

GUIDELINES FOR THE PREPARATION OF RESEARCH REPORTS, DISSERTATIONS AND THESES

Department of Physics
Faculty of Science
University Malaya

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The conventional format follows the traditional monograph structure. This is the most common form of research project/dissertation/thesis used by most candidates.

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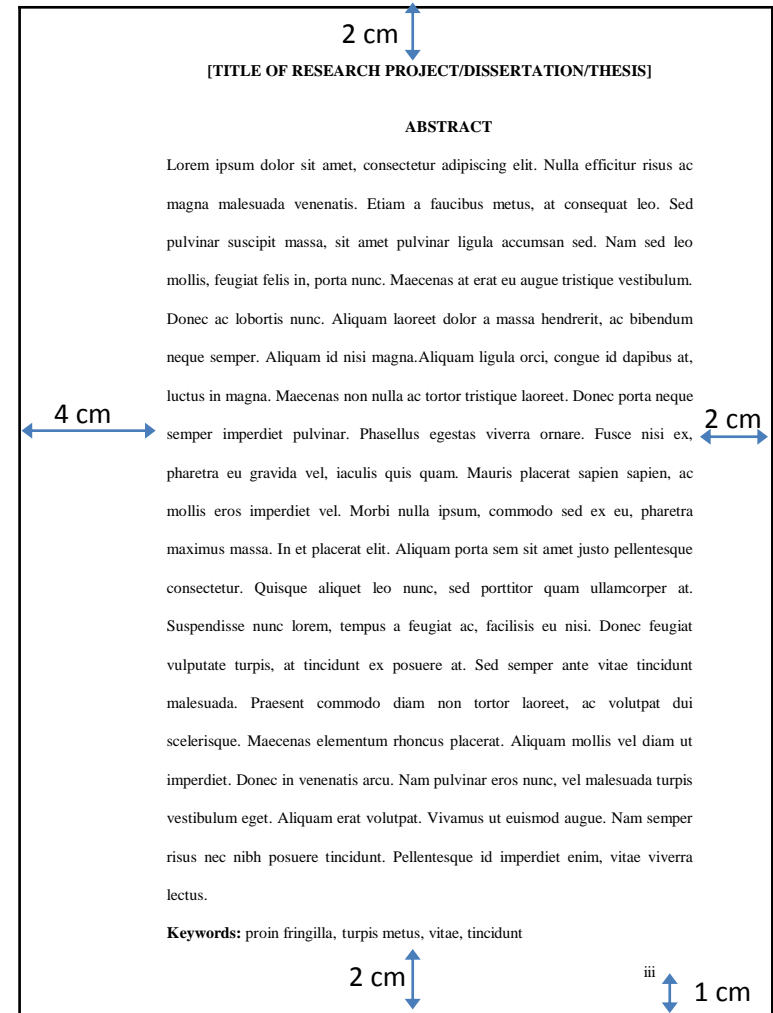
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ABSTRACT

- Is a short summary of the research project/dissertation/thesis.
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ABSTRACT

Examples

NOVEL DNA-BASED ELECTRONIC PROFILING METHOD FOR SELECTED ALGAE

ABSTRACT

The utilization of deoxyribonucleic acid (DNA) in electronics has become significant and gradually accepted by researchers due to its remarkable characteristics. There are several devices and sensors that employ DNA in their fabrication process. The standard methods to detect and recognize any species of living organism are polymerase chain reaction (PCR), sequencing and microarray techniques. However, there are several drawbacks pertaining to these methods such as sample contamination, misleading results as well as being costly and involving complicated procedures. As an alternative method, this study presents a simple, fast, high sensitivity and economical novel identification method for algae-derived DNA using the electronic properties of DNA. Novel current-voltage (I-V) characteristics of chosen algal species using DNA-specific diodes were obtained and its corresponding diode parameters (turn-on voltage, shunt and series resistance, knee voltage, breakdown voltage as well as breakdown current) were then calculated in this study. Each algal species exhibits specific turn-on voltage values for example *Chlorella* sp. had a value of 1.40 V, *Synechococcus* sp. with 1.15 V and *Amphora* sp. with 1.36 V. This novel technique demonstrates an exciting potential that may have huge impact in various fields, especially in pathology and taxonomy.

