THE HONG KONG POLYTECHNIC UNIVERSITY

Department of Aeronautical and Aviation Engineering

Subject Title	:	Introduction to Aviation System and Air Transport Regulation	**Subject Code**	:	AAE2004
Session	:	Semester 1, 2023/24			
Date	:	9 December 2023	**Time**	:	15:15 – 18:15
Time Allowed	:	3 hours	**Subject Examiner(s)**	:	Dr Kam Ng

This question paper has a total of __seven__ pages (attachments included).
(Some pages may be intentionally omitted.)

Instructions to Candidates:

This paper has two parts.
Part A consist of 10 questions.
Part B consist of 6 questions.
Answer **ALL** questions.

Constants : 1 mile = 1.6093 kilometres; 1 mile = 0.8690 nautical miles; 1 kilogram = 0.001 tonnes; RMB : HKD = 1 : 1.1

Others : Nil

Available from Invigilator : Nil

DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

Part B – Short answers and long questions (80 marks)

Question 1 – Freedom of the air (6 marks)

PolyU Airways is an airline based in Hong Kong. The company would like to offer a round-trip flight between Penang International Airport and Kota Kinabalu International Airport, where both airports are located in Malaysia. The flight would pass through the shaded island in the middle of the map (as shown in **Figure 2**).

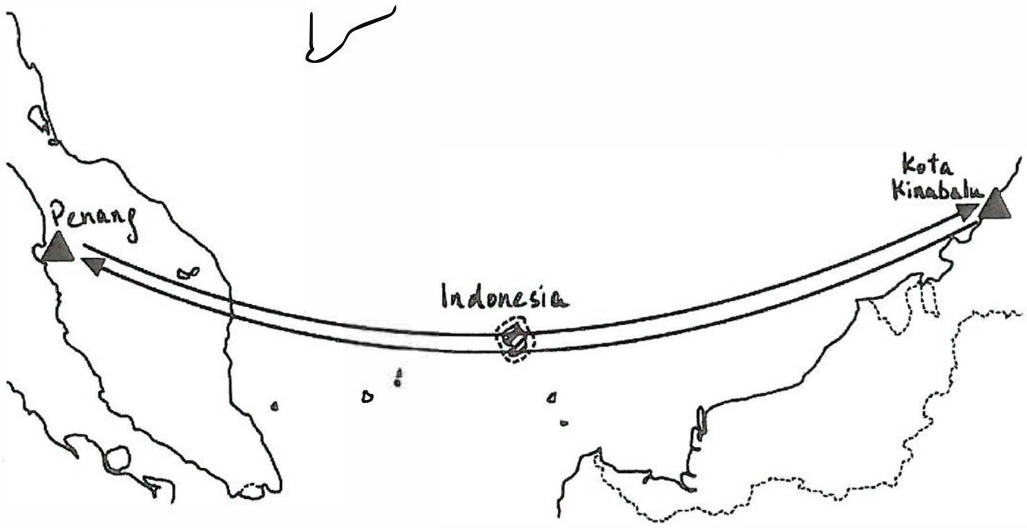

Figure 2. Map showing the locations of Penang International Airport and Kota Kinabalu International Airport. Solid lines represent the boundaries between ocean and land; dotted lines represent the boundaries between countries.

Which freedom(s) of the air is/are required? Explain your choice.

Question 2 – Airline's business analysis (16 marks)

AAE Airline is an airline based in Taiwan. The company would like to offer a one-way flight from Tokyo, Japan to Changi, Singapore. The distance between the cities is 2866 nautical miles. The company would like to choose either B777-300ER, which can travel up to 7825 nautical miles, or A380-800, which can travel up to 8500 nautical miles, for this flight.

(a) Based on the above information, which type of aircraft would you choose for the operation? Explain your choice. (1 mark)

The callsign AAE1002 is assigned to the above flight. It is expected to carry 300 passengers. 84% of the passengers are expected to choose economy class, passengers choosing premium economy class and business class are 8% each. If A380-800 is used, 4 passengers are expected to change from business class to first class.

