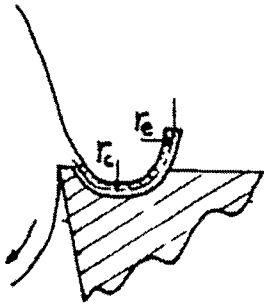
Depth of Cut	A	B	C	D	E
Excess					
Slight					
Curled Length	No Curling	Over 50mm	Up to and Including 50mm 1 to 5 Turns	Below 1 Turn	Half Turn
Remarks	Continuous Random Shape	Continuous Regular Shape	Good	Good	Excessively Broken Chip



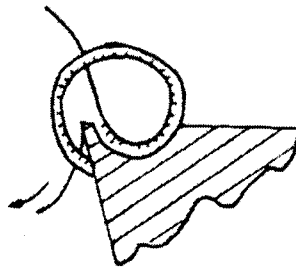
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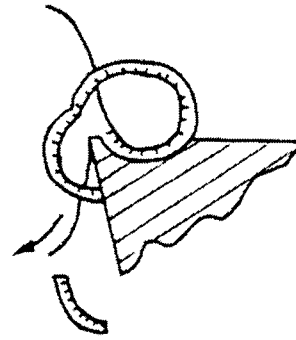
8.2 Explain the chip breaking process based on the following Figure.



(a)



(b)



(c)