UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

SUBJECT NAME : CONCURRENT AND REVERSE ENGINEERING

SUBJECT CODE : BDD 4053

EXAMINATION DATE : JUNE 2012

DURATION : 2 HOURS 30 MINUTES

INSTRUCTION : ANSWER **FOUR (4)** OUT OF

SIX (6) QUESTIONS

THIS EXAMINATION PAPER CONTAINS **FIVE (5)** PAGES

Q1 a) The Principles of Concurrent Engineering do include teamwork, multidisciplinary team, enhanced communication, management support, and involvement of suppliers and customers. Explain how each of these principles may contribute to reduce the 'Lead Time', or the time to get the product to the market.

(15 marks)

b) One of the tools used in Concurrent Engineering is the Failure Modes and Effect Analysis. Describe the meaning of FMEA and how it is applied in Concurrent Engineering strategy.

(5 marks)

c) Taguchi Method involves designing robustness into a product design which establishes design parameters, system parameters, and tolerance parameters.

i. Define 'Robustness'.

ii. Describe **FOUR (4)** quality concepts devised by Taguchi.

(5 marks)

Q2 a) There are five stages involved in the Reverse Engineering projects, including Prescreening, Technical Data Generation, Data Evaluation, Design Verification and Project Implementation.

i. Elaborate on the activities involved with each of the steps.

(18 marks)

ii. Briefly discuss the reasons that approval is required at the end of each step.

(2 marks)

b) The early tasks in a Reverse Engineering efforts must include visual inspection, dimensional inspection and material analysis. For what purposes are these steps taken?

(5 marks)

Q3 a) Reverse Engineering is widely applied in Automotive Industries, Aerospace Industries, Architecture and also in Manufacturing of Prosthetics . Suggest the way in which Reverse Engineering is applied in each one of these fields.

(20 marks)

b)   List **FIVE (5)** advantages of Reverse Engineering that makes it so useful in manufacturing, in recent years.

(5 marks)

\ **Q4**   a)   The very next era in manufacturing will be Mass Customization following Mass Production concept developed by Hendry Ford at the turn of last century and Flexible Manufacturing introduced in the 70s and the 80s.

i.   Define the term 'Mass Customization'.

(2 marks)

ii.   Choose one specific application (product) where Mass Customization is necessary and elaborate on how the stages in manufacturing of this particular product will take place.

(6 marks)

iii.   There are **FIVE (5)** keys to the success of Mass Customization. State and briefly describe each one of them.

(5 marks)

b)   'Point of Sale Manufacturing' is a new idea in the production of personalized products.

i.   Describe the meaning of 'Point of Sale Manufacturing'.

(2 marks)

ii.   List **FIVE (5)**   the greatest advantages in Point of Sale Manufacturing for companies that can offer this service.

(10 marks)

Q5   a)   As a Reverse Engineer, you are given a well preserved body of a dead full grown man found frozen in an iceberg in Iceland. He passed away 5000 years ago. From this body, you have to construct a 3 Dimensional CAD image in order to have a CAD database for future anthropometric studies. The only method you are allowed to use in digitizing this body is the Destructive Method. This means, no MRI, no Tomography and no Ultrasonic scanners will be used.

i.   Explain in detail the whole procedure you have to take for this project in order to construct the whole anatomical structure of the man. The head part of the final result is like the one displayed in **Figure 5 (a)**.

(10 marks)

ii. **Figure 5 (b)** shows the cross section image of the skull after the picture taken is converted using a process known as 'thresholding'. Define the term ' thresholding'.

(2 marks)

iii. How is thresholding performed?

(2 marks)

iv. How will image processing steps such as interpolation and extrapolation processes help you to construct the full 3D CAD full image of the body, considering that parts of the full body will be destroyed by the thickness of the high speed saw?

(4 marks)

b) Converting millions of points (point cloud) scanned by the scanners into an STL file format will take several steps.

i. Discuss each steps involved.

(4 marks)

