

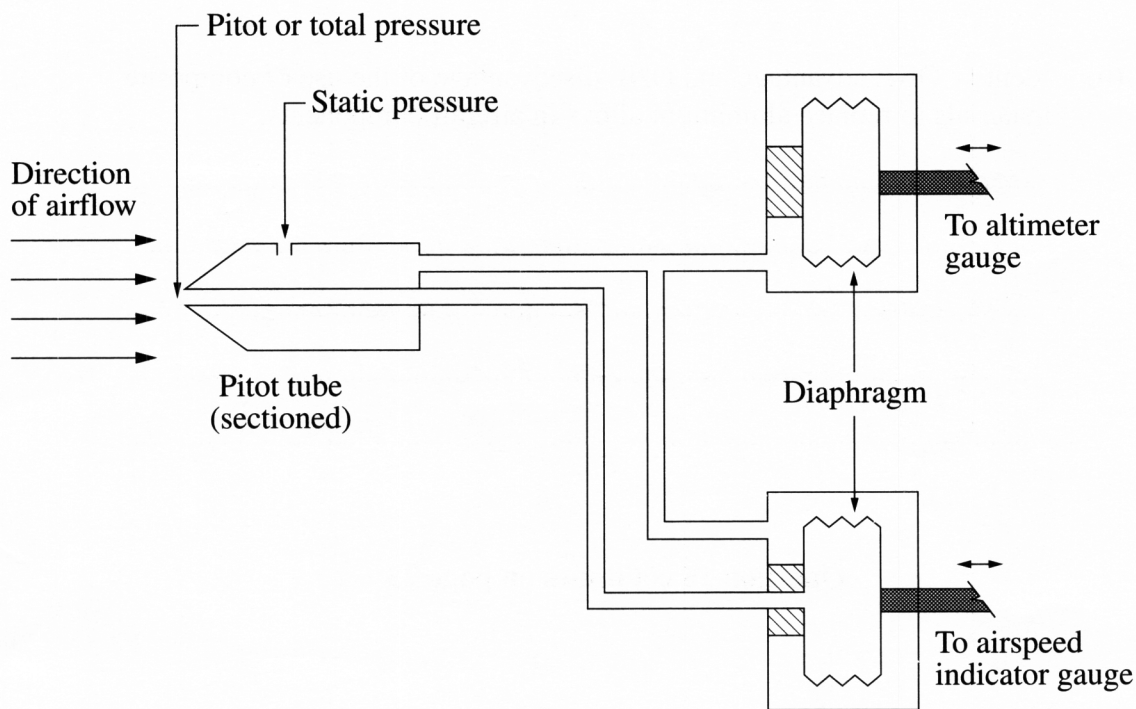
Engineering Studies

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

..... air enters the pitot tube and  
 ..... ~~static pressure~~ and enters  
 ..... a Diaphragm. this Diaphragm is allowed  
 ..... to expand or contract according to the static  
 ..... pressure. this information can be processed  
 ..... by an air speed indicator to detect air speed

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

.....as aluminium oxide forms on.....  
 .....the outside of aluminium when it.....  
 .....comes into contact with air. ~~It~~.....  
 .....Aluminium oxide is more corrosion resistant.....  
 .....than steel.....

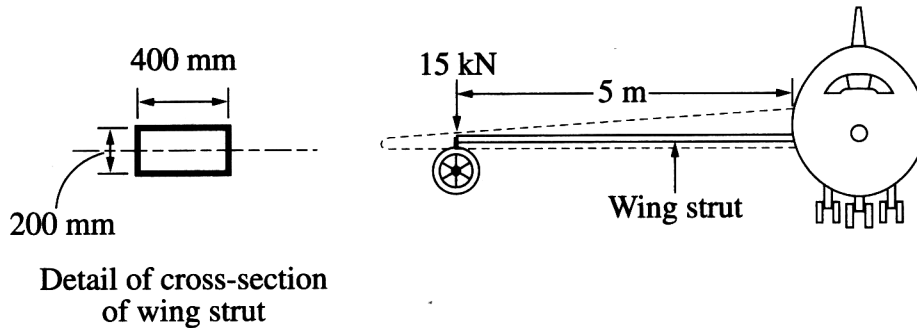
- (ii) Identify ONE advantage and ONE disadvantage of the use of composite materials to replace aluminium alloys in aircraft components. 2

.....composite materials can be stronger.....  
 .....than aluminium alloys in aircraft.....  
 .....components. composite materials.....  
 .....are generally heavier than aluminium.....  
 .....alloys.....

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

*.....while on the ground, the strut wing would sag, the top of the strut would be in tension and the bottom in compression while in the air the wings would create lift, and the opposite would occur, bottom in tension top in compression the effects would magnify further from the plane*

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

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

$$\sigma = \frac{my}{I} \quad 7500 = \frac{M \cdot 200}{267 \times 10^6} \quad M = \frac{15000 \times 267 \times 10^6}{200}$$

$$\sigma = \frac{F}{A} = \frac{15 \times 10^3}{400 \times 200} = 7500$$

Bending stress =  $2.0025 \times 10^{10}$

Question 15 continues on page 24

Question 15 (continued)

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

2

...If...an...aircraft...climbs...to...fast...airflow...  
...over...the...wings...becomes...turbulent...and...the...low...  
...pressure...system...the...creek...is...disrupted...  
...no...more...lift...is...created...weather...can...  
...also...create...this...same...effect

End of Question 15