



**UTHM**  
Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2016/2017**

COURSE NAME : RAPID PRODUCT DEVELOPMENT  
AND MANUFACTURING  
COURSE CODE : BDD40303  
PROGRAMME : 4 BDD  
EXAMINATION DATE : JUNE 2017  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ONLY FIVE (5)  
QUESTIONS FROM SIX (6)  
QUESTIONS PROVIDED

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

- Q1** (a) In product development, identify **TWO (2)** stages that the most cost of a certain product occur and evaluate why it occur in such manner?  
(6 marks)
- (b) Analyze **THREE (3)** gaps or area that the additive process (rapid prototyping process) is complementary to subtractive process (machining process).  
(6 marks)
- (c) With the aid of a diagram, differentiate between these three terminologies in relation with its definition.
- (i) Rapid prototyping (2 marks)
  - (ii) Rapid tooling (3 marks)
  - (iii) Rapid manufacturing (3 marks)
- Q2** (a) Some of the rapid prototyping (RP) techniques require support structure in their part fabrication process.
- (i) Define the meaning of support structure and explain its purposes.  
(2 marks)
  - (ii) List **TWO (2)** RP techniques that do not require any support structure and state the reason why they do not require such support structure during fabrication process?  
(4 marks)
- (b) Differentiate the method of bonding (solidification) between these three types of rapid prototyping (RP) technologies.
- (i) Stereolithography Apparatus (SLA) (2 marks)
  - (ii) Layered Object Manufacturing (LOM) (2 marks)
  - (iii) Three Dimensional Printing (3DP) (2 marks)
- (c) What is the most dominant surface effect caused by RP processes and describe in brief the meaning of this effect. With the aid of figure, illustrates this effect and explain the relationship between the thickness to the building time and product quality?  
(8 marks)

- Q3**
- (a) With a schematic diagram, demonstrate the basic principle of Stereolithography Apparatus (SLA) process. (6 marks)
  - (b) Briefly explain what is the meaning of over-cured resin in Stereolithography Apparatus (SLA) process. (6 marks)
  - (c) Stereolithography Apparatus (SLA) systems build parts in a vat of photo-curable liquid resin that cures or solidifies under the effect of exposure to ultraviolet (UV) light and this solidification process is famously called a photo-polymerization process.
    - (i) Describe the process of photo-polymerization during solidification. (5 marks)
    - (ii) List the key effects resulting from this process. (3 marks)
- Q4**
- (a) Roller or recoater is one of the main components in Selectives Laser Sintering (SLS) system. List **TWO (2)** purposes of this component. (4 marks)
  - (b) In Selectives Laser Sintering (SLS), parts are built by sintering when a laser beam hits a thin layer of powder material.
    - (i) With the aid of a figure, describe the sintering process. (4 marks)
    - (ii) Outline **TWO (2)** key parameters of SLS process which may affect the quality of the building parts. (2 marks)
  - (c) SLS is an additive manufacturing technique that uses a high power laser. Demonstrate with diagram, the details of its fabrication process in building prototype/parts. (10 marks)

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- Q5** (a) Differentiate between these two rapid tooling terminologies in relation with its definition. Support your answer with an appropriate figure.
- (i) Direct Rapid Tooling Method (3 marks)
  - (ii) Indirect Rapid Tooling Method (3 marks)
- (b) A product shown in **Figure Q5 (b)** will be used as a master pattern to create a mold and Rapid Prototyping (RP) process is capable of making a very quick injection mold for a limited number of parts (5 to 50 parts).
- (i) Select the appropriate Rapid Tooling (RT) method to create the mold. (2 marks)
  - (ii) Demonstrate with a diagram the process to manufacture a wax pattern using the mold made previously in **Q5 (b) (i)**. (12 marks)
- Q6** (a) Briefly explain how the preparation of CAD model in Reverse Engineering (RE) is differ from the standard Rapid Prototyping (RP) process and outline the **TWO (2)** methods of preparing CAD models in RE. (6 marks)
- (b) Describe what are the steps in reverse engineering (RE) process and the **TWO (2)** area of its application. (6 marks)
- (c) Coordinate Measuring Machine (CMM) is among the tools used in Reverse Engineering (RE) technology with reference to the development of a product. By employing CMM, evaluate how can the prototype be fabricated using RP machines. (8 marks)

- END OF QUESTION -

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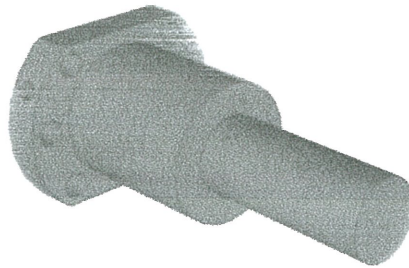
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**FIGURE Q5 (b)**

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