CODE:

```
def calculate_thrust_turbojet():
    print("\nEnter the data for TURBOJET ENGINE!!!\n")
    alt = float(input("Enter the altitude in (Meters) : "))
    m = float(input("Enter mach number : "))
    pr = float(input("Enter compressor pressure ratio : "))
    pl = float(input("Enter power loss in combustion camber(in percent) : "))
    t03 = float(input("Enter turbine inlet temperature (t03) in (K) : "))
    ce = float(input("Enter compressor efficiency : "))
    te = float(input("Enter turbine efficiency : "))
    ie = float(input("Enter inlet efficiency : "))
    je = float(input("Enter jet efficiency : "))
    me = float(input("Enter mechanical efficiency : "))
    f = float(input("Enter the value of f : "))

print("################################################################################
###############")
    pa = (1 - ((0.0065 * alt) / 288.16)) ** ((9.80665 * 0.029) / (8.314 * 0.0065))
    ta = 288.16 - (0.0065 * alt)
    print("Pressure at %.0f" % alt, "m is = %.3f" % pa, "(bar)")
    print("Temperature at %.0f" % alt, " m is = %.3f" % ta, "(K)")
    # To FIND AIRCRAFT VELOCITY:
    ci = ((1.4 * 287 * ta) ** 0.5) * m
    print("Inlet velocity (Ci) = %.3f" % ci, "(m/s)")
    # DIFFUSER:
    p01 = ((1 + (ie * (ci * ci) / (2 * 1005 * ta))) ** (1.4 / 0.4)) * pa
    print("Diffuser Outlet Pressure (p01) = %.3f" % p01, "(bar) ")
    t01 = ta + ((ci * ci) / (2 * 1005));
    print("Diffuser Outlet Temperature (t01) = %.3f" % t01, "(K)")
    # COMPRESSOR:
    p02 = pr * p01
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print("Compressor Outlet pressure (p02) = %.3f" % p02, "(bar)")
t02 = t01 + (((pr ** (0.4 / 1.4) - 1) * t01) / ce)
print("Compressor Outlet Temperature (t02) = %.3f" % t02, "(K)")
# power absorbed by Turbine = Work done by the Compressor:
t04 = t03 - ((1005 * (t02 - t01)) / (1148 * me))
print("Turbine Outlet Temperature (t04) = %.3f" % t04, "(K)")
# Combustion Camber:
p03 = p02 - (p02 * (pl / 100))
print("Combustion camber Outlet pressure (p03) = %.3f" % p03, "(bar)")
# Turbine:
t04d = t03 - ((t03 - t04) / te)
print("Turbine Outlet Temperature(ideal) (t04') = %.3f" % t04d, "(K)")
p04 = ((t04d / t03) ** (1.333 / 0.333)) * p03
print("Turbine Outlet Pressure (p04) = %.3f" % p04, "(bar)")
# Nozzle:
b = p04 / pa
print("Nozzle Pressure Ratio (p04/pa)= %.3f" % b)
c = 1 / ((1 - (0.333 / (2.333 * je))) ** (1.333 / 0.333))
print("Nozzle Critical Pressure Ratio (p04/pc)= %.3f" % c)
if (b > c):
    print("As (p04/pa)>(p04/pc) The nozzle is chocked")
    t05 = (2 / 2.333) * t04
    print("Nozzle Outlet Temperature (t05) = %.3f" % t05, "(K)")
    p05 = p04 / c
    print("Nozzle Outlet Pressure (p05) = %.3f" % p05, "(bar)")
    # Exit Density:
    d5 = (p05 * 100000) / (287 * t05)
    print("Exit Density = %.3f" % d5, "(Kg/m^3)")
    # Exit Velocity:
    cj = ((1.333 * 287 * t05)) ** 0.5
    print("Exit Jet Velocity (Cj) = %.3f" % cj, "(m/s)")
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        # Specific Exit Area:
        sa = 1 / (d5 * cj)
        print("Specific Exit area (A/m) = %.6f" % sa, "(m^2s/Kg)")
        # specific Thrust;
        Fs = (cj - ci) + (sa * (p05 - pa) * 100000)
        print("Specific Thrust (Fs) = %.3f" % Fs, "(Ns/Kg)")
        # Specific Fuel Consumption(SFC):
        SFC = (f / Fs) * 3600
        print("Specific Fuel consumption (SFC) = %.4f" % SFC, "(Kg/hr.N)")



    print("Turbojet engine calculations completed.")



def calculate_thrust_turbofan():
    print("\nEnter the data for TWIN SPOOL TURBOFAN ENGINE!!!\n")
