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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

COURSE NAME : COMPOSITE
COURSE CODE : BDB 40703
PROGRAMME : 4 BDD
EXAMINATION DATE : DECEMBER 2016 / JANUARY 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWERS FIVE (5) QUESTIONS ONLY

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THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGE

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- Q1**
- (a) Differentiate between whiskers and fibers.
(2 marks)
 - (b) With an appropriate diagrams, explain composite wetting and non-wetting condition.
(6 marks)
 - (c) Discuss the disadvantages of using ceramic as matrix in composites.
(6 marks)
 - (d) Propose the detailed mechanisms of matrix functions in a composite body when:
 - (i) The matrix binds the fibers together
 - (ii) The matrix distributes applied stress to fibers
 - (iii) The matrix protect individual fibers from damage(6 marks)
- Q2**
- (a) Discuss and relate the importance of mechanical properties testing in industry.
(2 marks)
 - (b) One of the advantages of using polymer as matrices is that it allows excellent load transfer in between fibers. Identify the appropriate property of a polymeric material that promotes the advantage.
(2 marks)
 - (c) Identify the main procedure or information explained in testing standard.
(2 marks)
 - (d) Compare the polymer matrices that used in composites manufacturing based on their viscosities and pressures relation.
(3 marks)

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- (e) Predict and illustrate a stress-strain graph of polymer matrix composite and label its elastic region, plastic region, necking region and fracture, then sketch the sample condition at each region.

(7 marks)

- (f) Explain the sandwich composites failure mode that tested under flexural loading conditions.

(4 marks)

- Q3** (a) Relate the importance of mechanical properties testing in industry.

(2 marks)

- (b) Illustrate the four-point bending tests.

(3 marks)

- (c) Propose a composite material that can be used to fabricate bicycle frame and give your reasons on choosing it and explain its properties.

(5 marks)

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

(4 marks)

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

(i) isostrain

(ii) isostress

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

(6 marks)

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- Q4** (a) CTRM AC Sdn. Bhd were awarded with Airbus project to produce Airbus A380 Fuselage. Fuselage is the main structure of an airplane which have long dimension with cylindrical shape. Carbon fiber and epoxy resin are the material for fuselage, as referred to Airbus Manufacturing Standards.

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

(5 marks)

- (b) Differentiate between hand lay-up method and spray-up method by using appropriate illustrations and explanations.

(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 general properties of carbon fiber composites and glass fiber composites.

(8 marks)

- (b) Justify the importance usage of composites materials in aircraft and airframe applications.

(4 marks)

- (c) Toyota Research and Development (TRD) division were planning to develop new prototype aluminum engine block. This engine were design to withstand high temperature that cause by high revving. To strengthen the engine, PRD decided to use Silicon Carbide (SiC) particles to enhance the material properties.

Construct the suggested manufacturing process figure and flowchart by selecting suitable processing method to cast the engine block.

(8 marks)

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- Q6** (a) Choose a suitable fabrication process to develop ceramic matrix composites (CMC) that consists of ceramic slurries and continuous glass fiber. Sketch the figure of the process.
(6 marks)
- (b) Differentiate between CMC's hot press method and hot isotactic press.
(4 marks)
- (c) Develop the manufacturing technique of aluminum foil and stainless steel fiber mat to become laminate composites. The matrix and reinforcement fiber have to be stacked prior to fabrication. Describe the manufacturing technique and use a diagram to illustrate the step and brief the procedure.
(10 marks)

- END OF QUESTION -

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