Keywords: Indium tin oxide, DNA, Schottky diode, biosensor, diode parameters.

NOVEL DNA-BASED ELECTRONIC PROFILING METHOD FOR SELECTED ALGAE

ABSTRAK

Penggunaan asid deoksiribonukleik (DNA) dalam elektronik menjadi lebih penting dan semakin diterima pada masa kini oleh penyelidik kerana ciri-cirinya yang luar biasa. Terdapat beberapa peranti dan pengesan yang menggunakan DNA dalam proses fabrikasinya. Kebanyakan kaedah piawai untuk mengesan dan mengenali mana-mana spesies organisma hidup adalah reaksi berantai polimerase (PCR), teknik penjujukan dan teknik microarray. Sebaliknya terdapat beberapa kekurangan berkaitan kaedah tersebut seperti pencemaran sampel, keputusan mengelirukan serta mahal dan prosedur yang rumit. Sebagai kaedah alternatif, tesis ini membentangkan kaedah pengenalanpastian baru yang mudah, cepat, sensitiviti tinggi dan praktikal digunakan untuk DNA yang berasal dari alga yang menggunakan sifat-sifat elektronik DNA. Ciri-ciri arus voltan (I-V) spesies alga yang terpilih menggunakan diod khusus DNA ditunjukkan dan parameter diod yang berkenaan (voltan putar, peredaran dan rintangan siri, voltan lutut, voltan kerosakan serta arus pecahan) kemudian dikira dalam kajian ini. Setiap spesies alga menunjukkan nilai voltan pemula yang khusus seperti *Chlorella* sp. mempunyai nilai 1.40 V, *Synechococcus* sp. dengan 1.15 V dan *Amphora* sp. dengan 1.36 V. Teknik novel ini mungkin mempunyai impak yang besar dalam pelbagai bidang, terutamanya dalam patologi dan taksonomi.

Kata kunci: Indium tin oksida, DNA, diod Schottky, pengesan bio, parameter diod.

ACKNOWLEDGEMENT

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- Most research projects, dissertations or theses include a message to convey appreciation to those who have been involved and provided their assistance directly or indirectly in the preparation of the study.
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ACKNOWLEDGEMENTS

First of all, I thank Allah the Almighty for all His providence in carrying out this work successfully.

I would like to express my deepest gratitude to my supervisors Dr. Rozalina Zakaria and Dr. Woon Kai Lin for guidance, support, patience and encouragement throughout the course of this work.

I am grateful and touched for the attentions and support from my loving husband, Mohd Kamil bin Ramli. I am blessed to have you and our daughter in my life. I am indebted to my late father Che Noh Mat Il and my mother Samsiah binti Awang, for their constant encouragement and understanding throughout the years of my life. Hereby, I place on record to dedicate this thesis solely to my beloved parents and husband.

Also, my warm thanks to my fellow labmates in for the stimulating discussions, for the struggle we have in working together before deadlines and for all the fun we have had. Special thanks to Noor Azrina Talik and Khairus Syifa Hamdan for all the helps and supports.

Last but not least, my sense of gratitude to one and all, who directly or indirectly have lent their hand in this venture.

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LIST OF SYMBOLS AND ABBREVIATIONS

| LIST OF SYMBOLS AND ABBREVIATIONS | | |
|-----------------------------------|---|--|
| <i>E_a</i> | : | activation energy |
| σ | : | conductivity |
| η | : | efficiency |
| <i>R_Ω</i> | : | electrolyte resistance |
| <i>f</i> | : | frequency |
| <i>T_g</i> | : | glass transition temperature |
| <i>R_{ct}</i> | : | interfacial charge-transfer resistance |
| <i>V_{oc}</i> | : | open circuit voltage |
| <i>J_{sc}</i> | : | photocurrent |
| <i>n</i> | : | power law exponent |
| τ | : | relaxation time |
| ζ | : | zeta potential |
| C | : | capacitance |
| C.I | : | carbonyl index |
| DSSC | : | dye-sensitized solar cell |
| EP | : | electrode polarization |
| FF | : | fill factor |
| PSSE | : | polymeric solid state electrolytes |
| R | : | resistance |
| TSC | : | total solid content |
| W | : | Warburg impedance |

symbols

abbreviations

- Alphabetical order.
- List down the symbols (*italic*) than follow by abbreviations.
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MAIN BODY