ii. Explain the issues involved in file conversion between IGES, STEP and DXF for different software and scanning machines.
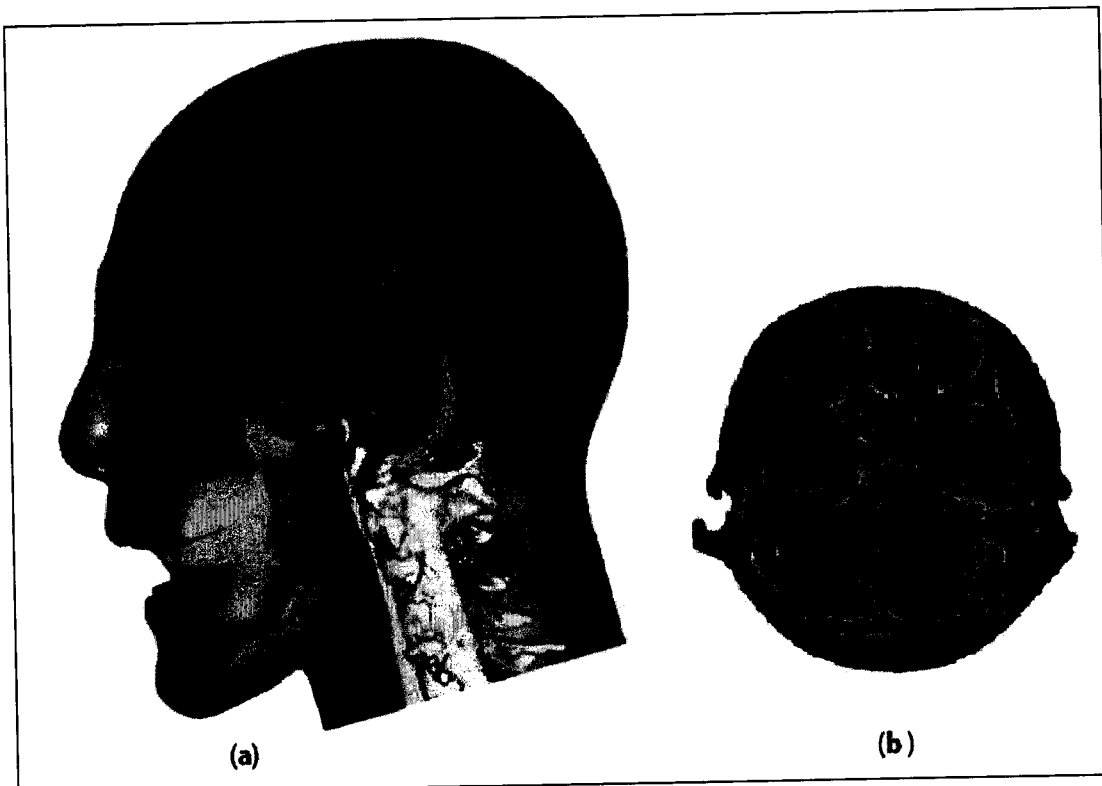
(3 marks)

(a) **(b)**

Figure Q5 (a) A cross-section of the skull defined by thresholding method.

(b) A full head section reconstructed from images of sliced sections

Q6   a)   Reverse Engineering increases the ability for industries to survive and succeed in intense global competition.

i.   State **THREE (3)** different definitions of Reverse Engineering
(3 marks)

ii.   List **FIVE (5)** main objectives for the use of Reverse Engineering in industries.
(5 marks)

iii.   Discuss how Rapid Proptotyping may complement the Reverse Engineering efforts.
(5 marks)

iv.   **Figure Q6 (a)** shows the comparison of as-designed part and the variation from the as-produced part of a mobile phone housing. describe the process of RE in this particular quality control procedure.
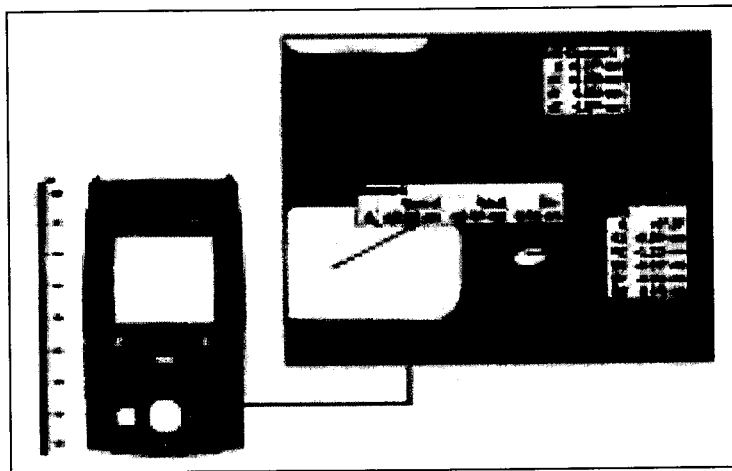(5 marks)

Figure Q6 (a) Deviation of the digitized data of the sample part from the CAD data (nominal data), the ATOS Inspection Software immediately shows warpage and bending of the housing cover.

b)   Value Engineering. considers overall factors involving a system or a product.

i.   List the steps required to perform Value Engineering.
(4 marks)

ii.   Discuss the importance of Value Engineering
(3 marks)