SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	:	**FGB 41103**
SUBJECT TITLE	:	**ADVANCED MANUFACTURING TECHNOLOGY**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2.5 HOURS**
DATE	:	

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.

2. This question paper is printed on both sides of the paper.

3. Please write your answers on the answer booklet provided.

4. Answers should be written in blue or black ink except for sketching, graphic and illustration.

5. This question paper consists of TWO (2) sections. Section A and B. Answer ALL questions in Section A. For Section B, answer three (3) questions only.

6. Answer all questions in English.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

A production line consists of 6 stations. The time taken for each station to complete their operation is shown in *Figure 1*.
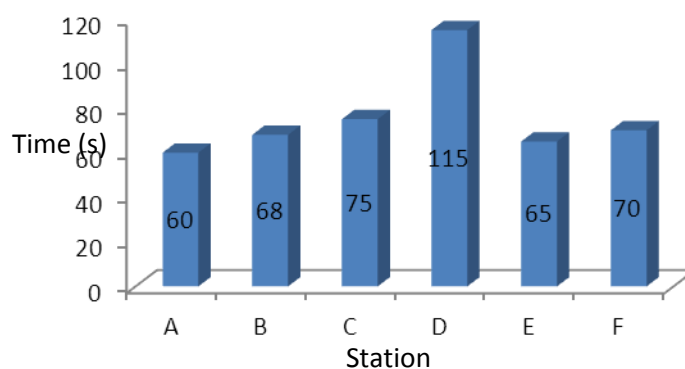

Figure 1

(a) Define the meaning of 'Bottle neck station'.

(3 marks)

(b) Identify the location of bottle neck station at this production line.

(2 marks)

(c) Calculate the production rate for the above production layout.

(4 marks)

(d) Suggest two (2) causes of bottle neck station in (b) and suggest the solution for each cause.

(4 marks)

(e) Calculate the new production rate for this line (after the solution of bottle-neck problem) and discuss the differences between before and after the implementation of bottle-neck solution.

(7 marks)

Question 2

Concurrent Engineering (CE) is a systematic approach to the integrated, concurrent design of products and their related processes, including, manufacturing and support.

(a)   Suggest two (2) enabling technologies in CE and briefly explain how these technologies improve CE.

(6 marks)

(b)   Remanufacturing is one of the consideration under Design for Environment. Certain parts are very suitable for remanufacturing. Discuss three (3) criterions of parts to be remanufactured.

(9 marks)

(c)   Failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service. Examine three (3) reasons the need of implementing FMEA.

(5 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE questions.
Please use the answer booklet provided.

Question 3

The manufacturing of Integrated Circuit (IC) is involving an advanced technology. Three main important processes in IC preparations are silicon processing, IC fabrication and packaging.

(a)   *Figure 2* shows the procedure in Czochralski process in crystal growth used to obtain single crystals of semiconductors. By referring to *Figure 2*, explain the procedure in Czochralski process.
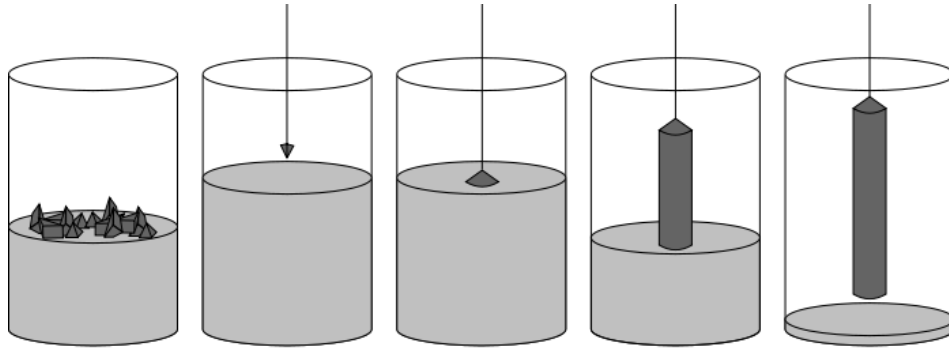
(7 marks)

Figure 2: Czochralski process

(b)   *Equation 1* is used to approximate the number of chips quantity in one silicon ingot. Name the variables n_c, D_w and L_c.

(3 marks)

(c)   The number of chip can be fabricated per wafer in IC manufacturing can be estimated by using *Equation 1*. Consider silicon ingot with 2.7m length, 125mm radius, chips area 29mm^2 and wafer thickness 0.85mm. Calculate the number of chips that can be fabricated from this silicon ingot at 96% production efficiency.

$$n_c = 0.34 \left[\frac{D_w}{L_c} \right]^{2.25}$$

Equation 1

(10 marks)

Question 4

Computer Aided Design (CAD) software is widely used in the advanced manufacturing environment. The operation in CAD is involving a huge computation inside the software which is done by the microprocessor. Consider point A which is located at (17,11, 8) in the xyz coordinate system. By using Homogeneous Transformation Matrix (HTM) method, find the new location of point A if:

(a)   Point A is translated 9 points and rotated 32 degree along x-axis.

