

COMMONWEALTH OF AUSTRALIA

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Family Name	
Given Names	
Student Number	
Teaching Period	Semester 1, 2016

FINAL EXAMINATION	DURATION				
ENG235 – Manufacturing	<table border="1"> <tr> <td>Reading Time:</td> <td>10 minutes</td> </tr> <tr> <td>Writing Time:</td> <td>180 minutes</td> </tr> </table>	Reading Time:	10 minutes	Writing Time:	180 minutes
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INSTRUCTIONS TO CANDIDATES

This exam has three (3) sections. Marks for each section are as shown.

- A. Multiple Choice: (28%) Answer all twenty (20) questions in the exam booklet.
- B. Short Answer: (42%) Answer six (6) out of eight (8) questions in the exam booklet.
- C. Design & Analysis: (30%) Answer all three (3) questions in the exam booklet.

EXAM CONDITIONS

You may begin writing from the commencement of the examination session.

The reading time indicated above is provided as a guide only.

This is a CLOSED BOOK examination.

No calculators are permitted.

No handwritten notes are permitted.

No dictionaries are permitted.

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
No additional printed material is permitted.	1 x 20 Page Book.

**THIS EXAMINATION IS PRINTED
DOUBLE-SIDED.**

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Section A
Multiple Choice Questions
Total No of Marks for this section: 28

This section should be answered in the answer booklet.
Marks for each question are indicated.

Section B
Short Answer Questions
Total No of Marks for this section: 42

Answer only 6 of the following 8 questions (21 – 28).

This section should be answered in the Answer Booklet provided.
Each question is worth 7 marks as indicated.

Question 21 (7%)

Why is it important to have a good understanding of manufacturing processes when involved in product design? What is the link between design and manufacturing?

Question 22 (7%)

What are two advantages and two disadvantages of welding compared to other types of assembly operations?

Question 23 (7%)

Identify three desirable properties of a cutting tool material and describe why they are important.

Question 24 (7%)

Describe how roller burnishing processes induce compressive residual stresses on the surface of parts and why this is advantageous.

Question 25 (7%)

Describe the steps in producing parts via the investment casting process.

Question 26 (7%)

Design the nominal sizes of a GO/NO-GO plug gauge to inspect a 40 ± 0.80 mm hole. There is a wear allowance applied only to the GO side of the gauge. The wear allowance is 2% of the entire tolerance band for the inspected feature. Determine

- (a) the nominal size of the GO gauge including the wear allowance and
- (b) the nominal size of the NO-GO gauge.

Question 27 (7%)

The part shown in Figure 1 is a proposed design for a connecting rod for a small lawnmower engine and is approximately 100mm long. The production part will be investment cast from an aluminium alloy in large quantities, but initially only 20 parts are required for engine reliability testing.

Suggest the most suitable method of producing the 20 parts which is also fast and cost effective. Clearly outline the steps involved in the process.



Figure 1 – Aluminium connecting rod.

Question 28 (7%)

Figure 2 - Powder metallurgy designs shows three poor and three better designs for powder metallurgy parts. Explain what is wrong with each of the poor designs and how the problem is resolved with the better design.

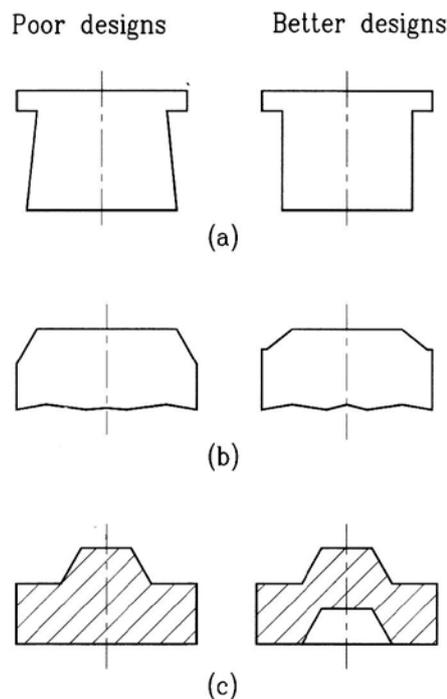


Figure 2 - Powder metallurgy designs

Section C
Design and Analysis Questions
Total Number of Marks for this section: 30

This section should be answered in the Answer Booklet provided.
Answer all three of the following questions. List any assumptions you make.