    opr = float(input("Enter over all pressure ratio : "))
    fpr = float(input("Enter Fan pressure ratio : "))
    bpr = float(input("Enter Bypass Ratio : "))
    t04 = float(input("Enter Turbine inlet temperature in (K) : "))
    fct = float(input("Enter Fan,Compressor & Turbine polytropic efficiency: "))
    ne = float(input("Enter Isotropic efficiency of each propelling nozzle: "))
    me = float(input("Enter mechanical efficiency of each spool : "))
    ccpl = float(input("Enter combustion chamber pressure loss in (bar) : "))
    tmf = float(input("Enter Total air mass flow in (Kg/s) : "))
    p01 = float(input("Enter the ambient pressure in (bar) : "))
    t01 = float(input("Enter the ambient temperature in (K) : "))

print("_____
_____")
    # CALCULATION OF THRUST DUE TO COLD AIR:
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```
# Fan
p02 = p01 * fpr
t02 = t01 * ((p02 / p01) ** (0.4 / (fct * 1.4)))
print("p02 = %.3f" % p02, "(bar)")
print("t02 = %.3f" % t02, "(K)")
# nozzle
# p01=p08
a = (p02 / p01)
# let b=(p02/pc)
b = 1 / ((1 - (0.4 / (2.4 * ne))) ** (1.4 / 0.4))
print("(p02/p8) = %.3f " % a, "(bar)")
print("(p02/pc) = %.3f " % b, "(K)")
if (b > a):
    print("As (p02/pc) > (p02/p01) The Nozzle(COLD) is not Chocked")
    # To find velocity:(Nozzle)
    t8 = (1 - (ne * (1 - ((p01 / p02) ** (0.4 / 1.4))))) * t02
    print("t8 = %.3f " % t8, "(K)")
    # To find cold jet velocity
    cjc = (2 * 1005 * (t02 - t8)) ** (0.5)
    # To find mass flow rate of cold air
    mc = (bpr * tmf) / (bpr + 1)
    # To find thrust due to cold gas
    tc = mc * cjc
    print("velocity of cold air = %.3f" % cjc, "(m/s)")
    print("Mass flow rate of cold air = %.3f" % mc, "(Kg/s)")
    print("Thrust due to cold air = %.3f" % tc, "(N)")
    # CALCULATION OF THRUST DUE TO HOT AIR:
    # Compressor
    p03 = (opr / fpr) * p02
    t03 = t02 * ((p03 / p02) ** (0.4 / (fct * 1.4)))
    print("p03 = %.3f" % p03, "(bar)")
```

```
    print("t03 = %.3f" % t03, "(K)")
    # finding t05 by relating compresor and turbine work:
    t05 = t04 - ((1005 * (t03 - t02)) / (1148 * me))
    print("t05 = %.3f" % t05, "(K)")
    t06 = t05 - ((1005 * (bpr + 1) * (t02 - t01)) / (1147 * 0.99))
    print("t06 = %.3f" % t06, "(K)")
    p04 = p03 - ccpl
    print("p04 = %.3f" % p04, "(bar)")
    p05 = p04 * (1 / (t04 / t05) ** (1.33 / (fct * 0.33)))
    print("p05 = %.3f" % p05, "(bar)")
    p06 = p05 * (1 / (t05 / t06) ** (1.33 / (fct * 0.33)))
    print("p06 = %.3f" % p06, "(bar)")
    # To check chocking condition
    # let (p06/p01) be c;
    c = p06 / p01
    print("(p06/p01) = %.3f" % c)
    # let (p06/pc) be d;
    d = 1 / ((1 - (0.33 / (2.33 * ne))) ** (1.33 / 0.33))
    print("(p06/pc) = %.3f" % d)
if (d > c):
    print("As (p06/pc) > (p06/p01)The Nozzle(HOT) is not Chocked")
    t7 = (1 - (ne * (1 - ((p01 / p06) ** (0.33 / 1.33))))) * t06
    print("t7 = %.3f" % t7, "(bar)")
    # To find hot jet velocity
    cjh = (2 * 1147 * (t06 - t7)) ** 0.5
    print("velocity of hot air is = %.3f" % cjh, "(m/s)")
    # to find Thrust due to hot air
    th = (tmf * cjh) / (bpr + 1)
    print("Thrust due to hot air = %.3f" % th, "(N)")
    # Total thrust
    T = tc + th
```

```
        print("Total Thrust = %.3f" % T, "(N)")



engine_name = input("Enter Engine Name (Turbojet/Turbofan): ").strip().lower()


if engine_name == "turbojet":
    calculate_thrust_turbojet()
elif engine_name == "turbofan":
    calculate_thrust_turbofan()
else:
    print("Enter Turbofan/Turbojet engine")
```

