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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2019/2020**

COURSE NAME : ENGINEERING POLYMER AND CERAMIC  
COURSE CODE : BDB40603  
PROGRAMME : 4 BDD  
EXAMINATION DATE : DECEMBER 2019/JANUARY 2020  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER FIVE(5) QUESTIONS ONLY.

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

**TERBUKA**

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- Q1** (a) Differentiate the stress-strain curve behaviour for amorphous and semi-crystalline polymer. (5 marks)
- (b) The polymer structural units resulting from the reaction of monomers may in principle be linked together in any conceivable pattern. Based on your knowledge, summarize the different between linear, branched and cross-linked of the polymer structure. (5 marks)
- (c) The chemical reactions of monomers joined together to form polymer are called polymerization reaction. Explain in detail THREE (3) steps in the addition polymerization process. (10 marks)
- Q2** (a) Extrusion is the most common polymer processing (60 % of world production). Explain in detail the die-swell issue of polymer extrusion problem and discuss the parameters which affect the swell ratio. (6 marks)
- (b) Compression molding is one of the fabrication techniques of thermoplastics and thermoset materials from the pellet or powder form into a variety of useful products. Based on your knowledge explain the key important factors in compression molding technique. (4 marks)
- (c) The injection molding process is very complex and interactions are numerous. When a problem has been noted, several parts should be made to ensure the process is stable. Generally there is no specific procedure exist for the correcting injection molding problems. As an engineer, you decide to solve incomplete filling of cavity problem by increasing the processing temperature. In your opinion what are the consequences based on your action. (10 marks)
- Q3** (a) Blow molding is a plastic-forming process that is well suited for manufacturing bottle and other simple hollow-shaped parts. Explain in detail the principal problem in forming a bottle using injection blow molding. (5 marks)

- (b) Compare the advantages of casting and plastic molding operations in term of equipment size and cost.  
(5 marks)
- (c) Polymer processing always involved heat to mold the polymer. What do you expect the response of nylon 6,6 structure if you give heat from 28°C to 1000°C?  
(10 marks)
- Q4** (a) Suggest TWO (2) methods that can be used to avoid any failure of ceramic components/products during its operation and usage (your answer can consider in any aspect of ceramic component production i.e. processing technique, composition, fabrication technique etc.)  
(4 marks)
- (b) Ceramic component has higher elastic modulus and hardness value compared to the metal component. Discuss this statement based on these materials structure and bondings.  
(6 marks)
- (c) Mr. Hakim found that the prepared ceramic slurry was agglomerated and not distributed uniformly. Therefore, he used lubricant as additive to overcome this problem. Give your opinion whether the additive that has been applied by Mr. Hakim is suitable or not? Suggest TWO (2) additives that can overcome the problem of particles agglomeration.  
(6 marks)
- (d) Mr. Hisham has selected a polymeric sponge method to produce a porous ceramic body with more than 60 % porosity. What do you think of Mr. Hisham decision?  
(4 marks)
- Q5** (a) In drying process, water is removed from an unfired ceramic object or raw material in the green or as-formed state or in the as-received state. Explain with appropriate figure the sequence in which various water are removed from the ceramic body  
(10 marks)
- (b) Select and explain in a flow chart one forming method of ceramic materials based on gel casting that can be used to produce complex part.  
(6 marks)

- (c) Differentiate the purpose of calcination and sintering process in the ceramic product processing route. (4 marks)
- Q6** (a) Contamination is a problem in milling process. Suggest TWO (2) methods that can be used to control or overcome contamination during milling. (4 marks)
- (b) Surface coating is among the finishing process for advanced ceramic products. Explain THREE (3) techniques of surface coating that can be used. (6 marks)
- (c) Farid decided to use wet milling process to mix alumina and other additives. Explain action of mixing process inside the mill and what will happen if Farid operate the milling machine too fast or too slow. (10 marks)

**-END OF QUESTION-**