16.050 Thermal Energy

Recitation #6 – Fall 2002

Problem 1:

Consider the gas turbine engine shown schematically on the board. The system consists of an isothermal and reversible compressor, a burner, and two adiabatic and irreversible turbines. You are given the following system specifications:

P_1=1 bar
T_1=350 K
PR=20
T_3= 1000 K
P_5= P_1
Turbine 1 & 2 adiabatic efficiency= 0.85

You may assume air is the working fluid with perfect gas behavior and cp= 1kJ/kgK. Neglect the kinetic and potential energy terms, and the burner pressure drop.

a) Find the net work per kg of fluid.
b) Find the thermal efficiency of the cycle.
c) Sketch the cycle on a T-s diagram.