

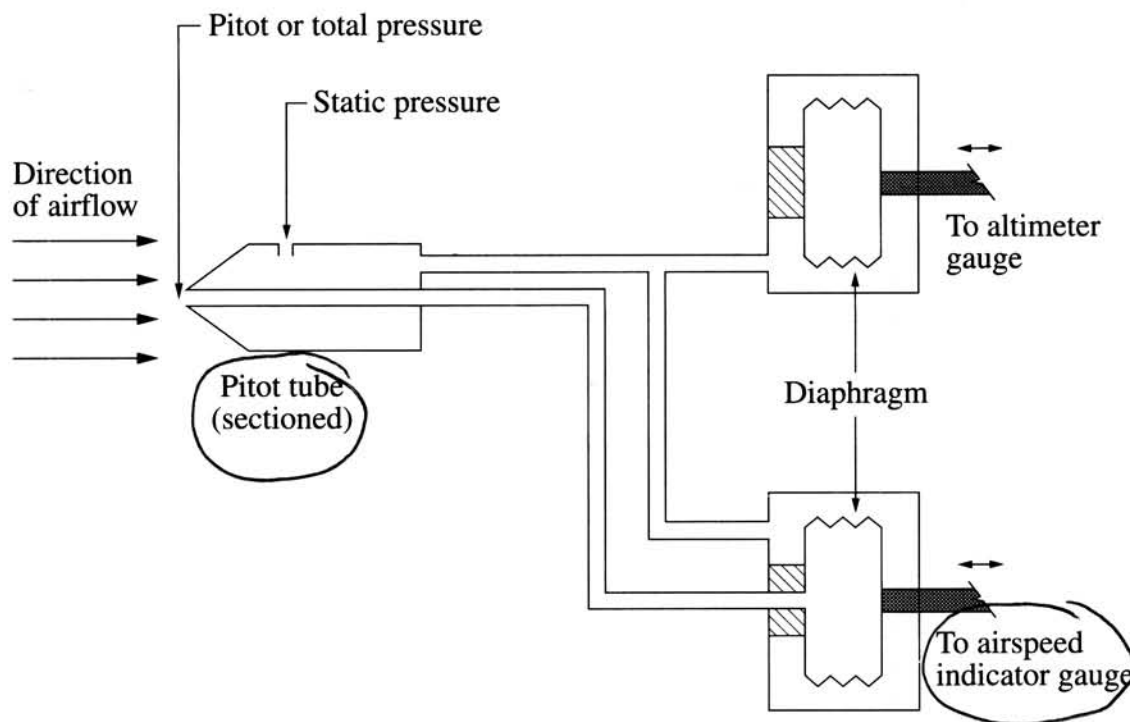
Engineering Studies

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 airflow is slowed down by the static pressure to give a reading of the amount of force which flows through the chamber. The diaphragm is used to alternate the airspeed to the indicator gauge. The static pressure is picked up from the airflow and is separated from the airflow so that a reading can be taken at the altimeter sending its reverse reading to the indicator gauge.

Question 15 continues on page 22

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 are more corrosion resistant as they contain more copper than steels, making it more susceptible to different climates.

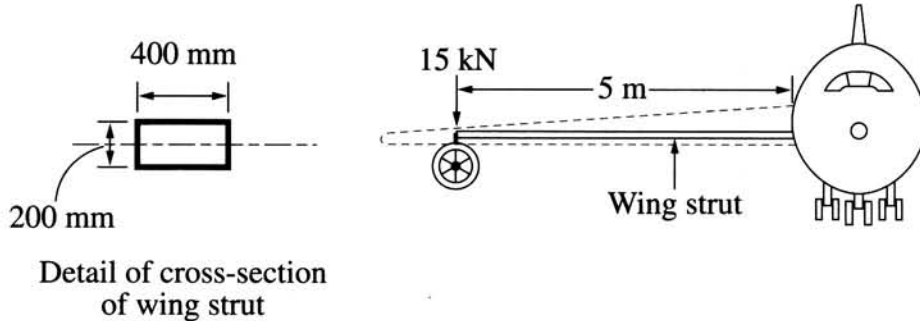
- (ii) Identify ONE advantage and ONE disadvantage of the use of composite materials to replace aluminium alloys in aircraft components. **2**

advantage - able to be subjected to different climates, high modulus of strength
 disadvantage - rupture can occur rapidly and can be catastrophic, also that internal cracks and stress are hard to find and decipher.
 fractures

Question 15 continues on page 23

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.



- (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

~~Static~~ stresses with the wing strut on the ground are nil as there is no direct air flow. When in flight the strut is under incredible pressure and force due to the wind flow around the wing, as it cuts through the air there are many internal stresses within the wing itself.

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

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



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

$$\frac{15 \times 0.4}{267 \times 10^6} = \frac{6}{267000000}$$

$$= 0.000000022$$

$$= 2.2 \times 10^{-8}$$

Bending stress = 2.2×10^{-8}

Question 15 continues on page 24

Question 15 (continued)

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

Two conditions that may cause an aircraft to stall during flight are not enough airflow, correctly cutting the wing. The angle of attack can be too little so the airflow is ceased around the wings which control the flight path.

End of Question 15