AE 5535 Non-ideal turbofan homework (1) **Assigned: Feb 1, 2021**

Due: Feb 5, 2021

Consider a non-afterburning turbofan engine with engine parameters as given below.

If τ_λ = 7.3 (ratio of total enthalpy at burner exit to freestream enthalpy), M_0 = 2.0 (flight Mach number), π_C = 12 (compressor total pressure ratio), π_{fan} = 1.64 (fan total pressure ratio), and α = 3.6 (engine bypass ratio), **find the specific thrust and specific fuel consumption of this engine.**

T_0 = 220K (ambient temperature) $\pi_d = 1 - 0.015M_0^2$ (inlet total pressure drop)

e_C = 0.91 (polytropic compressor efficiency) γ_C = 1.4 (ratio of specific heats upstream of burner)

π_b = 0.98 (burner total pressure drop) e_{fan} = 0.90 (polytropic fan efficiency)

$C_{P,c}$ = specific heat at constant pressure upstream of burner = 1000J/kgK (also thru fan stream)

$\pi_N = \pi_{N'}$ = 0.99 (primary and bypass nozzle total pressure drops)

e_T = 0.89 (polytropic turbine efficiency) γ_t = 1.32 (ratio of specific heats downstream of burner)

η_b = 0.99 (burner efficiency) h = 4.5×10^7 J/kg (fuel) (heating value of fuel)

$C_{P,t}$ = specific heat at constant pressure downstream of burner = 1200 J/kgK

η_m = 0.99 (mechanical efficiency – shaft)

$P_9 = P_{9'} = P_0$ (both primary and bypass nozzles are ideally expanded)

If an efficiency/loss is not given, assume ideal for that particular efficiency/loss