2003 HIGHER SCHOOL CERTIFICATE EXAMINATION

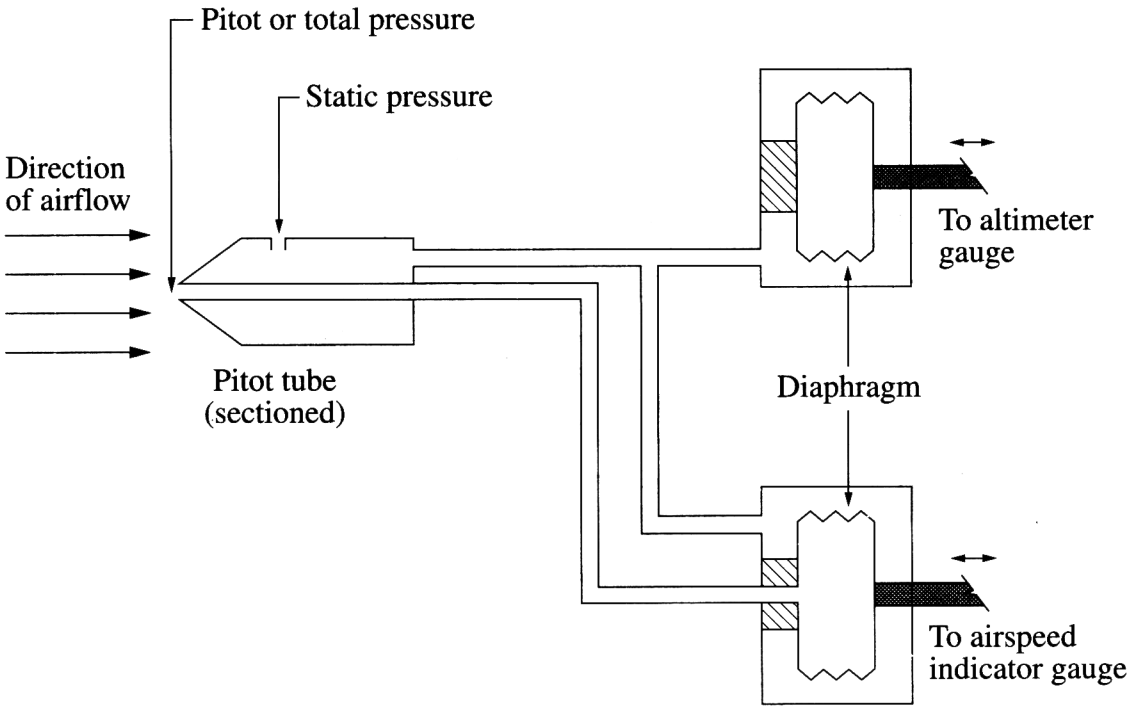
Engineering Studies

Section II (continued)

Marks

Question 15 — Aeronautical Engineering (15 marks)

In common aircraft instruments a pitot tube is connected to both the altimeter and airspeed indicator.



(a) Explain how the airspeed indicator determines airspeed from the pressures sensed by the pitot tube. **3**

As the airflow goes in it is surrounded by static air. The Air pushes the static air back. The faster ar aircraft is travelling the more air can enter to pitot the more the static air is being purhed back this is then sent to the airspeed indicator guage

Question 15 continues on page 22

Marks

Question 15 (continued)

(b) (i) Aluminium and its alloys are generally more active than irons and steels in the galvanic series. Explain why aluminium alloys are more corrosion-resistant than steels. **2**

- Aluminium alloys oxide layer formed by corrosion is non-porus so no oxygen can get to rest of structure to corrode it
- steels oxide is porus so oxygen can corrode rest of steel

(ii) Identify ONE advantage and ONE disadvantage of the use of composite materials to replace aluminium alloys in aircraft components. **2**

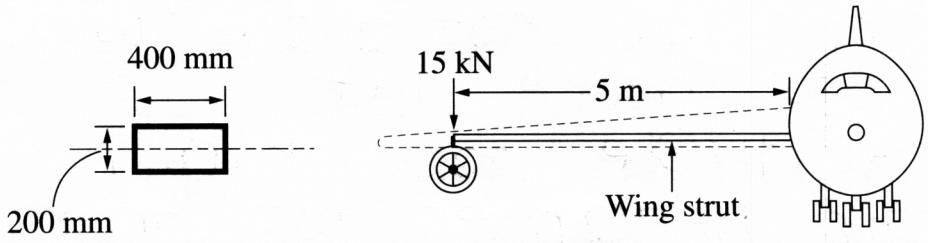
- Advantage: of carbon fibre very good in cyclic stress
- Disadvantage: failure is sudden and more severe

Question 15 continues on page 23

Marks

Question 15 (continued)

(c) In the diagram of an aircraft, the wing has been shown as hidden outline to reveal the wing strut, which has uniform section along its length.



Detail of cross-section of wing strut

(i) Compare the nature of the stresses experienced by the surfaces of the wing strut when the aircraft is stationary on the ground and when the aircraft is in flight. **3**

- Ground: gravity is acting on the strut this creates a torqueal stress, it wants to snap of body with 15kN, 5 acting down
- when moving the jet makes the stress of the strut it is moving foward & the strut needs to carry the body foword

(ii) Determine the maximum value of the bending stress when the strut experiences a force of 15 kN at its end. **3**

Use $I = 267 \times 10^6\ \text{mm}^4$.

$\sigma = \frac{My}{I}$

$= \frac{5000 \times 75}{267 \times 10^6}$

$I = 267 \times 10^6\ \text{mm}^4$

Bending stress = 0.281 (3 d.p) kpa

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Marks

Question 15 (continued)

(d) Outline TWO conditions that may cause an aircraft to stall during flight. **2**

- Angle of attack too great. This will not allow wing to create lift
- Altitude too high, the air becomes too thin and required air pressure on wings cannot be produced

End of Question 15