Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	COMPOSITE
COURSE CODE	:	BDB 40703
PROGRAMME	:	BDD
EXAMINATION DATE	:	DECEMBER 2019/JANUARY 2020
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 appropriate diagrams, explain wetting and non-wetting condition.

(4 marks)

(c) Compare fibrous and particulate reinforcement based on their aspect ratio basis. Support your explanation with suitable diagrams.

(6 marks)

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

(3 marks)

(e) Recommend TWO (2) suitable types of mechanical testing in order to measure the properties limit for aeroplane wing and explain the reason for these selection.

(4 marks)

Q2 (a) Describe why PMC widely used compared to other composites.

(3 marks)

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

(3 marks)

(c) The function of reinforcements in a composite material is to support and distribute 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 the difference between thermoset and thermoplastic resin as matrix in fabricating composite materials.

(5 marks)

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

(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 in composite structure 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 has a long dimension with cylindrical shape.

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

(5 marks)

(b) Differentiate between hand lay-up method and spray-up method in composite fabrication with a clear illustration and explanation.

(6 marks)

(c) Compression molding is one of the 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 the general differences between carbon fiber composites that used pre - Impregnation (pre-preg) layup with autoclave curing and hand lay-up with room temperature curing.

(8 marks)

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

(4 marks)

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

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

By evaluating the case given, brief the involved 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 suitable 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 -