

ENSC 461

Assignment #2 (Cycles)

Assignment date: Tuesday Jan 23, 2011

Problem 1: (the Stirling cycle)

Show that for an idealized Stirling cycle, the thermal efficiency is:

$$\eta_{th} = 1 - \frac{T_L}{T_H}$$

Problem 2: (Otto cycle)

An open, ideal Otto-cycle engine has a compression ratio of 10:1. The air just prior to the compression stroke is at 20C and 100 kPa. The maximum cycle temperature is 2000 C. The thermal efficiency of the ideal Otto cycle is 0.60.

Rather than simply discharging the air to the atmosphere after expansion in the cylinder, an isentropic turbine is installed in the exhaust to produce additional work. Assume constant specific heats, the mass flow rate through the turbine is steady and the pressure at the inlet to the cylinder is identical to the pressure at the discharge of the turbine.

- i) draw a $T-s$ diagram process for the compound engine
- ii) determine the work output of the turbine, (kJ/kg)
- iii) determine the overall thermal efficiency of the compound engine.