(5 marks)

(b)   Point A is translated 5 points twice along y-axis and then rotated for 150^0 along z-axis.

(5 marks)

(c)   Point A is rotated 51^0 in the y-axis and then 'mirror' at xz plane.

(5 marks)

(d)   The original location of point Y is unknown. It was rotated 33 degree along y-axis to a location (14, 22, 19). Find the original location of point Y.

(5 marks)

Question 5

Rapid Prototyping (RP) is the combination of engineering drawings and a physical model and it is known as one of the most compelling and effective ways to communicate on the look and "feel" of a new product design to others.

(a)   RP method can be classified into 2 types of technology. Name these 2 types of technology and briefly explain each of them.

(4 marks)

(b)   Time taken to complete a 3D build-up or printing in RP can be estimated by using "Layer Completion Time Equation". By using this equation, estimate the time taken to build or print part in Figure 3. Given v = 125mm/s, D=0.1mm, Tr = 4.9s and layer thickness is 0.12mm.
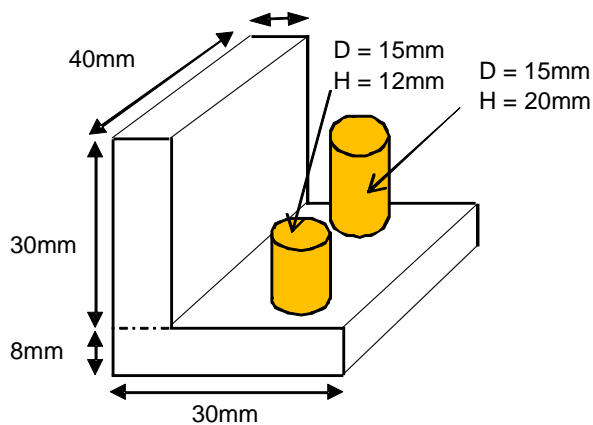
(i)   Calculate the time taken to print the 3D part shown in *Figure 3.*
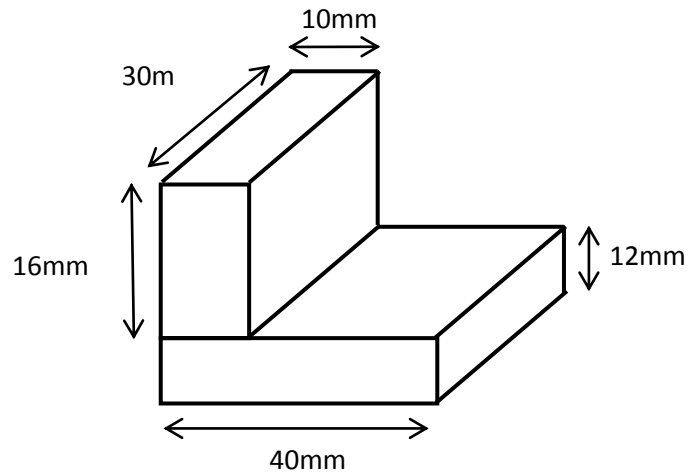
Figure 3

(6 marks)

(ii)   Calculate the time taken to simultaneously print the part in Figure 3 and Figure 4

Figure 4

(10 marks)

Question 6

Reverse engineering (RE) is the process of discovering the technological principles of a device, object or system through analysis of its structure, function and operation. The knowledge in the current product will be used in maintenance or to try to make a new device or program that does the same thing or better by considering the Design for X (DFX) factors.

(a)   RE can be applied in many DFX categories such as Design for Assembly, Design for Environment and also Design for Automation. Give one example for each of DFX category stated and briefly discuss each of them.

(9 marks)

(b)   *Figure 5* shows the internal view of a thumb drive which consists of 4 terminals. RE was applied during the design of this product. Name all the 4 terminals in the diagram and examine the difference in length of the terminals.
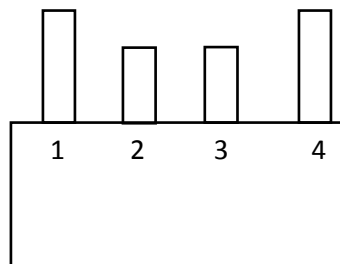
(6 marks)

Figure 5: USB terminal

(c)   Laser scanner is of the 3D scanning technologies currently available. In *Figure 6*, two cameras and multiple stripe lines are used in this 3D scanning machine. Discuss the reason of using 2 cameras and multiple stripe lines.
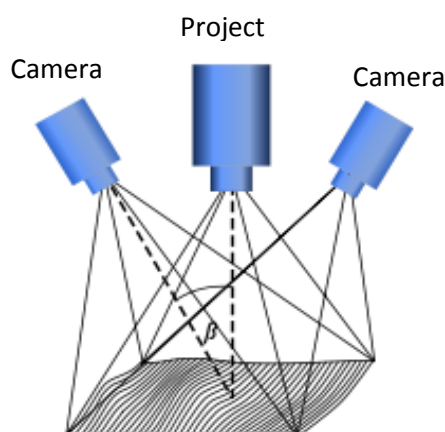
(5 marks)

Figure 6

END OF QUESTION