1. Explain or define the following terms: (15%)
   (1). Heat (2). Cycle (3). Continuum (4). Adiabatic Process
   (5). The Zeroth Law of Thermodynamics

2. Using the basic dimensions: Length(L), Time(T), Mass(M) and Temperature(K) to express the following dimension of physical quantities. (15%)
   (1). Energy (2). Density (3). Pressure (4). Entropy (5). Power

3. A cyclic engine operates between two thermal energy reservoirs at 900°C and 21°C. The engine receives 1800 Btu of heat from high temperature reservoir. Calculate the maximum Work that can be obtained. (15%)

4. Prove the Clausius inequality. (20%)

5. Show that
   (1). $T\,d\,s = d\,u + p\,d\,v$ (5%)
   (2). $T\,d\,s = d\,h - v\,d\,p$ (5%)
   where T represents the temperature, s the specific entropy, u the specific internal energy, p the pressure, v the specific volume, h the specific enthalpy.

6. (1). Explain the meaning of the Joule-Thomson coefficient and derive the equation $m_J = \frac{1}{C_P}\left[T\left(\frac{\partial n}{\partial T}\right)_p - n\right]$ by using the relationships $h = h(T, p)$, $T\,ds = d\,h - n\,dp$, and $\left(\frac{\partial n}{\partial T}\right)_p = -\left(\frac{\partial s}{\partial p}\right)_T$. (20%)
   (2). Show the $m_J = 0$ for an ideal gas. (5%)