Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	ENVIRONMENTAL IMPACT OF AVIATION
COURSE CODE	:	BDL 30402
PROGRAMME	:	BDC
EXAMINATION DATE	:	JULY 2022
DURATION	:	2 HOURS
INSTRUCTION	:	1. ANSWER **FOUR (4)** QUESTIONS **ONLY**. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**. 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Vulnerable ecosystem, depleting resources, high energy consumption and high population growth are reasons for the arising environmental issues. Among the four reasons given above, select two and discuss the impact of these reasons on the environment.

(5 marks)

(b) Among the by-products of the gas turbine combustion are carbon dioxide and water vapour. Discuss the two by-products briefly.

(5 marks)

(c) You have been officially appointed as the consultant for the Government of Malaysia to advise the Civil Aviation Authority Malaysia (CAAM). Your task is to propose improvements that can be made to the nation's airport infrastructure and air traffic management to reduce the annual emission growth. Prepare three suggestions for both the airport infrastructure and the air traffic management.

(12 marks)

(d) Apart from the task given in **Q1(c)**, you are also asked for advice on the best approach to be used when implementing new standards to the local aviation industry. For this reason, outline at least two approaches to be used.

(3 marks)

Q2 (a) It is known that global warming is caused by the greenhouse effects. Discuss:

(i) The greenhouse effect on global warming.

(5 marks)

(ii) The impact of global warming on precipitation

(2 marks)

(iii) The effect of precipitation change on the people and environment.

(3 marks)

(b) One of the strategies introduced by the International Air Transport Association (IATA) to combat climate change is adopting effective economic instrument. Apply this strategy to propose at least two initiatives that can be implemented in Malaysia.

(5 marks)

(c) You have been appointed as an aviation research consultant. As the consultant, you are asked by both the engine and airframe manufacturers to suggest several ways to improve the engine and airframe technologies. The objective is to reduce their impact on the environment. Outline at least five suggestions for each of the manufacturer.

(10 marks)

Q3 **Table Q3** provides the emission data for Trent XWB-84 and General GEnx-2B67/P engines. Based on the data given in the table:

(a) Calculate the amount of HC, CO and NOx produced for each component of the LTO cycle.

(19 marks)

(b) Determine for both engines the highest amount of emission for each LTO cycle.

(4 marks)

(c) Determine which engine generate the least emission.

(2 marks)

Q4 (a) Define noise frequency and amplitude. List the three sources of aircraft noises.

(4 marks)

(b) Among the effects of aviation noise on property and communities include structural damage, sleep disturbance, and annoyance. Describe these three effects.

(6 marks)

(c) You have been appointed as an Environmental Manager at Senai International Airport. Apply the International Civil Aviation Organisation (ICAO) balanced approach to recommend the steps to be taken to assess the aviation noise within the airport.

(10 marks)

(d) Apart from the task given in **Q4(c)**, you are also asked to strategise the land-use plan and management in the vicinity around the airport. For this reason, propose at least five recommendations to the Senai International Airport.

(5 marks)

Q5 (a) List four alternative jet fuels approved by the American Society for Testing and Materials (ASTM).

(4 marks)

(b) Discuss the reasons why the industry considers the business of aircraft end-of-life is lucrative.

(6 marks)

(c) A local airline came to you for a consultation on dismantling their old aircrafts. Prepare a list of actions that the airline is required to take to dismantle their aircraft. The list should include brief descriptions explaining the action listed.

(10 marks)

(d) Apart from **Q5(c)**, you are also asked for advice regarding challenges faced by the aviation industries in aircraft recycling and storage. Prepare an action plan that can be implemented by the local industries to reduce these challenges.

(5 marks)

- END OF QUESTIONS -

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Table Q3: Engine emission data

LTO Cycle	Measurement Component	Engine	
		Trent XWB-84	GEnx-2B67/P
Take Off	Fuel Flow (kg/s)	2.819	2.453
	HC (g/kg)	0	0.02
	CO (g/kg)	0.39	0.07
	NOx (g/kg)	45.24	34.21
Climb	Fuel Flow (kg/s)	2.306	2.009
	HC (g/kg)	0	0.02
	CO (g/kg)	0.39	0.17
	NOx (g/kg)	34.2	21.1
Approach	Fuel Flow (kg/s)	0.801	0.642
	HC (g/kg)	0.01	0.04
	CO (g/kg)	1.18	1.78
	NOx (g/kg)	11.12	11.11
Idle	Fuel Flow (kg/s)	0.291	0.219
	HC (g/kg)	1.03	0.41
	CO (g/kg)	21.46	14.28
	NOx (g/kg)	4.41	4.92

Note: ***LTO*** *: Landing, Take-off* ***HC*** *: Hydrocarbon* ***CO*** *: Carbon Monoxide*
NOx *: Oxides of Nitrogen*