

**Title should be Times New Roman 24 pt  
bold No abbreviations Maximum 15  
words 1.5 line spacing**

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by

**Firstname Middlename Lastname (18pt)**

B.E., Mechatronics Engineering, Air University, 2018

A thesis submitted (16pt) in partial fulfillment of the  
requirements for the degree of  
Master of Science in Mechatronics Engineering

**AIR UNIVERSITY**

**(16pt)2020 (16pt)**

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Master of Science in Mechatronics Engineering

SUPERVISOR

Prof. Dr. A. B. Lastname

**AIR UNIVERSITY**

**ISLAMABAD**

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## **CERTIFICATE 16PT**

### **Department of Mechatronics Engineering 14PT**

It is hereby certified 12PT that FullnameofStudent (Reg No) has successfully completed his/her thesis.

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Assistant Professor

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Dean Faculty of Engineering

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**Prof. Dr. A. B. Lastname**

*Air University*

Dean Faculty of Graduate Studies

## 16pt TNR DECLARATION 16pt TNR

I declare that all material in this thesis is my work, and that which is not my own work has been mentioned as such, and that no material from this work has previously been submitted or approved for the award of a degree by this or any other university.

Signature: \_\_\_\_\_

Author's Name: NameOfStudent

Dated: \_\_\_\_\_

It is certified that the work presented in this thesis is carried out and completed under my supervision.

Signature: \_\_\_\_\_

Supervisor's Name: **Dr. A. B. Lastname**

Assistant Professor

Department of NameOfDept

Air University, Islamabad

Dated: \_\_\_\_\_

### **Journal Publications**

In this section, use Mendeley for bibliography and IEEE format for Science and Engineering, and APA 6<sup>th</sup> Edition for Social Sciences, AUSOM and DASSS

- [1]. W. Chenglong, H. Sun, T. Simiao, T. Wenxi, and Q. Suixheng, “Thermal-hydraulic analysis of a new conceptual heat-pipe cooled small nuclear reactor system,” *Nucl. Eng. Technol.*, vol. 52, pp. 19–26, 2020.
- [2]. H. Li, G. Zhang, Z. You, H. Li, G. Zhang, and Z. You, “Optimization Design and Simulation of a Multi-Source Energy Harvester Based on Solar and Radioisotope Energy Sources,” *Micromachines*, vol. 7, no. 12, p. 228, Dec. 2016.

### **Conference Papers**

## 16pt TNR Acknowledgments16pt TNR

Acknowledgments should be in Times New Roman 12pt. You can thank all the people who helped you either in the form of a running paragraph or in indented format as

- Prof A. B. C, for his guidance, encouragement and help throughout my research. From him, I was inspired to excel ....
- ....
- Prof D. E. F for ....., and
- Prof G. H. I for ...

I would also like to thank the funding body, i.e. Higher Education Commission (H.E.C) of Pakistan who awarded the grant under NRPU to my Supervisor, which enabled me to use the equipment or whatever was purchased with the fund.

**Title should be Times New Roman 12 pt bold No abbreviations Maximum 15 words 1.15 line spacing**

by

**Firstname Middlename Lastname (12pt)**

B.E., Mechatronics Engineering, Air University, 2018

Submitted in partial fulfillment of the requirements for the degree of  
Master of Science in Mechatronics Engineering, Air University

## **Abstract**

This is the Abstract written in Times New Roman 12pt. Keep it brief. It must first tell the reader what the area of your research is and what motivated you to carry out your research, then what formulation or methods did you use, whether you performed any experiments, and finally, what does your thesis suggest.

Keep it short, ideally not more than 300 words, but definitely not going beyond this page.

Start with a introduction to the area of your research such as.....this year's Nobel Prize in Physics was awarded to three astrophysicists for their work on black holes which as massive objects in the universe that absorb light and everything that comes before them. The presence of black holes was one of the first predictions of Einstein's General Theory of Relativity in 1915. One of these three scientists showed that the black hole would lead to the end of time. Several anomalies have been explained by the presence of these black holes while several questions still remain unanswered.

The goal of this thesis is to develop the governing equations and demonstrate that the information loss paradox contradicts the presence of black holes. The mathematical methods used for this work are this and that. Experiments were also carried out to establish the validity of some of the assumptions in the models.

With the theoretical work and the experiments carried out, the findings of this thesis suggest that black holes are a mathematical singularity that need more than mathematics or physics to be understood.

