مدينة زويل للعلوم والتكنولوجيا
Zewail City of Science and Technology

Gas Turbine Engines SPC 417
Project
Due: Thursday, June 23, 2022 [11:59 pm]

A subsonic transport aircraft with 4 turbojet engines has the following performance data:

Segment	**Takeoff**	**Climb**	**Cruise**
M_0 **(Flight Mach Number)**	0.286	–	0.89
h (Altitude)	Sea Level	6 Km	8.7 Km
Drag Polar	$C_D = 0.01 + 0.065C_L^2$		
Estimated Average Aircraft Weight (kg)	140301.25	137503.75	113725

- Rate of climb=10 m/s at an altitude of 6 km and speed of 216 m/s.
- Rate of climb= 6.35 m/s at sea level and speed of 241 m/s.
- The maximum TIT allowed is 1170 K.
- Assume the engine specific fuel consumption to remain constant during each segment.
- To get the integration limits assume that the total fuel weight is divided to 10% for takeoff and climb 80% for cruise and 10% for loiter and landing.
- $\alpha = 10^\circ$ at sea level.

General characteristics of this aircraft:

$W_{max} = 141700kg$, $W_{empty} = 64600kg$, $W_{payload} = 21150kg$ & $Area_{wing} = 280m^2$

It is required to design a turbojet engine that meets the thrust requirements for all mission segments (takeoff, climb, and cruise) for this subsonic transport aircraft. You need to select the engine design parameters and size that maximize the aircraft range using the simplified method analysis. Results should contain representative figures of the engine performance at each segment and comparisons between different scenarios should be included. Comparisons between optimal engine for the cruise and optimal engine for the overall mission are also required.