
Thermodynamics and Energy Conversion (EN 203) – Autumn 2020-21**Problem Set - 6****Power Systems**

1. Ideal Brayton Cycle

Air enters the compressor of an ideal air-standard Brayton cycle at 100 kPa, 300 K, with a volumetric flow of 5 m³/s. The compressor pressure ratio is 10. The turbine inlet temperature is 1400 K. Determine (a) the thermal efficiency of the cycle, (b) the back work ratio, (c) the *net* power developed, in kW.

2. Brayton Cycle with Irreversibility

Reconsider the case of question#1, but include in the analysis that the turbine and compressor each have an isentropic efficiency of 80%. Determine for the modified cycle (a) the thermal efficiency of the cycle, (b) the back work ratio, (c) the *net* power developed, in kW.

3. Otto Cycle

The temperature at the beginning of the compression process of an air-standard Otto cycle with a compression ratio of 8 is 300 K, the pressure is 1 bar, and the cylinder volume is 560 cm³. The maximum temperature during the cycle is 2000 K. Determine (a) the temperature and pressure at the end of each process of the cycle, (b) the thermal efficiency, and (c) the mean effective pressure in atm.

4. Diesel Cycle

At the beginning of the compression process of an air-standard Diesel cycle operating with a compression ratio of 18, the temperature is 300 K and the pressure is 0.1 MPa. The cutoff ration for the cycle is 2. Determine (a) the temperature and pressure at the end of each process of the cycle, (b) the thermal efficiency, and (c) the mean effective pressure in atm.

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