Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	COMPOSITE
COURSE CODE	:	BDB 40703
PROGRAMME	:	BDD
EXAMINATION DATE	:	JUNE/JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS FIVE (5) QUESTIONS **ONLY**

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

Q1 (a) Give THREE (3) advantages of using composite materials.

(3 marks)

(b) With an appropriate diagrams, explain wetting and non-wetting condition.

(4 marks)

(c) Compare fibrous and particulate reinforcement in their aspect ratio basis. Support your explanation with a suitable diagram.

(6 marks)

(d) Discuss why wood is considered as a natural composite material.

(3 marks)

(e) Recommend TWO (2) suitable types of mechanical testing in order to verify the properties limit for aeroplane wing. Explain the reason of selected testing.

(4 marks)

Q2 (a) Describe why wood is considered as a natural composite materials.

(3 marks)

(b) List THREE (3) types of interfacial bonding mechanism.

(3 marks)

(c) The function of reinforcements in a composite material is to bear the stress applied. Based on this statement, provide TWO (2) general requirements of reinforcement for composite material.

(3 marks)

(d) MMC composite has a critical stress, σ_c of 1550 MPa and K_{IC} of 98 MPa.m$^{1/2}$. Calculate the size of a surface crack *(a)* that will lead to catastrophic failure at an applied stress equal to σ_c.

(6 marks)

(e) Polymer materials are widely used as matrices for composite fabrication. Compare thermoset and thermoplastic resin as matrix in order to fabricate composite materials.

(5 marks)

Q3 (a) Calculate the composite modulus of elasticity for polyester reinforced with 60% volume of E-glass particles if under condition:

(i) isostrain

(ii) isostress

Given : $E_{polyester}$ = 6.9 GPa and $E_{E\text{-}glass}$=72.4 GPa

(10 marks)

(b) Discuss natural fiber and synthetic fiber based on its origin. Support your arguments with an appropriate example based on your description.

(6 marks)

(c) Differentiate between interface and interphase by sketching an appropriate diagrams.

(4 marks)

Q4 (a) Goaway International introduced their new product named Faraway Outdoor Pressurized Water Filter (FOPWF). FOPWF tank made by fiberglass fibre and epoxy polymer resin. This tank have long dimension with cylindrical shape.

Based on the statements, choose the suitable process to produce HOPWF tank and illustrate process involved.

(5 marks)

(b) Differentiate between hand lay-up method and spray-up method by using illustration and explanation.

(6 marks)

(c) Compression molding is one of composite processing technique. Suggest suitable product to be produced by using this technique. Develop and sketch the mold design and explain the manufacturing stage.

(9 marks)

Q5 (a) Compare general differences of carbon fiber composites that using pre - Impregnation (pre-preg) layup with autoclave curing and hand lay-up with room temperature curing.

(8 marks)

(b) Justify the importance usage of composites in motorsport racing.

(4 marks)

(c) Polaris Defense, a division of Polaris Industries Inc. had planned to develop new prototype of combat vehicle.

This vehicle door assembled with lightweight armor panel which design to withstand ballistic impact and high temperature for bullet proof purpose. To meet those purposes, titanium layer (Ti) with stainless steel wire mesh (SS) were selected to be stacked as a door panel. The arrangement of the layer is Ti-SS-Ti-SS.

By evaluating the case given, brief the manufacturing process by using figure and flowchart to produce lightweight armor door panel.

(8 marks)

Q6 (a) Choose suitable process to develop ceramic matrix composites (CMC) that consists of ceramic slurries and continuous fiber class. Sketch the figure of the process.

(6 marks)

(b) Discuss the process of CMC's hot press method and hot isotactic press.

(4 marks)

(c) Select the manufacturing technique of Aluminium (Al) ingot as a matrix and Silicon Carbide (SiC) particles as a reinforcement to become metal matrix composites. The matrix and reinforment have to be mixed prior to fabrication. Describe the manufacturing technique and use a diagram to illustrate the step and brief the procedure.

(10 marks)

- END OF QUESTION -