Marks for each question are indicated.

Question 29 (5%)

As a respected manufacturing engineer within your company, senior management have asked you to modify the design of an extruded aluminium bracket shown in Figure 3 so that a bracket with the same dimensions and functionality can be made more cheaply from grey cast iron in a yet to be selected casting process.

One of the managers within the company wants to keep the current design and just change the material and implement “any type of sand casting” to save on design and development costs.

- (a) List and discuss why the manager’s reasoning is flawed and the likely problems that would result if the design was not modified to suit the yet to be selected casting process.

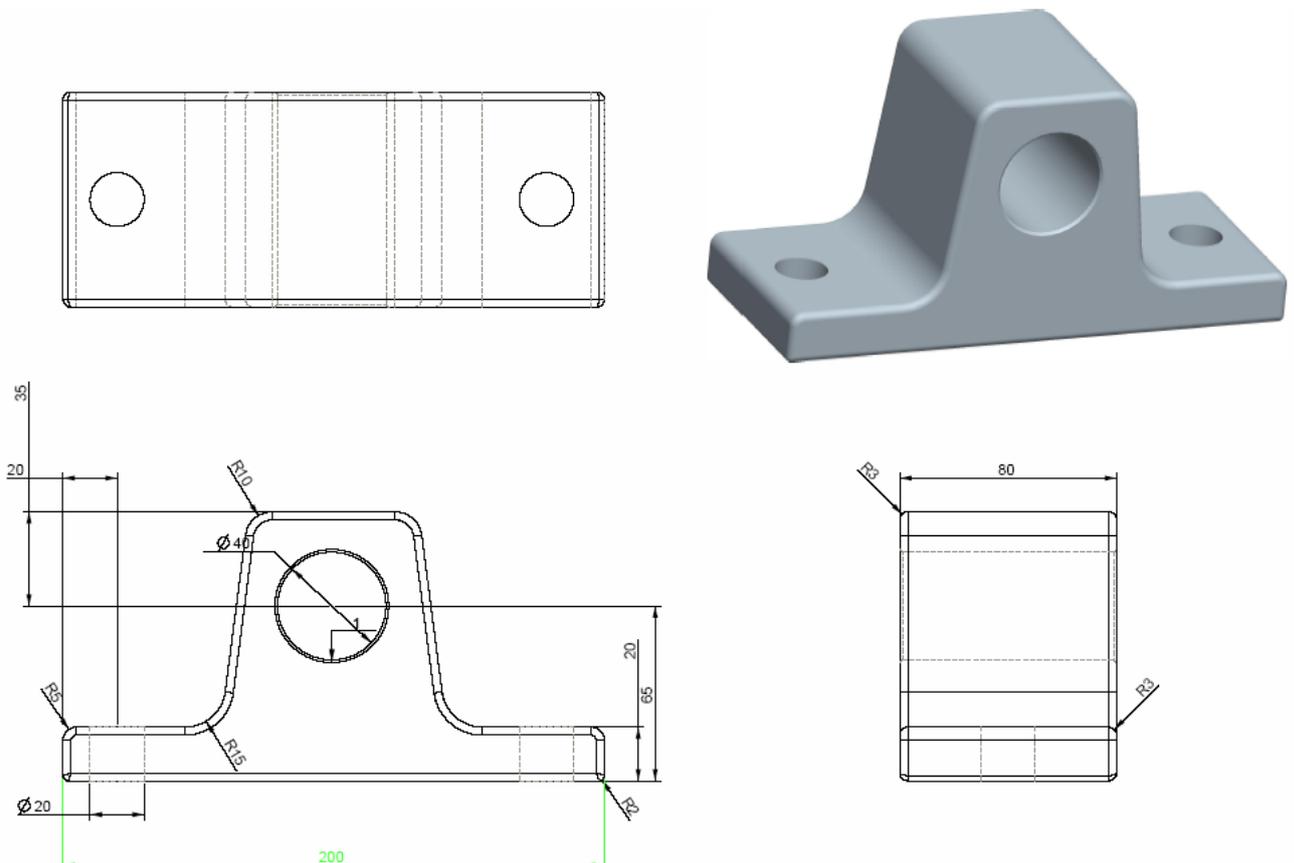


Figure 3 – Extruded aluminium bracket (current design).

