

環控農業工程學 期末考試卷

姓名：_____ 學號：_____ 系級：_____

說明：請使用試卷作答紙計算，在題目卷中表格內填入答案。兩項均需繳交。每題 20 分，滿分 120 分。

1. Fill the blanks of the following Table with the help of the Psychart software. Assuming the altitude is 300 m. Air at state 1 ($0.8 \text{ m}^3/\text{s}$) passing through an evaporative cooling pad at 80% efficiency becomes air at state 1', termed 'Air after pad'. State 3 air is the mixing of 'air after pad' with another stream of air at state 2 with $0.2 \text{ m}^3/\text{s}$ flow rate.

State	Tdb, °C	RH, %	?, m^3/kg	m, kg/s	Tdp, °C	Twb, °C	WBD, °C
1	30	60					
1'							
2	35	80					
3							

2. Two building roofs both having a 1:4 slope are irradiated with solar heat at a rate of $700 \text{ W}/\text{m}^2$. Air temperature is $28 \text{ }^\circ\text{C}$ and the sky is clear. The surface convective heat transfer coefficient is $30 \text{ W}/\text{m}^2\text{K}$. Calculate the Sol-Air temperature of both roofs. Assuming the UA of the house under roof A and B are $100 \text{ W}/\text{K}$. What are the cooling load (in tons) required in order to maintain indoor at $25 \text{ }^\circ\text{C}$?

Roof	solar absorptance	thermal emittance	Sol-Air T, °C	Cooling Load, in kW	Cooling Load, in tons
A	0.8	0.95			
B	0.4	0.7			

3. Determine the coefficients for a 2nd order polynomial ($Q_s = a + b \cdot T_{air} + c \cdot T_{air}^2$) to represent the sensible heat production of 30000 white leghorn laying hens averaging 1.9 kg body mass. Please includes the heat added by lights at $40 \text{ W}/\text{m}^2$. The building floor area is 1000 m^2 . When the indoor was kept at $24 \text{ }^\circ\text{C}$, what is the sensible heat produced.

	Coefficient a	b	c
For hens only			
lights only			
Hens + light			

4. A swine barn housing 1000 growing pigs (avg. 55 kg body mass) is located at 800 m elevation. Assuming UA+FP of the building is 800 W/K and desired indoor conditions are 18 °C, 60% RH. With the help of Ventgrph software, (A). find the intersection point of temperature control and humidity control for outdoor T at -20 to 5 °C and 80% RH. (B). How much supplementary heat is required to maintain the barn at 18 oC indoors when it is -20 °C outdoor.

Case A	T= °C	ventilation rate=	m ³ /s
Case B	Amount of heat required =		kW

5. A barn is to house 100 milking cows (avg. 550 kg weight). The UA+FP of the house equals 1000 W/K. Assuming indoor T is to keep at 25 °C and the outdoor T and RH are 36 °C, 70% RH, respectively. Find the maximum ventilation rate for the system. If an 80% efficiency pad was installed, what will be the new maximum ventilation rate required. How many fans can be saved by installing the pad system assuming one fan can provide 0.8 m³/s.

Without Pad	maximum ventilation rate=	m ³ /s
With Pad	maximum ventilation rate=	m ³ /s
	Number of fans saved (take integer)	

6. A Dairy barn housed 62 milking cows avg. 550 kg body mass. A 5 stages ventilation system is planned (1.8, 2.5, 3.5, 5.3, 8.8 m³/s). The barn is located 300 m above sea level, have UA+FP of 640 and 105 W/K. The production space is between 5 and 25 oC, and 30 and 80% RH. T setpoints of 8,12,16 and 20 will be specified. What is the EEI of the system using 嘉義與宜蘭氣象資料 and the help of WEATHER software.

嘉義(測站編號 748)	EEI 值=	%
宜蘭(測站編號 708)	EEI 值=	%