



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2022/2023**

COURSE NAME : ENVIRONMENTAL IMPACT OF AVIATION  
COURSE CODE : BDL 30402  
PROGRAMME : BDC  
EXAMINATION DATE : JULY/AUGUST 2023  
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

CONFIDENTIAL

**TERBUKA**

- Q1**
- (a) Combustion on an aircraft jet engine can be either complete or incomplete. For both types of combustion, write the correct equation. (2 marks)
- (b) Vulnerable ecosystems and depleting resources are among the reasons for the rising environmental issues. For both reasons above, discuss these reasons' environmental impact. (5 marks)
- (b) Among the by-products of aircraft jet engine combustion are sulphur oxides and particles. Discuss the two by-products briefly. (8 marks)
- (c) You have been officially appointed as the Chief Executive Officer of the Civil Aviation Authority Malaysia (CAAM). Your task is to develop a new Civil Aviation Directive that explains the new policy on the sustainable environment, which will be implemented by January 2025. For this reason, construct strategic plans on how this policy will be discussed, agreed upon by the stakeholders, and implemented. (10 marks)
- Q2**
- (a) State the International Civil Aviation Organisation (ICAO) standard Landing-Take-Off (LTO) cycle in terms of the operation modes, amount of thrust percentage, and time. (6 marks)
- (b) Some sources of pollutants in airports can be grouped as sources from aircraft handling and infrastructure or stationary-related facilities. For both groups, discuss in brief these sources. (6 marks)
- (b) One of the strategies the International Air Transport Association (IATA) introduced to combat climate change is adopting effective airport infrastructure. Apply this strategy to propose at least two initiatives that can be implemented in Malaysia's airports. (5 marks)
- (c) You have been appointed Director of the Malaysian Aviation Research Institute (MARI). You are asked to give a consultation to a local engine manufacturer, TK Aero-Engine, on improving their future engine design and technology to reduce the impact of the engine on the environment. Outline at least four suggestions for the engine. CH2 (8 marks)

- Q3** **Table Q3** provides the emission data for Trent 1000-H2 and CFM56-5B6 engines. Based on the data given in the Table:
- (a) Calculate the amount of HC, CO, and NO<sub>x</sub> 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 generates the least CO and NO<sub>x</sub>.  
(2 marks)
- Q4**
- (a) State the range of frequency the human ear can hear sound. List the three sources of aircraft noises.  
(4 marks)
  - (b) Describe jet noise and differentiate it:
    - (i) near the exhaust exit; and
    - (ii) further downstream of the exhaust.  
(6 marks)
  - (c) You have been appointed 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 Q4(c) task, you are also asked to strategise the noise reduction operational restriction. For this reason, propose at least five (5) recommendations to the Senai International Airport.  
(5 marks)
- Q5**
- (a) One of the long-term strategies set by the International Air Transport Association (IATA) is the introduction of sustainable aviation fuel. Describe three requirements for the fuel to ensure the usage is safe and economical.  
(6 marks)
  - (b) You are appointed as the executive representative of the Malaysia Aircraft Recycling Association (MARA). A new local aircraft recycling and dismantling company, AeroTech Solution Sdn Bhd, has made an appointment to seek guidance on addressing the company's challenges in creating a sustainable business. Prepare for the company, five strategic actions in brief that can be implemented to reduce these challenges.  
(10 marks)

- (c) Adopting the European Union's third strategy, which focuses on air traffic management and advancement in research, propose strategies for the Air Division of the Ministry of Transport Malaysia to improve the Air Transport Management of Malaysia's International Airports.

(9 marks)

- END OF QUESTIONS -

**FINAL EXAMINATION**

SEMESTER / SESSION : SEM II / 2022/2023  
 COURSE NAME : ENVIRONMENTAL IMPACT  
 OF AVIATION

PROGRAMME CODE : BDC  
 COURSE CODE : BDL 30402

**Table Q3: Engine emission data**

LTO Cycle	Measurement Component	Engine	
		Trent 1000-H2	CFM56-5B6
Take Off (0.7 minutes)	Fuel Flow (kg/s)	2.075	0.998
	HC (g/kg)	0	0.1
	CO (g/kg)	0.48	4.48
	NOx (g/kg)	40.46	13.51
Climb (2.2 minutes)	Fuel Flow (kg/s)	1.715	0.827
	HC (g/kg)	0	0.2
	CO (g/kg)	0.43	12.18
	NOx (g/kg)	31.49	10.41
Approach (4 minutes)	Fuel Flow (kg/s)	0.582	0.315
	HC (g/kg)	0.07	0.2
	CO (g/kg)	0.89	17.75
	NOx (g/kg)	12.56	10.32
Idle (26 minutes)	Fuel Flow (kg/s)	0.233	0.111
	HC (g/kg)	1.03	3.4
	CO (g/kg)	9.82	46.1
	NOx (g/kg)	5.21	3.9

Note: **LTO** : Landing, Take-off    **HC** : Hydrocarbon    **CO** : Carbon Monoxide  
**NO<sub>x</sub>** : Oxides of Nitrogen