Question 30 (15%)

Having convinced senior management that a redesign was essential, you modify the part as shown in Figure 4 – Modified design for the grey cast iron bracket.

- (a) Which casting process would you select given that the expected annual volumes are 38,000 parts and why? (5%)
- (b) Draw how the part would need to be oriented in the mould and the location of any cores that may be required. Also highlight where draft would be necessary for your selected process. (5%)
- (c) Suggest any improvements and refinements that could be made to the proposed design for the casting process you have selected. (5%)

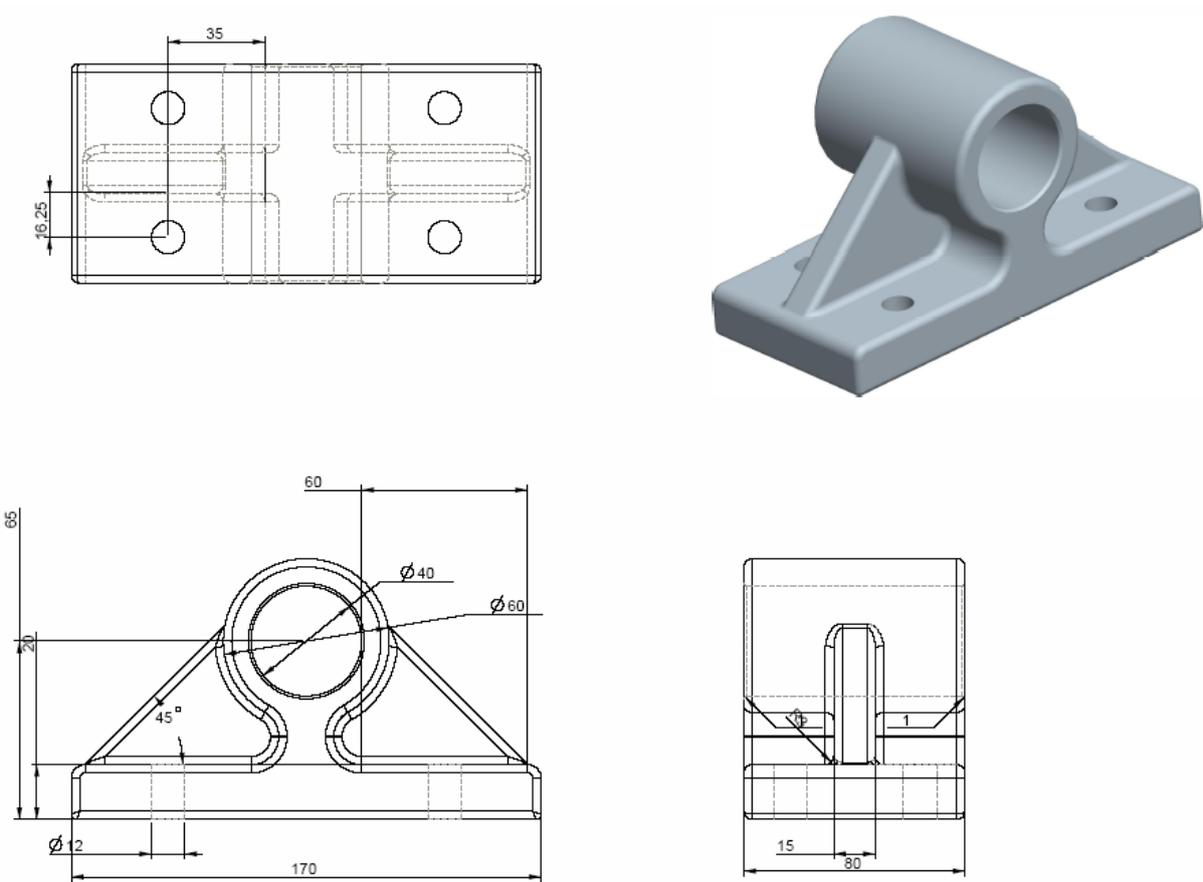


Figure 4 – Modified design for the grey cast iron bracket.