Candidates and supervisors should ensure that the text follows the agreed conventions of the individual faculty. The main text in the research project/dissertation/thesis must be organised following the guidelines as mentioned below:

- Text must be organised in titled chapters.
- The titles must reflect the content of the chapter.
- Every chapter must begin on a new page.
- Chapters can be divided into sub-chapters with corresponding sub-titles.
- Titles and sub-titles must be numbered.

Generally, a research project/dissertation/thesis will have the following basic structure:

- **INTRODUCTION**
- **LITERATURE REVIEW**
- **METHODOLOGY**
- **RESULTS**
- **DISCUSSION**
- **CONCLUSION**
- **REFERENCES**

CHAPTER 1: INTRODUCTION

Tab should
be 0.5 cm

1.1 Introduction

↔ When the size of a matter is reduced from bulk to the nanometer scale, the new properties will emerge. These significant new properties, such as optical, electronic, surface and structural properties make nano-size particles are manipulated for various applications such as signal amplifications, light trapping in light emitting device, light guiding and focusing, sensors, and a lot more.

Since 1908, scientist has figured out the existence of surface plasmons (Gaspar et al., 2013) which occurs when light (electromagnetic wave) strikes on noble metal nanoparticles and results in collective oscillation of free electrons. Noble metals such as gold (Au) and silver (Ag) is denoted as plasma in Drude-Lorentz model because it contains equal numbers of positive ion (fixed in positions) and conductive electrons (free and highly mobile). However, silver was chosen in this work since it is cheaper compared to gold.

Manufacturers are looking for simple, time and cost effective technique that can produce nanoparticles easily. Scientist has found that a process called dewetting occurred when the thin liquid film on the substrate ruptured due to application of heat and formed droplets.

1.2 Motivations and Objectives

The objectives of the research work presented in this thesis are:

1. to study the influence of size and thickness of silver nanoparticles towards the optical properties.
2. to verify the compatibility between the simulation and experimental's result.

- Chapter titles should be typed with capital letters and centred between the left and right margins.
- Each chapter must begin on a new page.
- Chapters and subchapters should be also titled.
- Titles should be typed in bold without underline.

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Require the following information:

- last name of the author,
- the year of publication,
- the page number for the reference (direct quotes only).

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- For summaries the author in text:

- Single author: (Bernard, 2001)
- Two authors: (Thomas & Peter, 1994)
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- Several authors in a sentence: (Bernard, 2002; Karnes et al., (2001); Thomas & Peter, 1994))
- If the authors have a similar surname more than one can put a, b or c.
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Example 2: Reference Citation in Text - For direct quotations or paraphrases in text

Single author

Irregularities discussed by Miralda-Escude (1991) and Nakamura et. al. (1995)

Several authors in a sentence

from the analysis of gravitational lensing clusters, had found that the distribution of the gravitational mass (i.e. the mass of all constituents) is not spherically symmetric but in actual fact has multiple peaks. Smail et al. (1995) for instance had discovered a misalignment between the different components in A2219. This was investigated using a gravitational lens model with the superposition of a spherical and an elliptical part.