Thesis Supervisor: Prof. A. B. Lastname  
Title: Associate Professor of Theoretical Physics

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## Symbols and Abbreviations

### *English upper case*

$A$	atomic mass number
$B$	buckling
$B(r)$	build-up factor
$\hat{C}$	collision operator
$D_i(r)$	diffusion coefficient, $m$
$E$	neutron energy, MeV
$E_o$	maximum neutron energy

### *English lower case*

$b$	barn ( $1\ b = 10^{-28}m^2$ )
$c$	group coefficient
$d, d'$	group coefficients
$q$	slowing down density
$u$	control parameter
$u$	lethargy; $\left( \ln \frac{E_o}{E} \right)$
$w$	weight fraction
$w$	statistical weight

### *Greek upper case*

$\Sigma_s(\vec{r}, E', \Omega' \cdot \Omega)$	macroscopic scattering cross-section
$\Sigma_{s,1 \rightarrow 2}$	macroscopic scattering cross-section (group 1 to 2)
$\Sigma_i$	macroscopic cross-section (type $i$ )
$\Sigma(\vec{r}, E' \rightarrow E, \Omega' \cdot \Omega)$	macroscopic scattering cross-section
$\Sigma_i^{tr}(r)$	macroscopic transport cross-section, cm; $\Sigma_i^{(t)}(r) - \mu_o \Sigma_{i \rightarrow i}^{(s)}(r)$
$\Omega$	solid angle (steradians)

### *Greek lower case*

$\alpha$	alpha particle
$\gamma$	gamma ray
$\kappa$	inverse of diffusion length
$\lambda$	Lagrange multiplier

$\phi_2$	group-2 flux
$\phi_2^\infty$	group-2 flux (infinite medium)
$\phi(u)$	neutron flux in an ‘infinite’ medium
$\phi_i^\infty$	average flux infinite medium
$\bar{\phi}$	Average flux
$\phi_i^{+ii}$	adjoint flux (Lagrange multiplier)
$\chi(E)$	fission spectrum

### ***Abbreviations and Acronyms***

BF <sub>3</sub>	boron trifluoride gas
CTME	computation time
DE	diffusion equation
MC	Monte Carlo

### ***Subscripts or Superscripts***

$a$	absorption
$i$	index for energy group ( $i=1,2$ )

For a sample nomenclature please see

<https://www.asme.org/wwwasmeorg/media/resourcefiles/shop/journals/samplenomenclature.pdf>

# Chapter 1: Introduction

This begins your thesis so it is very important that your opening sentence must catch the attention of the reader.

An MS thesis should typically be 30,000-50,000 words and a PhD thesis should typically be 50,000-100,000 words (please consult your Supervisor). Double spacing should be used. As a guideline an MS thesis should have ~50-75 references while a PhD thesis should have 75-150 references. Preferably a thesis should have about 10% text books, ~70% journal papers, and ~20% reports, conference publications etc., and should avoid references which are not authentic including references to websites. In case it is extremely unavoidable, the website in the references should also specify the date you accessed it.

Tables and figures should be cross-referenced; this is done by going to the References tab and select cross-reference under the heading `caption`. This will automatically cross-reference the Table with the word `Table` and the number. This appears as Table 1.1 so that whenever you change this in your thesis, this number will correctly change..

Table 1.1: Table caption single line Times New Roman 12pt

Heading 1	Heading 2
<b>a</b>	e
<b>b</b>	f
<b>c</b>	g
<b>d</b>	h

In the previous studies, various strategies have been practiced in order to monitor muscle activations all through activities, as reported by Chenglong [1] .

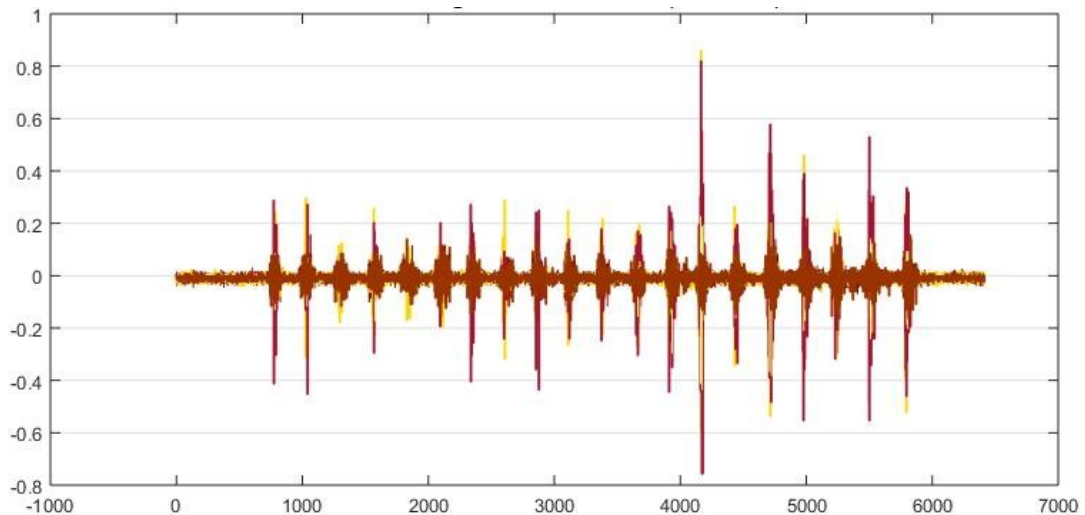


Figure 1.1: Figure caption here single line Times New Roman 12pt

The extracted light intensity patterns can be viewed in Figure 1.1. The axes labels should be 14pt and legend should also be visible. No axis should have numbers which cannot be read. Try not to use colours but black curves with solid or dashed curves. Figures should be designed to accommodate black and white paper print.

## **1.1 Problem Statement**

This section describes the problem at the center of this research.

## **1.2 Motivation**

Describe your motivation here.

