The University of Adelaide

Department of Mechanical Engineering

November 2002

6231:MANUFACTURING ENGINEERING 1 (PROCESSES) (MECH ENG 2007)

Time allowed: **TWO HOURS AND 10 MINUTES**

Students are advised to devote 10 minutes to reading the examination paper and planning their approach

NOTE CAREFULLY THE FOLLOWING:

1. **Attempt ALL questions.**
2. The **TOTAL** number of marks for the examination is **100.**
3. Questions are **NOT** of equal value, but the marks for each section are indicated on the paper.
4. Textbooks and notes are not to be taken into the examination.
5. Calculators are permitted.

Question 1 begins on page 2

Question 1 (27 marks)

You are the design engineer for the manufacturing company Adeluni Pty. Ltd. A prospective customer has asked you to quote your minimum price for the manufacture of the two gears shown in Figure 1. These gears are used to adjust the seat inclination of a bucket seat in an automobile. The gear on the left is approximately 25mm in diameter and the large flat gear on the right has a diameter of 53.267mm. The gears were used as prototypes as part of a new mechanism design.

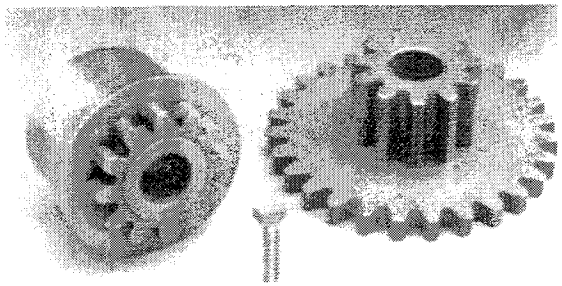

Figure 1. Small gears for seat assembly

While these prototype gears were manually machined from steel bar you are free to specify any material or method of fabrication.

(a) What further information do you need from the customer before you can begin preparing your quotation?

(8 marks)

(b) What suggestions could you make to the customer to reduce the unit cost?

(4 marks)

(c) What aspects of your manufacturing facility need to be considered before you decide whether your company should indeed quote for the manufacture of the gears?

(5 marks)

(d) Suggest three processes that you would consider suitable for the manufacture of the gears. Justify your choices and briefly outline each process.

(6 marks)

(e) Select the most suitable of the processes suggested in (d) and;

i) Justify its selection as the most suitable process.

ii) Suggest a material suited to the manufacturing process and the gears' application, again justifying its selection.

(4 marks)

Question 2 (21 marks)

(a) What distinguishes a primary deformation process from a secondary deformation process?

(3 marks)

(b) Explain why rolling may be considered either a primary or a secondary deformation process.

(2 marks)

(c) Explain the difference between a four stand mill and a four high stand.

(4 marks)

(d) Give an application for a cluster mill and explain why it is necessary to use a cluster mill in this application.

(6 marks)

(e) List three common rolling defects and the reasons for their occurrence.

(6 marks)

Question 3 (24 marks)

(a) Briefly describe the following processes and suggest a suitable application for each process;
i) GMAW
ii) GTAW
iii) MMAW
iv) SAW
v) Brazing

(10 marks)

(b) Sketch a CCT curve for a carbon steel. Label the regions.

(8 marks)

(c) Explain the application of CCT curves to fusion welding.

(6 marks)

Question 4 (28 marks)

(a) Sketch a Forming Limit Diagram (FLD) and label the different regions on the diagram.

(10 marks)

(b) Discuss the application of FLDs in deep drawing.

(9 marks)

(c) Select and briefly describe three casting processes for aluminium alloys illustrating each with an appropriate example.

(9 marks)

**********END OF EXAMINATION**********