

# PRACTICE EXAM

**Difficulty: MEDIUM**

**Questions: 10**

## MEC511 Thermodynamics & Fluids - Exam

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

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

Instructions: Choose the \*one best\* answer for each question.

**Question 1:** For an incompressible substance, which property is typically assumed to vary \*only\* with temperature?

- A) Specific Volume
- B) Density
- C) Specific Internal Energy
- D) Enthalpy

**Question 2:** In a polytropic process where  $n = 0$ , what type of process is it?

- A) Isothermal
- B) Isochoric (Isometric)
- C) Isobaric
- D) Isentropic

**Question 3:** What does 'k' represent in the context of thermodynamics?

- A) Specific Heat at Constant Volume
- B) Specific Heat at Constant Pressure
- C) Specific Heat Ratio
- D) Compressibility Factor

**Question 4:** In control volume analysis at steady state, what is true about the mass flow rate?

- A) The inlet mass flow rate is greater than the outlet mass flow rate.
- B) The inlet mass flow rate is less than the outlet mass flow rate.
- C) The inlet mass flow rate is equal to the outlet mass flow rate.
- D) The mass flow rate is zero.

**Question 5:** Which of the following devices typically involves a significant pressure drop and is often used to reduce the temperature of a fluid?

- A) Turbine
- B) Nozzle
- C) Throttling Device
- D) Heat Exchanger

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

Instructions: Answer each question in 2-3 sentences.

**Question 6:** Explain why the specific volume of a liquid changes very little with pressure at a fixed temperature.

**Question 7:** Describe the key difference between a nozzle and a diffuser in terms of their effect on fluid velocity and pressure.

**Question 8:** What is the significance of assuming a substance is incompressible when performing thermodynamic calculations?

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

Instructions: Show all work and clearly indicate your final answer.

**Question 9:** A 2-kg block of copper at 80°C is dropped into 4 kg of water at 20°C. Assuming the system is isolated and the copper and water are incompressible, determine the final equilibrium temperature. The specific heat of copper is 0.385 kJ/kg·K and the specific heat of water is 4.18 kJ/kg·K.

**Question 10:** Air enters a diffuser at 200 kPa and 25°C with a velocity of 300 m/s. It exits with a velocity of 50 m/s. Assuming steady-state conditions and neglecting potential energy changes, determine the exit temperature of the air. Assume air is an ideal gas with constant specific heats,  $c_p = 1.005$  kJ/kg·K.