OUTPUT -1:

Enter Engine Name (Turbojet/Turbofan): turbojet

Enter the data for TURBOJET ENGINE!!!

Enter the altitude in (Meters) : 10000

Enter mach number : 0.8

Enter compressor pressure ratio : 8

Enter power loss in combustion camber(in percent) : 4

Enter turbine inlet temperature (t03) in (K) : 1200

Enter compressor efficiency : 0.87

Enter turbine efficiency : 0.9

Enter inlet efficiency : 0.93

Enter jet efficiency : 0.95

Enter mechanical efficiency : 0.99

Enter the value of f : 0.0198

##

Pressure at 10000 m is = 0.260 (bar)

Temperature at 10000 m is = 223.160 (K)

Inlet velocity (Ci) = 239.554 (m/s)

Diffuser Outlet Pressure (p01) = 0.386 (bar)

Diffuser Outlet Temperature (t01) = 251.710 (K)

Compressor Outlet pressure (p02) = 3.088 (bar)

Compressor Outlet Temperature (t02) = 486.480 (K)

Turbine Outlet Temperature (t04) = 992.398 (K)

Combustion camber Outlet pressure (p03) = 2.965 (bar)

Turbine Outlet Temperature(ideal) (t04') = 969.331 (K)

Turbine Outlet Pressure (p04) = 1.262 (bar)

Nozzle Pressure Ratio (p04/pa)= 4.843

Nozzle Critical Pressure Ratio (p04/pc)= 1.919

As (p04/pa)>(p04/pc) The nozzle is chocked

Nozzle Outlet Temperature (t05) = 850.749 (K)

Nozzle Outlet Pressure (p05) = 0.657 (bar)

Exit Density = 0.269 (Kg/m^3)

Exit Jet Velocity (Cj) = 570.501 (m/s)

Specific Exit area (A/m) = 0.006510 (m^2s/Kg)

Specific Thrust (Fs) = 589.363 (Ns/Kg)

Specific Fuel consumption (SFC) = 0.1209 (Kg/hr.N)

Turbojet engine calculations completed.

OUTPUT-2:

Enter Engine Name (Turbojet/Turbofan): turbofan

Enter the data for TWIN SPOOL TURBOFAN ENGINE!!!

Enter over all pressure ratio : 25

Enter Fan pressure ratio : 1.65

Enter Bypass Ratio : 5

Enter Turbine inlet temperature in (K) : 1550

Enter Fan,Compressor & Turbine polytropic efficiency: 0.9

Enter Isotropic efficiency of each propelling nozzle: 0.95

Enter mechanical efficiency of each spool : 0.99

Enter combustion chamber pressure loss in (bar) : 1.5

Enter Total air mass flow in (Kg/s) : 215

Enter the ambient pressure in (bar) : 1

Enter the ambient temperature in (K) : 288

##

p02 = 1.650 (bar)

t02 = 337.625 (K)

(p02/p8) = 1.650 (bar)

(p02/pc) = 1.964 (K)

As (p02/pc) > (p02/p01) The Nozzle(COLD) is not Chocked

t8 = 294.866 (K)

velocity of cold air = 293.167 (m/s)

Mass flow rate of cold air = 179.167 (Kg/s)

Thrust due to cold air = 52525.790 (N)

p03 = 25.000 (bar)

t03 = 800.171 (K)

t05 = 1140.981 (K)

t06 = 877.455 (K)

p04 = 23.500 (bar)

p05 = 5.960 (bar)

p06 = 1.839 (bar)

(p06/p01) = 1.839

(p06/pc) = 1.917

As (p06/pc) > (p06/p01)The Nozzle(HOT) is not Chocked

t7 = 760.547 (bar)

velocity of hot air is = 517.869 (m/s)

Thrust due to hot air = 18556.961 (N)

Total Thrust = 71082.751 (N)