2003 HIGHER SCHOOL CERTIFICATE EXAMINATION

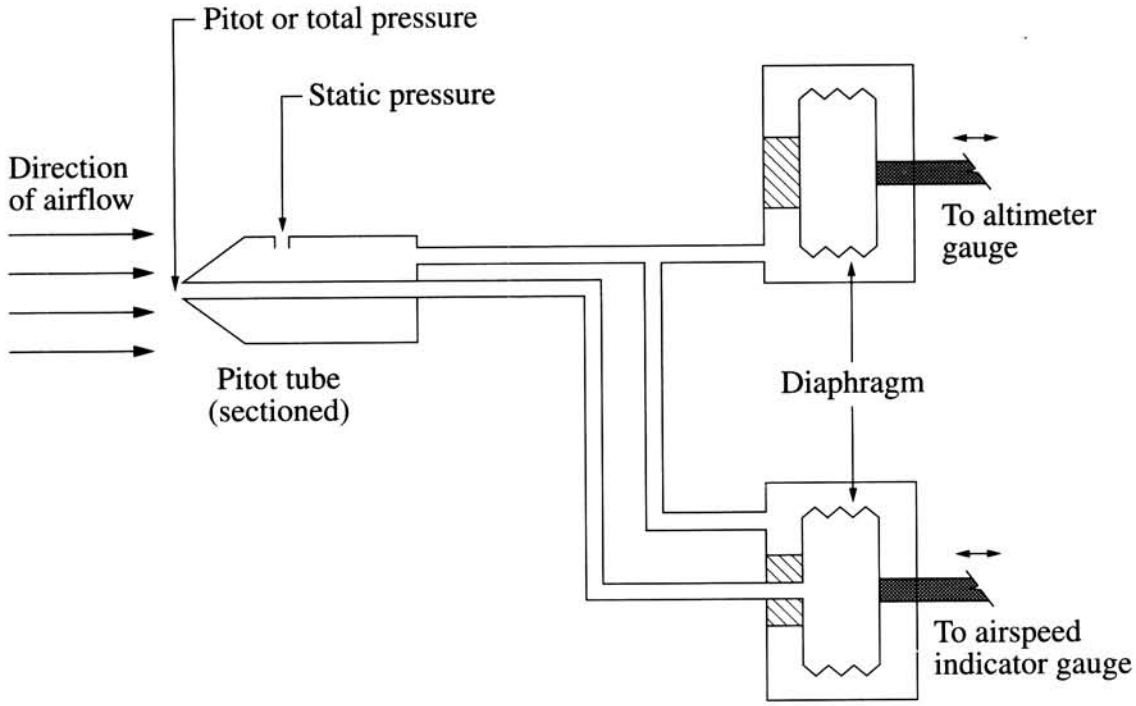
Engineering Studies

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**

The flow of the air, if the air is blowing directly into the pitot the airspeed will be constant & therefore if the airflow is not constant the airspeed will decrease when pulling up & increase when going down more & airflow on decent.

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 is one of many steels that has a corrosive ressistance, the Aluminium alloys are coated with a resistant oxide shell, therefore making it protected against this.

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

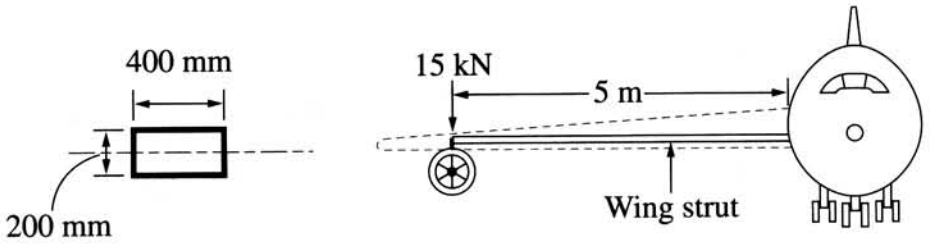
an advantage could be the greatness in strength, may have higher tensile strength, but this material may corrode very quickly & need to be replaced.

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**

when in flight the wing has airflowing over it making it lighter but when stationary on the ground the stresses would be seen clearly due to the weight that is need to be held.

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

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

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

$= \frac{15 \times 5 \times 0.04 \times 0.02}{267 \times 10^6\ \text{mm}^4}$

$= \sqrt{224.7191011\ \text{mm}^4}$

$= 14.99063378\ \text{mm}^2$

$= 3.9\ \text{mm}$

$\sigma = \frac{15000 \times 0.04 \times 0.02}{16340.13464\ \text{m}^2}$

$\text{MPa} = 0.00367194 \times 10^6$

$= 3671.940368$

$\therefore 3671.9\ \text{MPa}$

Bending stress = 3.9 MPa

Question 15 continues on page 24

Marks

Question 15 (continued)

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

the aircraft may peak to high & the airflow will decrase to ring the engine to stall. turning to sharply and letting the tail of the aircraft swing around to quickly will make the aircraft stall.

End of Question 15