Massachusetts Institute of Technology
Department of Aeronautics and Astronautics
Cambridge, MA 02139

16.003/16.003 Unified Engineering III, IV
Spring 2009

Problem Set 7

Name: _____

Due Date: 4/3/2009

	Time Spent (min)
T15	
T16	
T17	
S2	
Study Time	

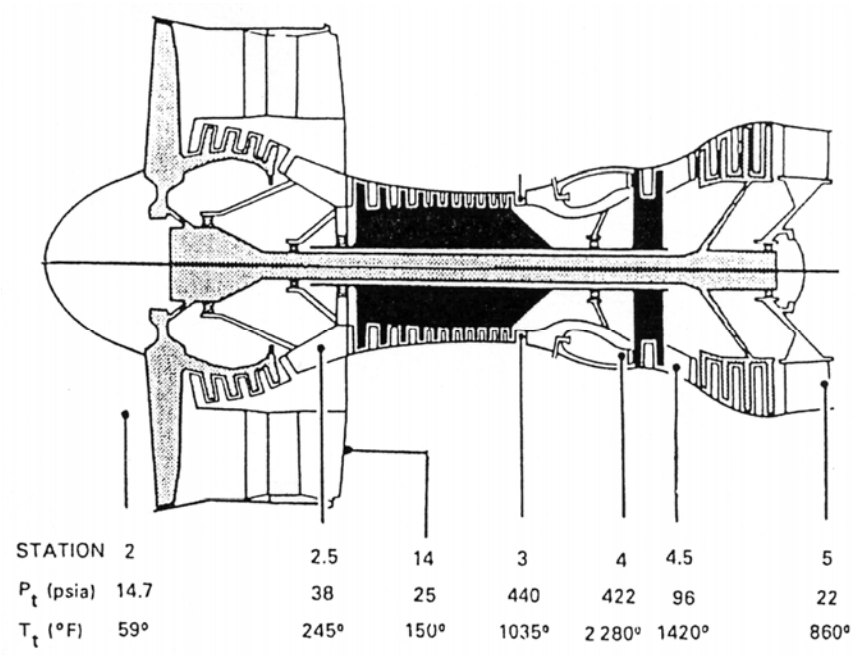
Announcements:

Unified Engineering Spring 2009
Thermodynamics & Propulsion Z. S. Spakovszky

(Add a short summary of the concepts you are using to solve the problem)

Problem T15

The internal stagnation quantities of a PW4000 engine are shown in the figure below. Assume liquid C_8H_{18} is coming in at standard conditions.



a) What is the fuel/air ratio (mass flow of fuel/mass flow of air through the combustor) of the engine?

b) Why isn't the fraction of the air utilized equal to unity? What functions are served by the excess air?

(Add a short summary of the concepts you are using to solve the problem)

Problem T16

Gaseous acetylene, C_2H_2, at 25 C is burned with 400 % theoretical air that enters the combustion chamber at 550 K. The products of combustion leave at 1100 K.

Calculate the heat loss from the combustion chamber per kg of acetylene burned.

(Add a short summary of the concepts you are using to solve the problem)

Problem T17

Ethene, C_2H_4, and propane, C_3H_8, in a 1:1 mole ratio as gases, are burned with 120% theoretical air in a gas turbine. The fuel is at a temperature of 25 C and a pressure of 1 MPa. It is mixed with air which has been isentropically compressed from atmospheric conditions, 25 C and 100 kPa to 1 MPa.

a) Find the mixture temperature before combustion.

b) What is the adiabatic flame temperature?

c) The turbine exit temperature is 800 K with an exit pressure of 100 kPa. Changes in kinetic energy can be neglected. What is the net work delivered by the gas turbine engine, assuming an isentropic compressor?

Signals 2

Please do problems 2.21, 2.22, and 2.26 from Oppenheimer and Willsky.