

系所組別： 航空太空工程學系在職專班甲組

考試科目： 航空工程概論（專班）

考試日期：0225，節次：3

1. Assume that at a point on the wing of the Concorde supersonic transport, the air temperature is -10°C and the pressure is $1.7 \times 10^4 \text{ N/m}^2$. Calculate the density and specific volume at this point. (20%)
2. Consider a wing in low speed wind tunnel, the velocity of the air flow is 160 ft/s. If the velocity at a point on the wing is 195 ft/s, what is the pressure coefficient at this point? (20%)
3. A light airplane weighs 3,000 lbf and has a wing area of 180 ft^2 . Estimate its sea level stall speed if the maximum lift coefficient is 1.8. (20%)
4. By the method of dimensional analysis, derive the expression $M = q_{\infty} S c C_m$ for the aerodynamic moment on an airfoil, where q_{∞} is the free stream dynamic pressure, S is the reference area, c is the chord length and C_m is the moment coefficient. (20%)
5. A missile is traveling at Mach 3 at standard sea level. What is its speed in Km/hour? (20%)

Note:

a. Gas constant for air	Units
286.9	J/(kg K)
53.3533	ft lbf/(lb $^{\circ}\text{R}$)
1716.59	ft lbf/(slug $^{\circ}\text{R}$)

Based on a mean molar mass
for dry air of 28.9645 g/mol

- b. The sea level standard value of air: pressure $1.01325 \times 10^5 \text{ N/m}^2$,
density 1.225 kg/m^3 or $0.00237 \text{ slug/ft}^3$,
specific heat ratio 1.4,
temperature 15°C .