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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2018/2019**

COURSE NAME : RAPID PRODUCT DEVELOPMENT  
AND MANUFACTURING  
COURSE CODE : BDD40303  
PROGRAMME : 4 BDD  
EXAMINATION DATE : DECEMBER 2018/ JANUARY 2019  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER **ONLY FIVE (5)**  
QUESTIONS FROM **SIX (6)**  
QUESTIONS PROVIDED

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1**
- (a) In product development stages, identify at which stage the most cost of a certain product will occur and evaluate why it is occur in such manner?  
(6 marks)
- (b) Analyze in which area or gaps 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 RP techniques require support structure in their part fabrication process.
- (i) Explain what does it mean by support structure and its purposes?  
(2 marks)
- (ii) List **TWO (2)** rapid prototyping (RP) techniques that do not require any support structure and state the reason why they do not require such support structure during its 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, write 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) SLA systems build parts in a vat of photo-curable liquid resin that cures or solidifies under the effect of exposure to UV light and this solidification process is famously called a photo-polymerization process. Distinguish the process of photo-polymerization during solidification and examine what are the key effects resulting from this process?  
(8 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 SLS, parts are built by sintering when a laser beam hits a thin layer of powder material. With the aid of a figure, appraise what it means by this sintering process and outline **TWO (2)** key parameters of SLS process which affected the quality of the building parts.  
(6 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)
- Q5** (a) Distinguish the benefits and limitations of the solid-based rapid prototyping system.  
(5 marks)
- (b) Write **TWO (2)** processes of solid-based rapid prototyping system. Support the explanation using suitable sketch/diagram.  
(5 marks)

- (c) Liquid-based rapid prototyping system is using photo-curable liquid resins as the raw material in the process, which are essentially photo-polymers and the photo-polymerization process. Describe how the solidification process occurs by this system.

(10 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) Coodinate 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 prototypes be fabricated using RP machines.

(8 marks)

- END OF QUESTION -