## **1.3 Objectives**

My objectives for carrying out this research were:

- i. It is a new development.
- ii. It has extensive applications.
- iii. Improvements can be made.
- iv. I want to make some improvements.

## **1.4 Scope of the thesis**

What does this thesis cover and what does it not cover.

## **1.5 Thesis Layout**

The thesis is arranged in this way. In Chapter 1, an Introduction is presented. Literature survey is presented in Chapter 2....

## **Chapter 2: Literature Survey**

Start your literature survey here. The work by Zhang et al. [2] gives a detailed description of the system. In this chapter you present the literature survey that you carried out to build your own knowledge in the research area you have selected for yourself. The literature that you will have gone through will be some from the net, for example we often start from the simplest and most popular sites but remember these may not be authentic. So you can spend some time on these sites but its best to start from text books which you have used during your coursework and then move into the research domain. Books have knowledge that has become accepted while research in journals is ‘new’ and may not have found its way into the textbooks we study in the classroom.

### **2.1 Foundations**

Start your literature survey from the books that are well known in your area such as in nuclear engineering (NE) the well-known names are Lamarsh [3], Bell and Glasstone [4], Duderstadt and so on. NE undergraduates have typically been taught from one or more of these books. Similarly mechanical engineering undergraduates have often used Holman [5] Holman, Cengel [6], Incropera and DeWitt [7], so it would give the reader confidence that you are updated on books in your area. It is recommended that you cite at least five textbooks.

#### **2.1.1 Books**

You can start by going through the books.

#### **2.1.2 Papers**

A survey of the papers.

#### **2.1.3 Experiments**

Describe some experiments carried out here.

### **2.2 Prior Work**

Describe what work has been done by others.

## **Chapter 3: Mathematical Formulation**

This is how to write an equation. First make a table with one row and three columns (width 10%-80%-10%) then write the equation using MS Math Equation Editor in the central column. Then in the last column enter the equation number, and finally show the table with no borders (by going to Borders and Shading and select none). It should appear like this.

$$\overline{F} = m \frac{d\overline{v}}{dt} \quad 3.1$$

Equation numbers should be written through Captions under References tab and as you can see, the chapter number also appears. You can cross-reference the equation in the same way that you did before. Science and engineering students must use vectors and operators such as curl, div and grad with the correct symbols.

## Chapter 4: Methods Developed

This chapter covers the hybridization technique, the hybridization criteria and the implementation of hybrid modality on the given control scheme.

*“... we balance probabilities and choose the most likely. It is the scientific use of the imagination ...” Sherlock Holmes, The Hound of the Baskervilles. AC Doyle, 1901.*

### 4.1 The First Method

Describe the mathematical method here. If your work was experimental you can describe the experiment you carried out.

### 4.2 The Second Method

## **Chapter 5: Results and Discussion**

This chapter presents the results from simulations based on the methods developed in chapter 4.

### **5.1 Your first results**

From the methods developed in Chapter 4, the results are presented in Table 5.1. These are plotted in Fig. 5.1 which shows that as the independent parameter was varied, the output showed an exponential decrease.

## **Chapter 6: Conclusions and Recommendations**

### **6.1 Conclusions**

From this research, it was concluded that... This description should give the reader a clear picture of what you have concluded. Most people will read your title, abstract and conclusions only so present in easy language what you would like to convey about your findings from this research.

### **6.2 Recommendations for Further Work**

This section is your recommendation to a future researcher to indicate the research gap which you have identified and what you think require further research. **At the end, carry out a grammar and spell-check and complete the check list**

## References

*References should appear in the order in which they are cited in your thesis. The first reference should not be a number other than 1.*

- [1] W. Chenglong, H. Sun, T. Simiao, T. Wenxi, and Q. Suixheng, “Thermal-hydraulic analysis of a new conceptual heat-pipe cooled small nuclear reactor system,” *Nucl. Eng. Technol.*, vol. 52, pp. 19–26, 2020.
- [2] H. Li, G. Zhang, Z. You, H. Li, G. Zhang, and Z. You, “Optimization Design and Simulation of a Multi-Source Energy Harvester Based on Solar and Radioisotope Energy Sources,” *Micromachines*, vol. 7, no. 12, p. 228, Dec. 2016.
- [3] J. R. Lamarsh, “Introduction to Nuclear Reactor Theory,” *Interactions*, 2005.
- [4] G. Bell and Glasstone S, *Nuclear Reactor Theory*. van Nostrand Reinhold Company, 1952.
- [5] J. P. Holman, “Heat transfer 9th Edition,” *New York, Boston, McGraw-Hill, Inc*, 2002.
- [6] Y. A. Cengel and A. J. Ghajar, *Heat and Mass Transfer, Fundamentals & Application, Fifth Edition in SI Units*. 2015.
- [7] F. P. Incropera, D. P. DeWitt, T. L. Bergman, and A. S. Lavine, *Principles of heat and mass transfer*. 2013.

# Appendix-A

Describe your Table here.

Table A- 1: Table caption here single line Times New Roman 12pt


## **Turnitin Originality Report**

(stamped and signed by QEC and to be submitted separately)