Explanation using simulations could give some clues for these discrepancies. Simulations done by several investigators have led to the evident conclusion that the irregularities are caused by the diversity of merger events. An example by Roettiger et al. (1993) shows that the hot gas follows the dark matter even after the merging of two clusters. Other findings by Evrard (1990), Schindler & Muller (1993) and Shindler & Böhringer (1993) had demonstrated that substructure of gas would disappear more quickly than substructure of dark matter during the merger of two clusters. As a result, structure differences should not be related to the radial concentration only. Furthermore, the structure and evolution of galaxy clusters should not be merely confined to the discussion from the optical, X-ray or lensing observations. Thus, the HI

Two authors

Example 1: Reference Citation in Text - For summaries the author in text

**More than
two authors**

Single author

**Only insert
authors
surname**

**Several
authors in a
sentence**

metal wires (Reyes et al., 2016). Recently, biomolecules like self-assembled proteins, viruses, bacteria etc. have emerged as fascinating bio-templates due to their sophisticated chemistries and special structural features, which are advantageous and beneficial characteristics for novel sub-micron to nanoscale material development (Gazit, 2007; Niu et al., 2007). Bio-template synthesis involves the use of biological building blocks as biological tools, templates and scaffolds for fabricating various non-biological nanostructures (Taton, 2003). Among these bio-templates, DNA molecules hold much importance as a template from the material science point of view. Seeman et al. (1998) reported that complementary DNA strands possessed specific recognition which allowed their arrangement into well-arranged structures at nanoscale. The polynucleotide chain of DNA has a length of 0.34 nm per nucleoside subunit and a diameter of 2 nm. Moreover, DNA molecules are chemically robust and due to their increased demand in molecular biology applications, the cost of synthesis of DNA has significantly reduced. It has been reported in literature that DNA-templated metallic nanowires tend to have different structural properties from nanowires fabricated by other techniques (Gu et al., 2005). These characteristics of DNA make them an interesting nanomaterial and bio-template for fabrication of metal structures.

RNA and DNA molecules have many common structural properties and RNA has been studied as a bio-template (Eber et al., 2015; Kumar & Gupta, 2017; Tsukamoto, Muraoka et al., 2007). However, no work on the RNA templated fabrication of metal wires has been reported before.

Two authors

Among various metal NPs, Ag NPs have exhibited the most effective light trapping potential due to their strong light scattering and surface plasmon strength (Gaspar et al., 2013). In addition, SPR absorption spectra of silver nanoparticles (Ag NPs) can be controlled from 300 (ultraviolet (UV)) to 1200 nm (near-infrared (NIR)) (Chen et al., 2012; Rycenga et al., 2011). The ability of metal NPs for SPR effect depends on its dielectric function ϵ including a real part ϵ_r and an imaginary part ϵ_i , both of which vary with excitation wavelength λ . (Rycenga et al., 2011) The SPR effect of metal NPs with spherical structure can be described using the extinction (absorption + scattering) cross-section based on Mie theory (Mulvaney, 1996),

$$C_{ext} = \frac{24\pi^2 R^3 \epsilon_m^{\frac{3}{2}}}{\lambda} \left[\frac{\epsilon_i}{(\epsilon_r + 2\epsilon_m)^2 + \epsilon_i^2} \right] \quad (2.2)$$

where C_{ext} is the extinction cross-section, R is the NP radius, and ϵ_m is the relative dielectric constant of the matrix surrounding the metal NPs. This equation implies that dielectric properties have strong effect on the interaction between light and metal NPs.

In addition, the SP strength (or damping) of metal NPs can be expressed using the quality factor (QF) (Ru & Etchegoin, 2009),

$$QF = \frac{w(\frac{d\epsilon_r}{d\omega})}{2(\epsilon_i)^2} \quad (2.3)$$

SP strength is proportional to QF . Specifically, high QF indicates strong plasmons and low QF means weak SP with a small C_{ext} . Ag has higher QF than do other metals over the spectrum from 300 to 1200 nm. Interband transitions (IBTs), which are excitations of electrons from the conduction band to higher energy levels, are key factor for the SP strength. (Perner et al., 1997) In Ag, these transitions occur at much higher energies

- Used Equation Editor.

All symbol should be *italic*.

- Equation must be numbered and written in bracket.
- The first number should be corresponded to the chapter's number.

FIGURES

Figures, like tables are printed within the body of the text at the centre of the frame and labelled according to the chapter in which they appear. Thus, for example, figures in Chapter 3 are numbered sequentially: Figure 3.1, Figure 3.2.

Figures, unlike text or tables, contain graphs, illustrations or photographs and their labels are placed at the **bottom** of the figure rather than at the top.

