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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : COMPOSITES
COURSE CODE : BDB 40703
PROGRAMME : 4 BDD
EXAMINATION DATE : DECEMBER 2018 / JAN 2019
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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- Q1** (a) List SIX (6) advantages of using composite materials. (6 marks)
- (b) Compare fibrous and particulate reinforcement in the basis of their aspect ratio. Support your explanation with a suitable diagram. (6 marks)
- (c) Manufacturing Engineers of Aileron B787 production were required to plan for bonding process for two laminate panel of carbon fiber composites.

Surface preparation of composites panel between two laminated panels of carbon fiber composites were required prior to bonding purposes. The method to be used must be at lowest cost and not required for any complex reaction. Appraise and evaluate the requirement to construct surface preparation procedure.

(8 marks)

- Q2** (a) List THREE (3) types of interfacial bonding mechanism. (3 marks)
- (b) Polymer materials are widely used as matrices in composite fabrication. Compare thermoset and thermoplastic resin as matrix in order to fabricate composite materials. (5 marks)
- (c) Surface characteristics is important factor that influence the fiber - matrix or panel to panel adhesion to promote high strength composites.

Surface preparation is required in order to enhance the adhesion properties. Wettability test is one of the method to determine the surface characteristic. By conducting the test, evaluate the good and bad surface characteristics *via* schematic diagram with explanation.

(12 marks)

- Q3** (a) Discuss the natural fiber and synthetic fiber based on its origin. Support your arguments with an appropriate example based on your description. (6 marks)
- (b) Recommend TWO (2) types of appropriate mechanical properties testing in order to verify the properties limit for aeroplane wing. support the reason of selected testing. (4 marks)

- (c) Evaluate the relation between fiber-matrix bonding and other factor in order to lead good adhesion by using cross section diagram and explanation. (10 marks)
- Q4** (a) Tensile test is done to evaluate the strength of materials. Explain and illustrate the schematic diagram of stress/strain curve for TWO (2) types of unidirectional fiber composite with:-
- (i) a brittle fiber/ductile matrix, and (5 marks)
- (ii) a brittle fiber/brittle matrix (5 marks)
- (b) Fracture toughness of epoxy reinforced glass fiber composite is $55 \text{ MPa.m}^{1/2}$. If during service, the composite is exposed to a tensile stress of 200 MPa, determine the minimum length of a surface crack that will lead to fracture. (5 marks)
- (c) ANZ Engineering Sdn. Bhd. is planning to design an automated and highly productive process of fabrication of PMC in form of continuous long products of constant cross-section. Based on this, develop and illustrate a schematic of the process. (5 marks)
- Q5** (a) Calculate the composite modulus for epoxy reinforced 70% vol. of E-glass particles under:-
- (i) isostrain condition (5 marks)
- (ii) isostress condition (5 marks)
- (b) Metal composite materials have been applied in many areas of daily life for quite some time. Often it is not realized that the application makes use of composite materials more than polymer composites. Judge this statement with THREE (3) advantages of MMC over PMC. (6 marks)
- (c) Evaluate the reasons why composites material is important in aircraft and airframes application. (4 marks)

- Q6** (a) Composites had been used in many application of our life style including in rail and trains. Determine TWO (2) main reasons that influence the used of composites in rail vehicle.

(10 marks)

- (b) Explain TWO (2) of the processing methods below:
- (i) Hand lay-up (Polymer Matrix Composite)
 - (ii) Pressure bag (Polymer Matrix Composite)
 - (iii) Autoclave
 - (iv) Squeeze casting or pressure infiltration (Metal Matrix Composite)
 - (v) Filament winding (Ceramic Matrix Composite)
 - (vi) Injection moulding (Ceramic Matrix Composite)

(10 marks)

– END OF QUESTIONS –