Examination Period 4: 2018/19

ENG205819NB

Module Title: Manufacturing and Manufacturing Systems Technology
Level: Five
Time Allowed: Two hours

Instructions to students:
- Enter your student number **not** your name on all answer books.
- Answer **all** questions.
- All questions are equally weighted. Where a question has more than one part the division of marks is clearly stated.
- Begin each question on a separate page; label each page clearly with the number of the question you are answering.
- The use of a calculator **is** permitted.

<table>
<thead>
<tr>
<th>No. of Pages</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Questions</td>
<td>4</td>
</tr>
</tbody>
</table>
Answer all questions.

**Question 1**

**a.** You are employed within the internal combustion engine production area. You produce pistons for different customers of differing types from small quantities to very large quantities. For standard vehicles and extremely specialised ones.

Name the main types of layout of manufacturing systems for different scales of production and state the criteria by which they would be chosen.  

(10 marks)

**b.** Simulation software has been designed for many aspects of industry, including as a manufacturing tool.

i. How would you use simulation software such as ‘Simul8’ to aid you in the following? Explain typical commands and sequences used by the programme.

ii. How would you use a simulation tool to justify or change the level of staffing and personnel on a production line using simulation software? Describe the process and analysis needed to justify shifts, hours of work and work patterns for a production line.  

(10 marks)

**c.** The simulation suggests that a new process using a different material might be beneficial. The difference will be for a change from metal construction to polymer for a large food hopper.

Briefly describe the new system and name the processes with some detail for the new material.  

(5 marks)

**Total: 25 marks**

**Question 2**

As a result of a failure within an organisation there may be serious loss.

Ensuring effective health and safety procedures are in place is a key legal obligation for all UK based engineering companies. Failures in health and safety procedures can have very significant impacts upon both employees, companies and the community.

Using a recent example you are familiar with, identify a situation where health and safety practices appear to have failed and address the following:

**a.** Name a well-known catastrophic incident and identify four possible examples of failures in health and safety procedures that may have occurred in relation to the incident. Explain the impact of the failures.  

(12 marks)

---

**Question 2 continues overleaf**
b. Evaluate the impact a health and safety failure can have upon a company and those involved in the incident.  

(8 marks)

c. Write a risk assessment for a typical maintenance procedure.  

(5 marks)

Total: 25 marks

Question 3

For a wheelbarrow manufacturer, a process is needed which will produce the ‘barrow’ or material containing part. It can be made from a polymer or a metal.

a. Describe with diagrams a suitable manufacturing process. Assume batch size to be 5000, repeated at variable intervals.  

(15 marks)

b. Using this process:

- One barrow container is made every five minutes.
- The process has two operatives. Their wages are £10 per hour.
- The material costs for this part is £10 per unit.
- The fixed costs of this press are £3,000 per batch.
- A new machine is recommended by the production engineer, which will have fixed costs of £10,000 per batch. It needs only one operative.
- The machine produces one ‘body’ every two minutes.
- The material costs stay unchanged.

Sketch a break-even graph making a comparison for these two processes.  

(7 marks)

c. A new less expensive tool is proposed which will drop the fixed cost to £4,000 from start for process number two. However, the material it is made from is not as resilient as the original press tool. It will need a partial refurbishment every 5000 parts, which has a fixed cost of £2000.

Sketch your understanding of what a new graph with this change would look like.  

(3 marks)

Total: 25 marks
Question 4

Selecting the correct process for a material and part is economically and technically important.

a. Name and describe the processes used to do the following:
   
   i. welding of a process hopper for ice cream manufacture in 2mm stainless steel.
   
   ii. production of 10,000 PET bottles.
   
   iii. manufacture of a surgical hip joint implant.  
          (15 marks)

b. Describe with a graph the relationship between cost and quality. (5 marks)

c. Explain with diagrams the relationship between tool wear, tool life, profit and cost. (5 marks)

Total: 25 marks