If the figure occupies more than one page, the continued figure on the following page should indicate that it is a continuation: for example:

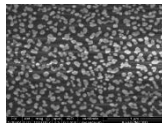


Figure 3.2, continued.

If the figure contains a citation, the source of the reference should be placed after the label.

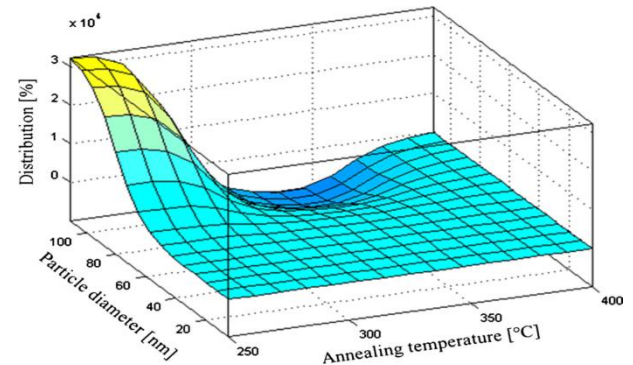


Figure 3.1: ANFIS prediction of distribution of different sizes of granular structures at certain annealing temperature.

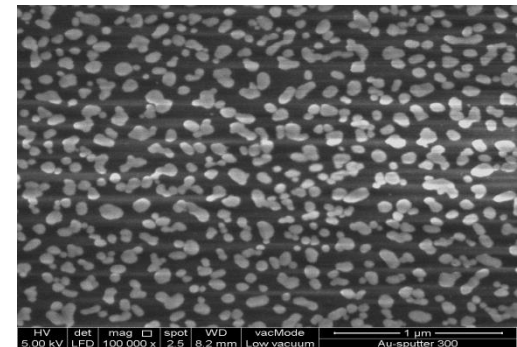


Figure 3.2: FESEM image of gold nanoparticles.

TABLES

Tables are printed within the body of the text at the centre of the frame (one line) justified (if more than one line) and labelled according to the chapter in which they appear. Thus, for example, tables in Chapter 3 are numbered sequentially: Table 3.1, Table 3.2 and so on.

The caption should be placed **above** the table itself (Table 3.1). If the table contains a citation, the source of the reference should be included in the table caption.

If the table occupies more than one page, the continued table on the following page should indicate that it is a continuation, for example: ‘Table 3.1, continued.’. The header row should also be repeated.

Table 3.1: Example of table.

| Heading | Heading |
|---------|---------|
| 1 | Text |
| 2 | Text |
| 3 | Text |

85

Table 3.1, continued.

| Heading | Heading |
|---------|---------|
| 4 | Text |
| 5 | Text |
| 6 | Text |

86

Table 3.2: Parameters of DSSCs for GPE samples in the system.

| Heading | Heading |
|----------|---------|
| System 1 | Text |
| System 2 | Text |
| System 3 | Text |

FOOTNOTES

There are differences in the use of footnotes in various disciplines. For example, footnotes are commonly used in Social Sciences but rarely in Science and Technology. However candidates are advised to limit the use of footnotes unless they are proved necessary to the document. Footnotes are used to elaborate or provide additional information regarding matters discussed in that page.

Footnotes are recorded using Arabic numeric and numbered consecutively. Raised superscript numerals in the text refer to explanatory notes and documented sources appearing either at the bottom of the page as footnotes or at the end of the thesis as endnotes in a notes section. The advantage of using notes is that explanatory type of information can be presented along with source citations on the same page or place.

Footnotes should use a smaller font than the text (font size 8).

When using footnote, a number formatted in superscript is inserted following the punctuation mark in the text. Footnotes should be placed at the bottom of the page on which they appear. Please refer to the faculty for the recommended convention for writing of footnotes.

Scientists examined, over several years, the fossilized remains of the woolly-wooly yak.¹

¹ While the method of examination for the woolly-wooly yak provides important insights to this research, this document does not focus on this particular species.

Example of footnote (Source: IPS).

