國立臺北科技大學 101 學年度碩士班招生考試

系所組別：1410 能源與冷凍空調工程系碩士班甲組

第二節 冷凍空調原理 試題

> **注意事項：**
>
> 1.本試題共五題，配分共 100 分。
> 2.請標明大題、子題編號作答，不必抄題。
> 3.全部答案均須在答案卷之答案欄內作答，否則不予計分。

(1) (10%) Using the temperature-entropy chart (T-s chart) of water to explain the definition and physical meanings of:

(a) Relative humidity,

(b) Dew-point temperature.

(2) (15%) A fan-duct system is designed so that when the air temperature is 20℃, the mass flow is 5.0kg/s when the fan speed is 20 r/s and the fan motor requires 4.0kW. A new set of requirements is imposed on the system : the operating air temperature is change to 40℃,and the fan speed is increased so that the same mass flow of air prevails. What are the revised fan speed and power requirement?(the density of air is 1.2kg/m^3 at 20℃)

(3) (20%) One instrument for measuring the rate of airflow is a venturi, as shown in Fig.1, where the cross-sectional area is reduced and the pressure difference between positions A and B measured. The flow rate of air having a density of 1.15 kg/m^3 is to be measured in a venturi where the area at position A is 0.5 m^2 and the area at B is 0.4m^2. The deflection of water (density = 1000 kg/m^3) in a manometer is 20 mm. The flow between A and B can be considered to be frictionless so that Bernoulli's equation applies.

(a) What is the pressure difference between positions A and B?
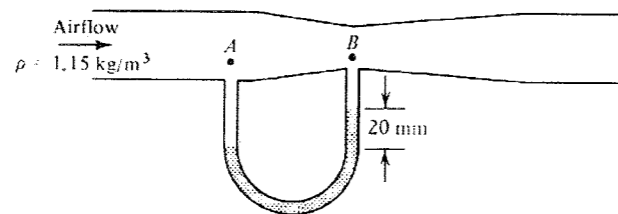
(b) What is the airflow rate?

Fig.1 A venturi for measuring air flow

(4) (40%) A stream of outdoor air is mixed with a stream of return air in an air-conditioning system that operates at 101 kPa pressure. The flow rate of outdoor air is 2 kg/s, and its condition is 35°C dry-bulb temperature and 25°C wet-bulb temperature. The flow rate of return air is 3 kg/s, and its condition is 24°C and 50 percent relative humidity. Determine (a) the enthalpy of the mixture, (b) the humidity ratio of the mixture, (c) the dry-bulb temperature of the mixture from the properties determined in parts (a) and (b), and (d) the dry-bulb temperature by weighted average of the dry-bulb temperatures of the entering streams.

(5) (15%) A centrifugal fan is operating as shown in Fig. 2 at point 1. Estimate the capacity, total pressure, and power requirement when the speed is increase to 1050 rpm. The initial power requirement is 12 hp.
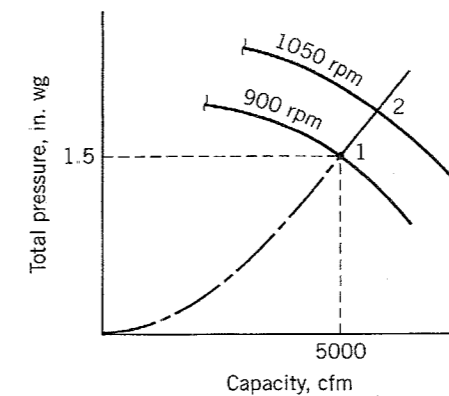

Fig.2

ASHRAE PSYCHROMETRIC CHART NO.1

NORMAL TEMPERATURE　SEA LEVEL

BAROMETRIC PRESSURE　101.325 kPa

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$$\text{SENSIBLE HEAT} = \frac{\Delta H_s}{\Delta H_t}$$

$$\frac{\text{ENTHALPY}}{\text{HUMIDITY RATIO}} = \frac{\Delta h}{\Delta W}$$

HUMIDITY RATIO w, g/kg$_{da}$

VOLUME CUBIC METRE PER KILOGRAM DRY AIR

WET-BULB TEMPERATURE, °C

SATURATION TEMPERATURE, °C

ENTHALPY h, kJ/kg$_{da}$

RELATIVE HUMIDITY

DRY-BULB TEMPERATURE, °C