Examination Period 2: 2017/18

ENG205818N

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.
- The exam paper consists of four questions. Please attempt all questions.
- All questions are equally weighted. Where a question has more than one part the division of marks is stated.
- Begin each answer on a separate page, label each page clearly with the number of the question you are answering.
- Graph paper will be provided or can be located at the back of each answer book.
- The use of electronic calculators of an approved type is permitted.

No. of Pages 4
No. of Questions 4
Question 1

a. Using the graph paper provided, sketch and fully label a typical graph to represent the life of a component in a Creep test. Name and briefly describe the three main stages of Creep and identify the conditions where it can occur in metal components. (15 marks)

b. Describe with sketches how you would prevent a bi-metal or dissimilar metal corrosion cell being established on a bolted flange where the bolts are a different alloy to the flange material. Label and identify corrosion cell components. (10 marks)

Total: 25 marks

Question 2

a. Identify three macroscopic defects and two microscopic defects. For each example briefly state how the defect could be avoided or the effects minimised. (10 marks)

b. Relating to an engineering component, under what physical conditions can equation i be simplified into equation ii? (5 marks)

\[ \sigma_c = \frac{K_{lc}}{\gamma \sqrt{\pi a_{\text{max}}}} \]

Equation i

\[ (\sigma_c \sqrt{a_{\text{max}}})_A = (\sigma_c \sqrt{a_{\text{max}}})_B \]

Equation ii

c. Suppose that a safety critical structural component of a railway carriage is fabricated from an aluminium alloy.

It has been determined that fracture results at a stress of 465 MPa when the maximum edge crack length is 4 mm.

For this same component and alloy, compute the stress level at which fracture will occur for a critical edge crack should the length increase to 7 mm.

Show the appropriate formula from part b of this question and all working. (10 marks)

Total: 25 marks
Question 3

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.

How would you use simulation software such as ‘Simul8’ to aid you in justifying or changing the level of staffing and personnel on a production line?

• Explain typical commands and sequences used by the programme
• 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 4:

As a result of a failure within an organisation, there may as a result 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 and 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)

b. Evaluate the impact a health and safety failures 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