REFERENCES

- All works or studies referred to in the research report/dissertation/thesis in the form of quotations or citations must be included in the references.
- The references should be written consistently in the American Psychological Association (APA) format or in another format approved by the Faculty.
- Each reference should be written in single spacing format and a double space between references.
- The list of references must be arranged in alphabetical order and the entries should not be numbered. The list must also have a hanging indentation of 0.5 inch.

REFERENCES

Examples

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Santini, S. N. (2008). *Research methods for business: A skill building approach*. (unpublished master's thesis). University of Malaya, Kuala Lumpur, Malaysia.

LIST OF PUBLICATIONS AND PAPERS PRESENTED

List of publications

1. Shakir, S, Abd-ur-Rehman, H.M., Yunus, K., Moi P.S., Iwamoto, M., & Periasamy, V. (2018). Fabrication of un-doped and magnesium doped TiO₂ films by aerosol assisted chemical vapor deposition for dye sensitized solar cells. *Journal of Alloys and Compounds*, 737, 740-747.
2. Shakir, S., Saravanan, J., Rizan, N., Babu, K. J., Aziz, M. A., Moi, P. S., Periasamy, V., & Kumar, G. G. (2017). Fabrication of capillary force induced DNA template Ag nanopatterns for sensitive and selective enzyme-free glucose sensors. *Sensors and Actuators B: Chemical*, 256, 820-827.
3. Shakir, S., Yüing Y. F., Rizan, N., Abd-ur-Rehman, H. M., Yunus, K., Moi P. S., & Periasamy, V. (2017). Electro-catalytic and structural studies of DNA templated gold wires on platinum/TiO as modified counter electrode in dye sensitized solar cells. *Journal of Material Science; Materials in Electronics*, 29(6), 4602-4611.

Papers Presented

1. Shakir, S., Yunus, K., & Vengadesh, P. (2017). *Electrochemical properties of RNA templated Au nanowires to be used as a counter electrode in dye sensitized solar cells*. Paper presented at the 6th International Conference on Functional Materials and Devices (ICFMD), 15-18 August 2017, Melaka, Malaysia.

