1. An airbreathing engine is shown in the following control-volume schematic. (20%)

Thrust is produced as fuel flowrate $\dot{m}_f$ is injected and burned in the combustor. You are asked to show that,

1) The mass flowrate $\dot{m}_s$ from the side control surface is

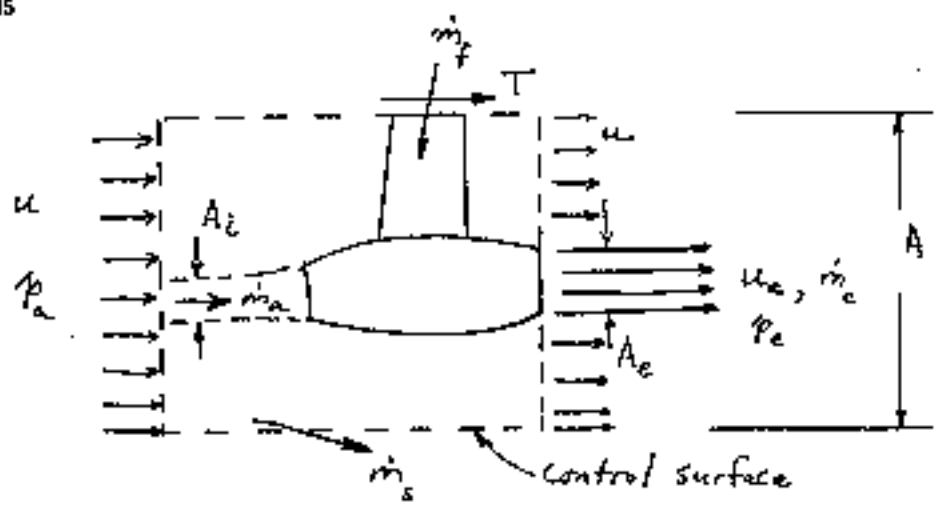
$\dot{m}_s = \rho u (A_e - A_i)$

2) Thrust produced by this engine is

$T = \dot{m}_e v_e - \dot{m}_a u + (p_e - p_a) A_e$

in which,

u = freestream volocity
p_a = freestream pressure
$\dot{m}_a$ = mass flowrate captured
A_i = freestream capture area
p_e = exit pressure
A_e = nozzle exit area
$\dot{m}_e$ = exit mass flowrate
v_e = nozzle jet velocity
$\dot{m}_f$ = fuel flowrate
T = Thrust
$\dot{m}_s$ = mass flowrate from the side area



2. ROC's first domestic satellite, ROCSAT-1, will be launched from Cape Kennedy, USA on December 15, 1998. Once operational, it has the following Kaplerian Parameters: (20%)

Altitude = 600 Km,
Eccentricity ≒ 0,
Inclination Angle = 35° ,
Right Ascending Node = 45°

There is a tracking station located in Tainan country side. Ground coordinate of this tracking station is given as:

Longitude = 120.277° East,
Latitude = 22.935° North.

(a) Compute the period (time required to circle the earth) of ROCSAT-1 trajectory? (4%)
(b) How many revolutions do ROCSAT-1 circles the earth per day? (4%)
(c) Do you think Tainan tracking station will see ROCSAT-1 on every revolution? Explain your reason. (4%)
(d) Do you consider the four given Kaplerian Parameter sufficient to describe the orbit of ROCSAT-1 for a two-body problem? Why? (4%)
(e) Describe the procedure to compute tracking information, i.e., right ascension, declination, angle rate with respect to time when ROCSAT-1 passes through the Tainan Tracking Station. (4%)

(背面仍有題目,請繼續作答)

3. (a) Explain the following technical terms: (15%)
   (1) Range and Endurance
   (2) Rate of Climb and Rate of Descend
   (3) Absolute ceiling and service ceiling
   (b) What is the stall speed of an aircraft? Derive the formula of the stall speed with the required parameters. Discuss how this stall speed is closely related with the aviation safety of the aircraft.

4. a) Describe the static flight stability and dynamic flight stability. (5%)
   b) There are several longitudinal flight modes. Describe these modes in terms of frequency and amplitude. (5%) (15%)
   c) Explain what is the term of "stick-fixed flight". (5%)

5. A finite-wing lift slope can be found to be (15%)
$$\frac{dC_L}{d\alpha} = \frac{a_0}{1+(a_0/\pi)AR}$$
   1) In this equation what is a_0 and AR?
   Explain what is the physical reason that makes this finite-wing lift slope differ from that of the two-dimensional one.
   2) Can this equation be used in supersonic flow?
   State your argument why it can or cannot be.

6. 請簡答下列飛航問題 (15%)
   a. 民航機做轉彎飛行時，應操作哪一個部分？
   b. 同上題，民航機的轉彎以飛行控制的六個自由度來看應是哪一個自由度的變化？
   c. 民航機降落階段利用儀器進場時，所必須保持的攻角大約在什麼範圍？
   d. 民航機的飛航安全首重隔離，一般以哪種隔離方式最為有效？
   e. 民航機飛航所使用的時間單位與基準為何？
   f. 高空的民航機如何量測飛機的飛航高度？
   g. 民航機做重飛(Go Around)的動作應立刻做哪兩項處置？(3%)