Seating details Seat map key

	Pitch	Width	Seating details
First	81	35	12 closed suites
Business	55	30	86 flat bed seats
Premium Economy	38	19.5	36 recliner seats
Economy	32	19	245 standard seats

Figure 3. Seating Details of A380-800

Seating details Seat map key

	Pitch	Width	Seating details
Business	82	21	39 flat bed seats
Premium Economy	38	19.5	32 recliner seats
Economy	32	17.2	297 standard seats

Figure 4. Seating details of B777-300ER

Statistics in the past showed that in every flight, there was 5% of the adult passengers who were having either complementary or redeem tickets, where 20% of them located in the business class, 20% located in the premium economy class and the others located in the economy class. In addition, 10% of the passengers, located in the economy class, were children who did not pay for the fare, and 2% of the passengers were students, whose fare is half of that of adult, located in the premium economy class.

Assumptions:

(1) The average mass of an adult, a student and a child are 80 kg, 65 kg and 50 kg respectively.
(2) The expected fare of a passenger air ticket travelling with the economy class and cargo transportation fee per tonne is RMB 2,500 and RMB 4,500 respectively.
(3) The total mass carried by the aircraft is expected to be 85.25 tonnes.
(4) The fare of the first class, the business class and the premium economy class is 5 times, 2 times and 1.5 times of the economy class fare, respectively.

(b) For both aircraft types, calculate

(i) the tonne kilometre (TKM); (3 marks)

(ii) the passenger load factor (PLF); (4 marks)

(iii) the passenger yield; and (4 marks)

(iv) the cargo yield. (3 marks)

(c) Based on the results in (b), which aircraft type should the company choose? Briefly explain your answer. (1 mark)

Question 3 – Safety Management Systems (10 marks)

(a) What is a safety management system (SMS)? (2 marks)

(b) According to the ICAO, there are five key processes in a SMS. State any of three and briefly explain why the process is needed. (3 marks)

(c) According to the statistics, the total number of incidents from 1970 to 2022 has been over 11,000, causing over 80,000 fatalities all over the world. Yet, the number of incidents has been significantly reduced in recent years.

Explain how the safety management system works in order to achieve the safety standards, which leads to a significant reduction in incidents. (5 marks)

Question 4 – Future Perspective of Air Traffic Control (8 marks)

Suppose you are an airport engineer. Your task is to determine whether your airport implements either the ADS-B receivers or radars. The budget approved only allows you to implement one of them. Write a short proposal to the airport senior management based on arguments in TWO perspectives.

Question 5 – AOC and aircraft acquisition (30 marks)

(a) You are now planning to register your airline, namely "Fly nowhere" Airways Limited, conduct commercial air transport operations and decide to set your base in Hong Kong. Explain the necessary approval to be obtained and the key information in that approval must be provided along with your application to HKCAD.
(5 marks)

(b) List five "Fly nowhere" Airways Limited AOC requirements that HKCAD is concerned in the application. (5 marks)

(c) Assuming that "Fly nowhere" Airways Limited is allowed to conduct commercial air transport operations in 2025 approved by HKCAD. As of December 2023, "Fly nowhere" Airways Limited is planning to purchase A320neo as part of its aircraft fleet. Briefly explain the aircraft acquisition process. (4 marks)

(d) Assuming that "Fly nowhere" Airways Limited is allowed to conduct commercial air transport operations in 2025 by approved HKCAD. As of December 2023, "Fly nowhere" Airways Limited is planning to purchase C919 as part of their aircraft fleet. Briefly explain the roles and responsibilities of the State of Design (SoD), State of Registration (SoR), AOC holder and CAA before the closing of the transaction. (8 marks)

(e) Assuming that "Fly nowhere" Airways Limited is allowed to conduct commercial air transport operations in 2025 by approved HKCAD. As of December 2023, "Fly nowhere" Airways Limited is planning to purchase C919 as part of their aircraft fleet. Briefly explain the aircraft acquisition process. (8 marks)

Question 6 – Aviation emissions (10 marks)

(a) List four types of aviation emissions in air transportation. (2 marks)

(b) Pick one type of aviation emission in Q6(a), and briefly explain how the emission contributes to climate change. (4 marks)

(c) Based on your answer in Q6(b), please explain with an example of how aircraft manufacturers can leverage the impact of innovative technology. (2 marks)

(d) Based on your answer in Q6(b), please explain with an example of how AOCs or CAAs can leverage the impact by innovative technology? (2 marks)

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