

ENGRD 221: ENGINEERING THERMODYNAMICS

Lecture 3: August 30, 2007

Reading Assignments (from Moran & Shapiro, Sixth Edition): Sections 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6 & 2.2.7 (briefly as needed in HW problems), 2.3, 2.4 & 2.5 (we will return to Section 2.5 in Lecture 4 as well). Be sure you also read ALL example problems discussed in the text in the above sections.

Topics covered:

- Work, mechanical work flow, work transfer at the system boundary, path dependence of the work
- Convention for the work (W) sign
- Evaluating work at the boundary, total work done due to the expansion of a gas ($\int (P_{\text{gas}} - P_{\text{amb}})dV$), work to raise the piston ($\int mgdx$)
- Evaluating the work of expansion $\int PdV$ ($P = P_{\text{gas}} - P_{\text{amb}}$) for quasistatic processes of ideal gases: polytropic processes ($PV^n = \text{constant}$), isobaric ($P = \text{constant}$) and isothermal ($T = \text{constant}$)
- Brief introduction to the first law of thermodynamics
- Examples motivating internal energy
- Energy transfer by heat
- Heat conduction, convection and radiation
- Adiabatic processes, adiabatic work
- Heat as a result of non-adiabatic processes, definition of heat
- Sign conventions: Heat transfer to and from the system
- The first law of thermodynamics for closed systems
 - Energy balances
 - Various examples of energy balances for practical thermodynamic systems
 - Application of energy balances for alternative choices of the thermodynamic system