PRACTICE EXAM

Difficulty: MEDIUM

Questions: 10

Thermodynamics & Fluids Exam - Chapters 3 & 4

Instructions: Please answer all questions to the best of your ability. Show your work for problem-solving questions.

Section 1: Multiple Choice (4 points each, 40 points total)

Question 1: Specific heat ratio, k, is defined as:
A) cp - cv
B) cv / cp
C) cp / cv
D) cp * cv

Question 2: For an incompressible substance, which property is typically assumed to be constant?
A) Temperature
B) Pressure
C) Specific volume
D) Internal energy

Question 3: In a polytropic process described by pV^n = constant, what type of process occurs when n = 0?
A) Isochoric
B) Isothermal
C) Isobaric
D) Isentropic

Question 4: Which of the following devices is primarily designed to increase the pressure of a fluid?
A) Nozzle
B) Diffuser
C) Turbine
D) Compressor

Question 5: At steady state, what is true about the mass flow rate into and out of a control volume?
A) The mass flow rate in is greater than the mass flow rate out.
B) The mass flow rate out is greater than the mass flow rate in.
C) The mass flow rate in is equal to the mass flow rate out.

D) The mass flow rate in and out are both zero.

Section 2: Short Answer (6 points each, 30 points total)

Question 6: Explain the two special methods used to evaluate properties of liquids and solids when compressed liquid tables are unavailable.

Question 7: Describe the key assumptions made when modeling a substance as incompressible.

Question 8: Define a polytropic process and provide two examples of processes with specific values of 'n' and their corresponding names.

Question 9: What is the primary purpose of a throttling device, and what usually happens to the pressure and temperature across it?

Question 10: What is the conservation of mass principle and why is it important in control volume analysis?

Section 3: Problem Solving (10 points each, 30 points total)

Question 11: A 2-kg block of aluminum at 100°C is placed in 1 kg of water at 20°C in an insulated container. Assuming the aluminum and water are incompressible with constant specific heats of 0.9 kJ/kg.K and 4.18 kJ/kg.K, respectively, determine the final equilibrium temperature of the system.

Question 12: Air enters a diffuser at 200 kPa and 25°C with a velocity of 300 m/s and exits with a velocity of 50 m/s. Assuming the process is adiabatic and kinetic energy effects are significant, determine the exit temperature of the air, assuming constant specific heats with *cp* = 1.005 kJ/kg·K. *Note: This problem only needs to be set up with the correct equation(s) ready to be solved.*