



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION SEMESTER II SESSION 2021/2022

- COURSE NAME : POLYMER TECHNOLOGY
- COURSE CODE : BNN 30603
- PROGRAMME CODE : BNN
- EXAMINATION DATE : JULY 2022
- DURATION : 3 HOURS
- INSTRUCTION :
1. ANSWER ALL QUESTIONS.
 2. THIS FINAL EXAMINATION IS A PHYSICAL ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**.
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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- Q1** a) The mechanical properties of polymers are one of the features that distinguishes them from small molecules. The mechanical properties of a polymer involve its behavior under stress. These properties tell a polymer scientist or engineer many of the things he or she needs to know when considering how a polymer can be used.
- i) State **THREE (3)** factors that affecting the strength of polymers.
(3 marks)
- ii) Sketch the typical stress – strain curve which compares the stress-strain behavior of different types of materials.
(5 marks)
- b) The extrusion process basically is continuously shaping a fluid polymer through the orifice of a suitable tool (die), and subsequently solidifying it into a product (extrudate of constant cross section). Describe **FOUR (4)** advantages of this process in term of its production, process flexibility and costing.
(4 marks)
- c) The basic principle of the blow molding process is to inflate a softened thermoplastic hollow preform against the cooled surface of a closed mold, where the material solidifies into a hollow product. As future technologist, analyze the basic process of injection blow moulding in producing complicated parts.
(6 marks)
- d) There are countless options when it comes to additives and each one offers a specific improvement to the polymer's functionality or stability. Justify the function of antioxidants, flame retardant, anti-static, and odor as additives in polymer processing.
(7 marks)

Q2 Advanced composites are used in many ways such as controlling surfaces, aerodynamic fairings, engine cowlings and etc. in transportation industry.

(a) Explain briefly **FIVE (5)** reasons why polymer composites are gaining acceptance in the transportation industry.

(5 marks)

(b) The use of polymer composite materials in engineering applications still has a long way to go. Determine **FIVE (5)** challenges or issues that limit its wide use in engineering applications.

(5 marks)

(c) Composite process utilizes different starting materials and therefore the final properties of the part are different. The strength of the composite part strongly depends on fiber type, fiber length, fiber orientation, and fiber content.

(i) Choose **ONE (1)** example of nanocomposite application and list its reinforcement agent and matrix system.

(3 marks)

(ii) Determine **FIVE (5)** advantages of polymer composite system as compared to a polymer blend without a filler. Choose **ONE (1)** example of polymer composite.

(5 marks)

(iii) Explain the mechanism of reinforcement in polymer composite.

(3 marks)

(d) Determine the predicted curve of tensile stress-strain behavior by drawing a curve for each of the following composite systems (draw all curves on the same graph and label the specific properties for each curve):

(i) Polypropylene / Layered silicate clay at high percentage (agglomerate).

- (ii) Polypropylene / Layered silicate clay at high percentage (well dispersed).
- (iii) Polypropylene / Layered silicate clay at high percentage (well dispersed) modified with natural rubber.
- (iv) Polypropylene / Layered silicate clay at low percentage (well dispersed) modified with natural rubber.

(4 marks)

Q3 When blending two or more polymers, it leads to immiscibility which consequently improves the desired properties.

- a) Draw **THREE (3)** morphology of immiscible blend when varying the concentration of one polymer.

(7 marks)

- b) Identify **THREE (3)** types of blending.

(3 marks)

- c) Determine **FIVE (5)** characteristics for each type of blending in **Q2(b)**.

(15 marks)

Q4 Characterization is an important step to evaluate the property of polymer.

- (a) Describe a tensile strength.

(2 marks)

- (b) Develop a procedure to test tensile strength.

(5 marks)

- (c) Sketch a test specimen according to ASTM for tensile strength. (3 marks)

- (d) Determine **FIVE (5)** stages and mechanisms of plastic deformation. (5 marks)

- (e) Identify **SIX (6)** factors of tensile behavior of polymer. (6 marks)

- (f) Differentiate between amorphous and crystalline structures in drawings. (4 marks)

-END OF QUESTIONS-

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