Ph.D. Qualifying Examination

Thermodynamics

Spring 2014

Logistics Notes:

- Time allowed: 2 hours.
- Exam is open-book (one book) and closed-notes; one sheet (8.50 in. $\times$ 11.00 in.) of notes is allowed.
- Calculators are allowed.
- Laptops, cell phones, and similar electronic devices are not allowed.

Qualifying Examination Spring 2014
Thermodynamics
2 hours, Open book (one book, one sheet of note), calculator is allowed
State your assumptions

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1. (55 points) An insulated air tank has a volume of 0.04 m^3 with air at pressure of 100 kPa and temperature of 17 ^oC. An adiabatic and reversible compressor is started so that it charges the tank up to a pressure of 1000 kPa and then it shuts off. Assuming that air behaves as an ideal gas, calculate the temperature of the air in the tank after the compression process and the amount of work required filling the tank.

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2. (45 points) A steam turbine receives steam at a pressure of 1 MPa and a temperature of 300 ^oC. The steam leaves the turbine at a pressure of 15 kPa. The work output of the turbine is measured and is found to be 600 kJ/kg of steam flowing through the turbine. Determine the efficiency of the turbine and the quality of the steam exiting the turbine.