

**TULISKAN JUDUL DISINI**

**A MASTER'S THESIS**

Submitted to  
Graduate School of Electrical Engineering



By

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**APPROVAL PAGE**

**MASTER'S THESIS**

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**Approved and authorized to fulfil one of the requirements of  
Program of Master of Electrical-Telecommunication Engineering  
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## **SELF DECLARATION AGAINST PLAGIARISM**

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct. I have full cited and referenced all materials and results that are not original to this work.

16<sup>th</sup> October, 2025

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## ABSTRACT

Quantum technology in recent decades is attracting great attentions, especially on the quantum computing, quantum communications, and quantum key distribution (QKD), which are candidates for the sixth generation of telecommunications (6G) in 2030 and beyond.

**Keywords:** CSS, Decoherence, Depolarizing Channels, Red-Muller codes, QWER.

## **ACKNOWLEDGEMENTS**

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1. Allah SWT, for all the love, guidance and forgiveness in every mistake that the author has ever done and Rasulullah SAW, as role model who inspire writer in living life and trying to be better.

## **PREFACE**

Alhamdu lillahi rabbil 'alamin, praise to Allah, the most gracious, the most merciful, with the mercy and guidance, the author has successfully finished this thesis with the title of **"TULISKAN JUDUL DISINI"**. The author compiled this thesis to be filled in the graduation requirements in Program of Master of Electrical-Telecommunication Engineering, School of Electrical Engineering, Telkom University.

Some parts of this thesis also have been submitted to The 9th Asia Pacific Conference on Wireless & Mobile (APWIMOB) Conference 2024.

The suggestions for improving this thesis are highly appreciated. Hopefully, this thesis is expected to be improved and provided contributions for the reader and Indonesia especially for education and research of telecommunication on the future.

Bandung, 16<sup>th</sup> October, 2025

REYNALDHI TRYANA GRAHA

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## **LIST OF ABBREVIATION**

1G	:	First Generation
2G	:	Second Generation
3G	:	Third Generation
4G	:	Fourth Generation
5G	:	Fifth Generation
6G	:	Sixth Generation
CSS	:	Calderbank-Shor-Steane
MDS	:	Maximum distance separable
LUT	:	Look Up Table
QECC	:	Quantum Error Correction Codes
QKD	:	Quantum Key Distribution
QWER	:	Quantum Word Error Rate
RM	:	Reed-Muller codes
SIP	:	Simplectic Inner Product
WP	:	Work Packages

## LIST OF SYMBOL

$\alpha$	Constant number complex
$\beta$	Constant number complex
$\rho$	The density operator
$\rho'$	Evolution of quantum system

## **ACHIEVEMENTS**

1. AAAAA

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Background**

With information theory led the mathematician Peter Shor to introduce a fast-factoring algorithm for a quantum computing, a quantum computing whose bits exist in superposition and can be entangled [1]. Superposition and entanglement are useful for quantum computing and quantum key distribution (QKD).

## **CHAPTER 2**

### **BASIC CONCEPT**

This chapter presents some basic theory that serves as a foundation for proposes a new quantum coding scheme constructed from classical codes.

#### **2.1 General Communications System**

Communication systems is a system that allows the information to occur between two points. The main elements in the communication systems process are transmitters, channels, and receiver information. Transmitter is one of the main elements in the communications process because at this stage settings are made to process data or signals into a form that is in accordance with the transmission. Generally, at this stage there are other stages of processing i.e., the encoding process, the modulation process, etc.

## **CHAPTER 3**

### **THE PROPOSED CODES**

This thesis proposes new quantum coding scheme

## **CHAPTER 4**

### **PERFORMANCE EVALUATIONS**

This section evaluates the performance of the proposed codes in several aspects (i) syndrome extraction produces unique codes for each single errors occurred in quantum and (ii) the performance of quantum word error rate (QWER).



## **CHAPTER 5**

### **CONCLUSION**

#### **5.1 Conclusions**

This thesis has proposed a new quantum coding scheme

#### **5.2 Future Works**

This thesis can be further possible be developed, especially, in terms of QWER performance under the other quantum channels.

## REFERENCES

- [1] D. Garisto. The second quantum revolution. [Online]. Available: <https://www.symmetrymagazine.org/article/the-second-quantum-revolution>