

ME 201

Thermodynamics

Exam 2

Directions: Open notes (including course web postings). No books, computers, or phones. Any calculator is fair game.

Problem 1

Water at 15 MPa and 60°C enters a boiler and exits at 650°C. It then passes through a turbine that exhausts to a pressure of 7 kPa.. Determine

- The heat transfer in the boiler in kJ/kg
- The phase at the exit of the turbine
- The work of the turbine in kJ/kg
- The mass flow rate of water required to produce 300- kw of power from the turbine

Problem 2

A refrigeration machine is used to air condition a car. The size of the refrigerator is dictated by how quickly we wish to cool the car down after it has been sitting in the sun. The outside air temperature is 35°C. The inside car temperature is 290 K. The mass of air in the car interior is 10 kg. During cool down, the car interior drops from 310 K to 290 K and stays at a pressure of 100 kPa. Determine the minimum power required for the refrigerator for a cool down time of 300 seconds..

Problem 3

A hyperbaric oxygen chamber is used to accelerate the healing of open wounds. The chamber consists a of rigid wall cylinder of volume 4 m³. The chamber initially contains O₂ at 100 KPa and 300 K. During pressurization O₂ at 300 kPa and 310 K is added to the chamber. The final temperature and pressure of the chamber are 290 K and 200 kPa. Determine the heat transfer from the chamber in kJ.

Problem 4

A piston cylinder system undergoes a polytropic process with a polytropic exponent of 1.39 during which the volume increases 5 times. For initial conditions of 1500 K and 700 kPa, determine the boundary work and heat transfer in kJ/kg.