Question 31 (10%)

The spool in figure 5 requires a smooth surface finish. Five alternative processes for the manufacture are shown. These are

- (a) Machined from solid
- (b) Cast horizontally
- (c) Cast vertically
- (d) Forged vertically
- (e) Fabricated and welded

The dimensions are approximately

Bore diameter	50mm
Wall thickness	2.5mm
Flange diameter	75mm
Flange width	10mm
Total length	100mm

Discuss the advantages and disadvantages (or strengths and weaknesses) of each process and for which situations they would be suitable. For example, one process may be best suited to mass production of large quantities and another may be ideal to produce small numbers for specialised situations. Include the strength of the part in your discussion.

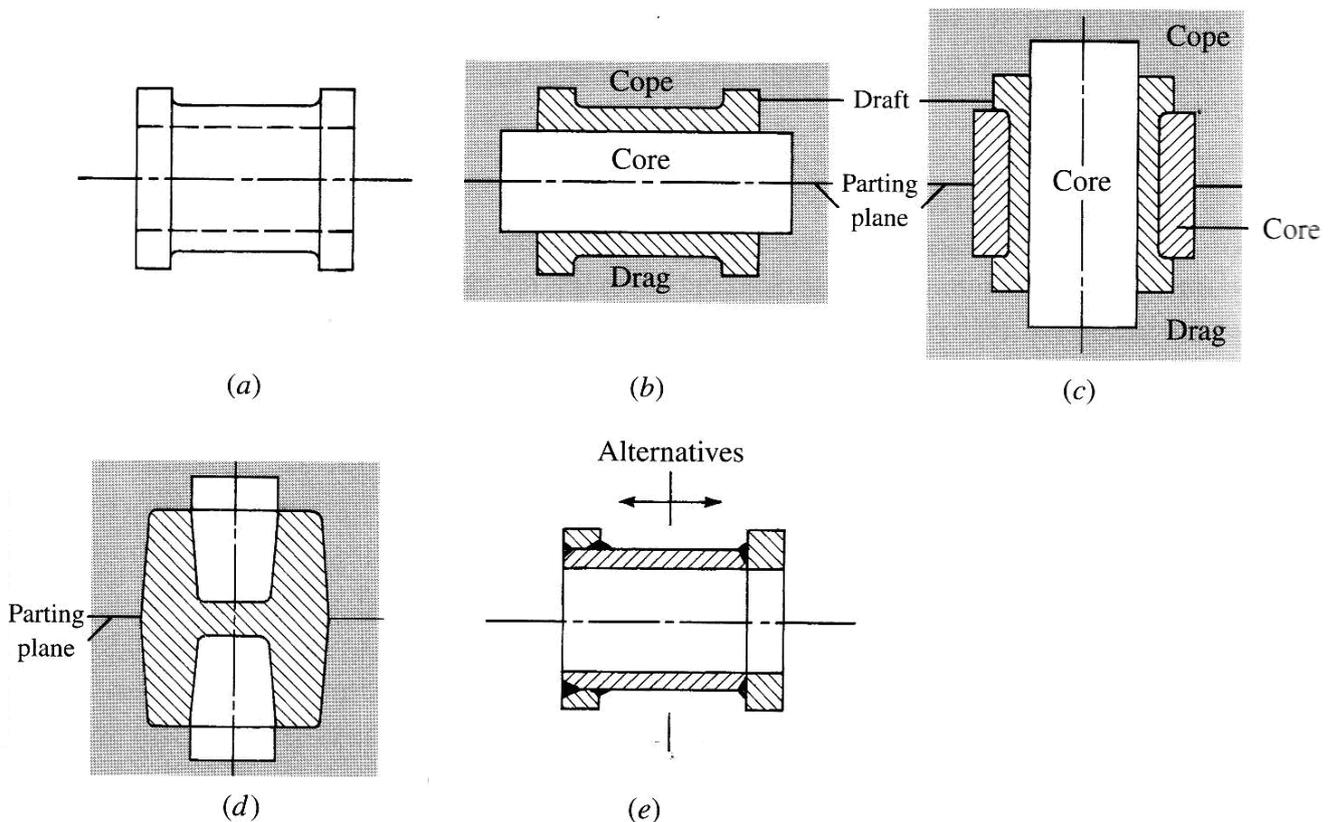


Figure 5 – Spool design.