淡江大學八十七學年度碩士班入學考試試題

系別： 航空太空工程學系　　科目： 熱力學

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一. 簡答題（50分，每題5分）

(1) What is the difference between the macroscopic and microscopic forms of energy?

(2) What is the state postulate?

(3) Is it true that it takes more energy to vaporize 1 kg of saturated liquid water at 100°C than it would to vaporize 1 kg of saturated liquid water at 120°C?

(4) On a hot summer day, a student turns his fan on when he leaves his room in the morning. When he returns in the evening, will the room be warmer or cooler than the neighboring rooms? Why? Assume all the doors and windows are kept closed.

(5) Will the temperature of air rise as it is compressed by an adiabatic compressor? Why?

(6) In the absence of any friction and other irreversibilities, can a heat engine have an efficiency of 100 percent? Explain

(7) Is it possible for the entropy change of a closed system to be zero during an irreversible process? Explain.

(8) In large compressors, the gas is frequently cooled while being compressed to reduce the power consumed by the compressor. Explain how cooling the gas during a compression process reduces the power consumption.

(9) Does a power plant that has a higher thermal efficiency necessarily have a higher second-law efficiency than one with a lower thermal efficiency? Explain.

(10) Why are high compression ratios not used in spark-ignition engines?

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二. 計算題 (25分)

A turbojet aircraft is flying with a velocity 280 m/s at an altitude of 6100 m, where the ambient conditions are 48 kPa and −13°C. The pressure ratio across the compressor is 13, and the temperature at the turbine inlet is 1300 K. Assuming ideal operation for all components and constant specific heats for air at room temperature, determine (*a*) the pressure at the turbine exit, (*b*) the velocity of the exhaust gases, and (*c*) the propulsive efficiency.

Notes:

Air: $C_p = 1.0\ KJ/kg$, $\gamma = \frac{C_p}{C_v} = 1.4$,

isentropic relations: $\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{v_1}{v_2}\right)^{\gamma-1}$

三. 計算題 (25分)

An ideal dual cycle has a compression ratio of 12 and uses air as the working fluid. At the beginning of the compression process air is at 100 kPa and 30°C, and occupies a volume of 1.2 L. During the heat addition process, 0.3 kJ of heat is transferred to air at constant volume and 1.1 kJ at constant pressure. Using constant specific heats evaluated at room temperature, determine the thermal efficiency of the cycle.

Notes:

Air: $R = 0.2968\ kpa \cdot m^3/kg \cdot K$, $\gamma = \frac{C_p}{C_v} = 1.4$, $C_p = 1.0\ KJ/kg$

isentropic relations: $\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = \left(\frac{v_1}{v_2}\right)^{\gamma-1}$