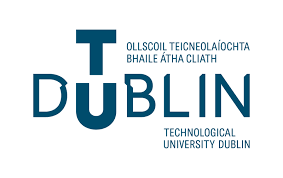
**

SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

Bachelor of Engineering (Hons) BE in Elect/Cont/Comm/Comp Eng

Program Code: (DT021A)

<YEAR 4>

Name of Module: ([Thermodynamics, ENER4601](https://brightspace.tudublin.ie/d2l/home/179100))

**TU Dublin – Grangegorman**

**Cooling Tower Experiment**

Student Name: \_Talha Tallat, D18124645 \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Academic Lecturer:  \_John McGrory\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_

Submission Date: \_26th November 2021\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Table of Contents

[Table of Contents 2](#_Toc88827044)

[1. Experiment Aim 3](#_Toc88827045)

[1.1. Introduction to Cooling Tower 3](#_Toc88827046)

[2. Laboratory Tasks 3](#_Toc88827047)

[2.1. Part 1 – Diffusion 3](#_Toc88827048)

[3. Procedure 4](#_Toc88827049)

[3.1. The test with 0.5kw 5](#_Toc88827050)

[3.1.1. Mass flow of Air 6](#_Toc88827051)

[3.1.2. Energy transferred to the water 6](#_Toc88827052)

[3.1.3. Energy transferred to Air 6](#_Toc88827053)

[3.1.4. Evaporation Rate 7](#_Toc88827054)

[3.1.5. Summary 7](#_Toc88827055)

[3.2. The test with 1kw 8](#_Toc88827056)

[3.2.1. Mass flow of Air 9](#_Toc88827057)

[3.3. The test with 1.5kw 10](#_Toc88827058)

[3.3.1. Functions of silicon dioxide in the fabrication of semiconductor ICs 10](#_Toc88827059)

[3.3.2. Two properties photoresists possess 10](#_Toc88827060)

[3.3.3. Name two steps of a diffusion process 10](#_Toc88827061)

[4. References 10](#_Toc88827062)

Table of Figures

[Figure 1 - Psychrometric graph of the colling tower experiment 3.1 5](#_Toc88827063)

[Figure 2 - Psychrometric graph of the colling tower experiment 3.2 8](#_Toc88827064)

List of Table

[Table 1 - Summary of 0.5kw label switch 7](#_Toc88827065)

# Experiment Aim

Demonstrating awareness and comprehension of the processes found in a forced draft cooling   
tower.

## Introduction to Cooling Tower

The

A picture containing text

Description automatically generated

# Laboratory Tasks

## 2.1. Part 1 – Diffusion

View the “Cooling Tower Overview” Video. This video describes the operation of the whole rig and all its parts. In addition an explanation is given for the evaporative cooling   
phenomenon and the design of cooling tower stack media. It shows the heat exchange   
between “Electricity to Water”, and “Water to Air” and the “Evaporative Top Up” water rate. An important aspect is the balance of energy throughout the whole system.

View the “Cooling Tower Experiment” Video. This video goes through the calculations needed for this experiment using a sample set of results.   
3. Your submission:   
a) Beside your name is your assigned Experiment Data #1, #2 or #3. You must use your   
assigned data. All the work must be your own.   
b) Complete the calculations for all three tests, 0.5kw, 1.0kw and 1.5kw in your Experiment   
Data #. Clearly show your work, calculations, steps and graphs used.   
c) Plainly state if the process is as you would expect! Are all three independent checks, (1)   
electrical energy to water energy, (2) water energy to air energy and (3) Top up water   
actually matching the expected calculated top up water values? Confirm if you believe   
from the data that the switches are connected to the appropriate heating element or   
were they switched by an unscrupulous technician. Don’t just state that “They   
were/weren’t switched”, you need to explain why, from what your observed, you have   
chosen that answer.   
d) Answer the following questions:   
a. Why are temperatures T3 and T4 closer to each other in value than T1 and T2.   
What does this mean?   
b. Why is T1 always hotter than T3 in these test results? Surly, if we are dissipating   
energy the outlet air temperature T3 should be hotter than the inlet air temperature T1! Is the machine broken? Would the T1 always be hotter than T3?

# Procedure

Table

Description automatically generated

## 3.1. The test with 0.5kw

Diagram

Description automatically generated

Figure 1 - Psychrometric graph of the colling tower experiment 3.1

3.1.1. Mass flow of Air

Using Bernoulli’s equation in this experiment to calculate the mass flow of air.

3.1.2. Energy transferred to the water

The amount of energy transfer calculated from the first principle is 1.05kw even though the switch shown to be 0.5kw. Therefore, calculating furthermore to get more evidence.

3.1.3. Energy transferred to Air

**0.914 kw**

So, the energy transferred to Air is about equal to energy transferred to water.

3.1.4. Evaporation Rate

**=**

=

**=**

3.1.5. Summary

Table 1 - Summary of 0.5kw label switch

|  |  |  |
| --- | --- | --- |
| **Energy to water** | **Energy to Air** | **Measured Evaporating rate** |
|  | 0.914 kw | 0.000415 |
|  |  | **Calculated Evaporating rate** |
|  |  |  |

## 3.2. The test with 1kw

Diagram

Description automatically generated

Figure 2 - Psychrometric graph of the colling tower experiment 3.2

3.2.1. Mass flow of Air

Using Bernoulli’s equation in this experiment to calculate the mass flow of air.

## 3.3. The test with 1.5kw

Chart

Description automatically generated with medium confidence

3.3.1. Functions of silicon dioxide in the fabrication of semiconductor ICs

There are m

3.3.2. Two properties photoresists possess

exposure

3.3.3. Name two steps of a diffusion process

The

# 4. References

**[1]** "chapter 6: Carrier Motion", *http://osp.mans.edu.eg/*, 2021. [Online]. Available: http://osp.mans.edu.eg/rehan/solid\_2004/ch6.htm#1. [Accessed: 23- Oct- 2021]

**[2]** "The manufacturing process", *Bwrcs.eecs.berkeley.edu*, 2021. [Online]. Available: http://bwrcs.eecs.berkeley.edu/Classes/icdesign/ee141\_f01/Notes/chapter2.pdf. [Accessed: 23- Oct- 2021]

**[3]** "Oxidation Process in IC Fabrication", Circuitstoday.com, 2021. [Online]. Available: https://www.circuitstoday.com/oxidation-process-in-ic-fabrication. [Accessed: 26- Oct- 2021]