Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	MATERIAL ENGINEERING TECHNOLOGY
COURSE CODE	:	BDX 10703
PROGRAMME CODE	:	BDX
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE (5)** QUESTIONS **ONLY**

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

Q1 (a) What are aerospace materials?

(4 marks)

(b) Aluminium is a popular aerospace structural material although it has several disadvantages. List FOUR (4) disadvantages of using aluminium alloys in the aircraft structures.

(8 marks)

(c) Materials affect virtually on the fuel consumption of the aircraft.

(i) Design an aircraft that will reduce the fuel needs?

(4 marks)

(ii) Provide a justification to your answer in (c) (i).

(4 marks)

Q2 (a) State the main groups of materials used in aerospace structures?

(4 marks)

(b) Differentiate TWO (2) materials in (a) in terms of the following criteria of the materials;

(i) the cost,
(ii) weight,
(iii) strength and
(iv) corrosion resistance

(8 marks)

(c) By referring to the **Figure Q2(c)**;

(i) What can you conclude from the figure in terms of the composite used and year of service?

(4 marks)

(ii) Correlate the explanation in c (i) with the properties of the material showed in **Figure Q2(c)**.

(4 marks)

Q3 (a) Identify FOUR (4) properties of the materials to be used in the aircraft structures.

(4 marks)

(b) Suggest the tests to be carried out to identify all the properties listed in Q3 (a) with a brief explanation of each test.

(16 marks)

Q4 (a) The strength properties of aerospace metals, which include the proof strength, ultimate strength, fatigue strength and creep strength, are controlled by a multitude of factors. Identify those THREE (3) factors?

(6 marks)

(b) Differentiate the crystal structures for;
(i) aluminium,
(ii) magnesium and
(iii) titanium.

(6 marks)

(c) Grains in aerospace alloys typically range from about 1 mm (coarse or large grains) to 1mm (fine or small grains). Describe the importance of the grain size in the aerospace alloys?

(8 marks)

Q5 (a) What does fatigue test measures?

(4 marks)

(b) Determine the importance of fatigue test to the materials used in the aircraft structures?

(6 marks)

(c) There is a requirement for aircraft structures and engine components to have high stiffness to resist excessive deformation under load.
(i) Choose ONE (1) testing that can be carried out to measure the material's stiffness.

(2 marks)

(ii) Briefly explain how the test is carried out.

(8 marks)

Q6 (a) Explain why titanium has better resistance to corrosion than high-strength aluminium alloy.

(6 marks)

(b) The microstructure and mechanical properties of the hypoeutectic steels used in aircraft structures is controlled by heat-treatment as well as the carbon and alloy contents.
(i) Relate the heat treatment with the changes of the steel properties.

(6 marks)

(ii) Interpret the effect of carbon to the strength of steel.

(8 marks)

-END OF QUESTIONS –

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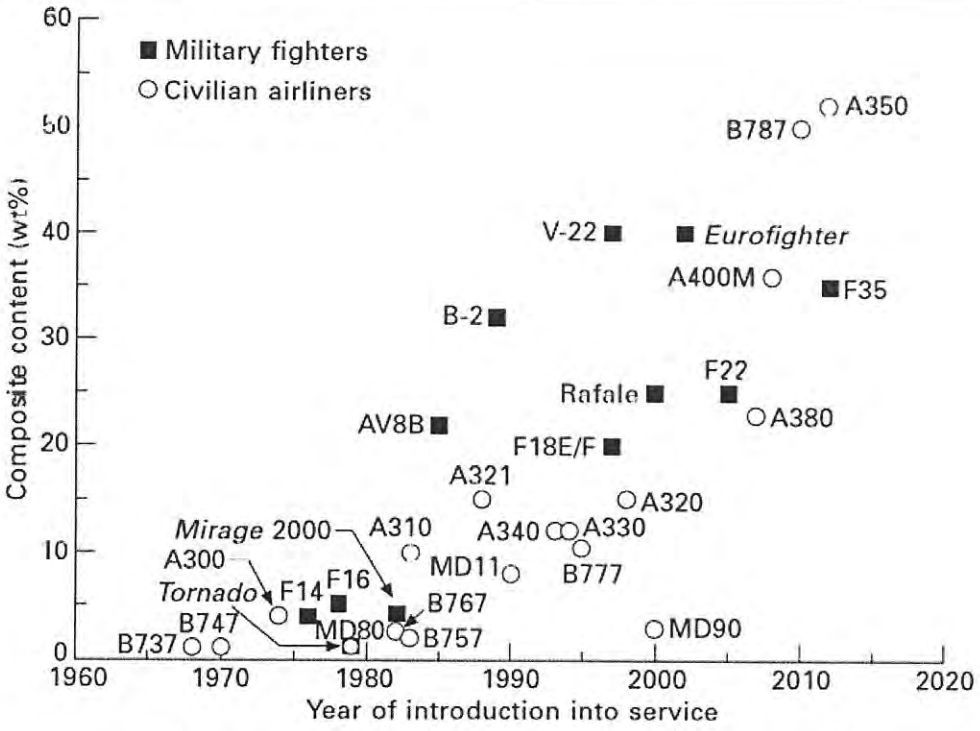

Figure: Amount of composite materials used in the aircraft (Adrian P. Mouritz 2012).

Figure Q2(c)