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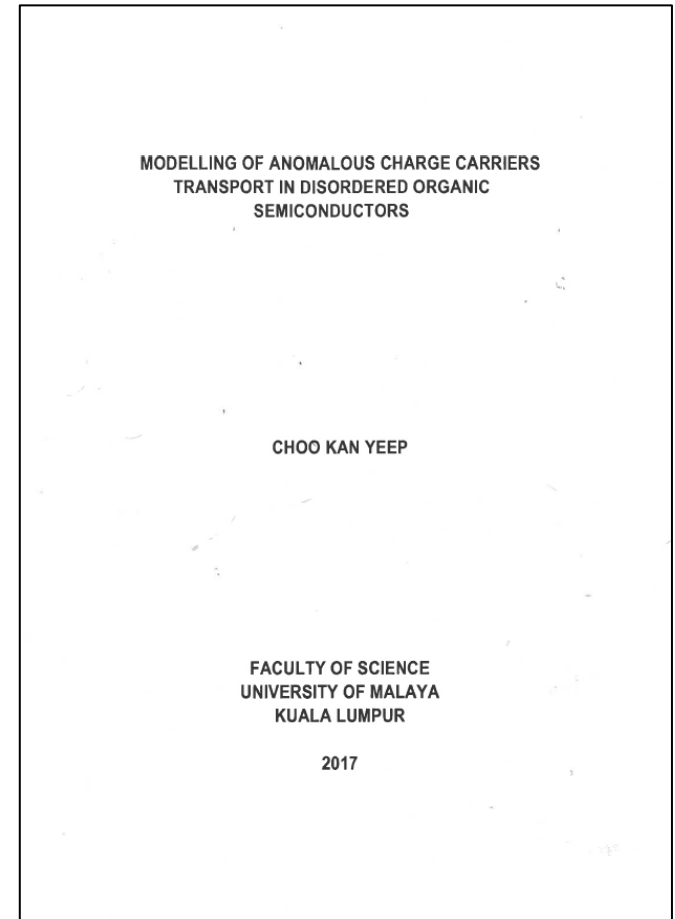
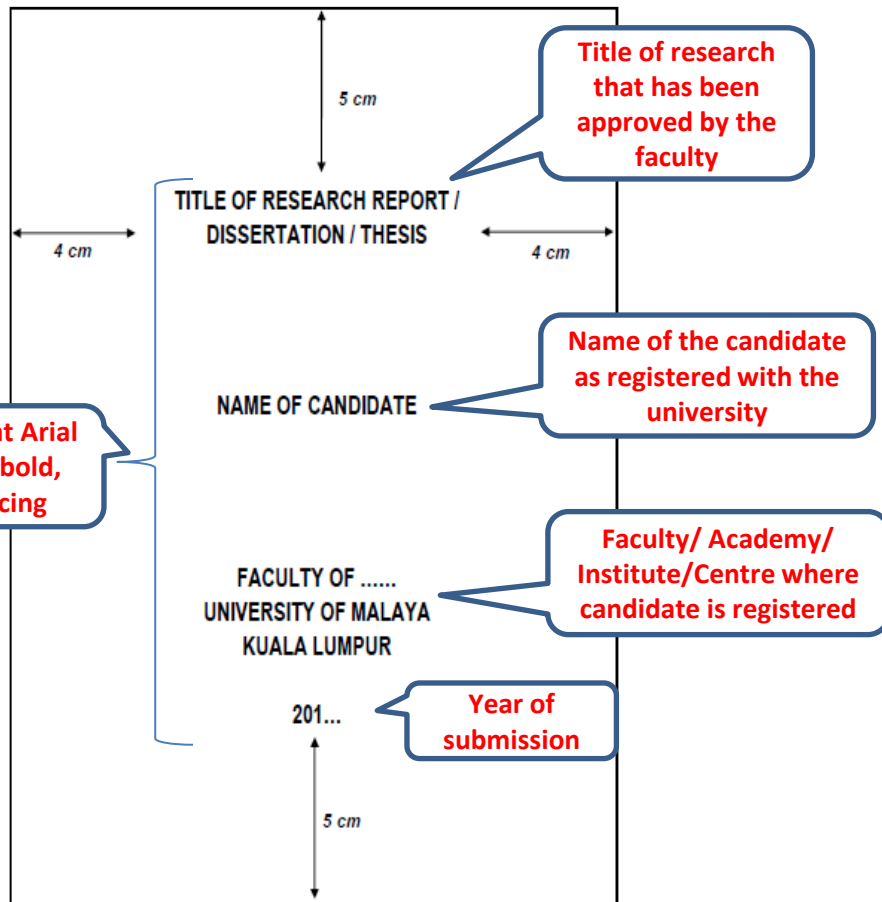
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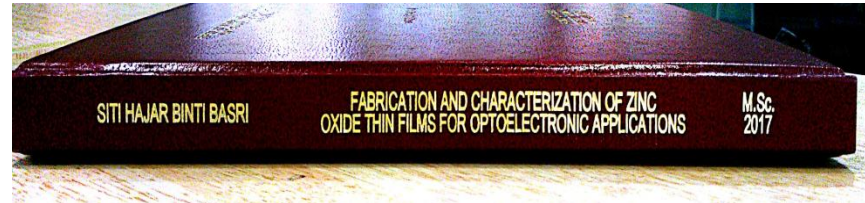
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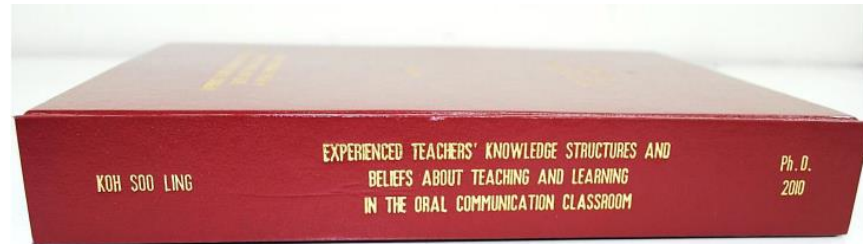
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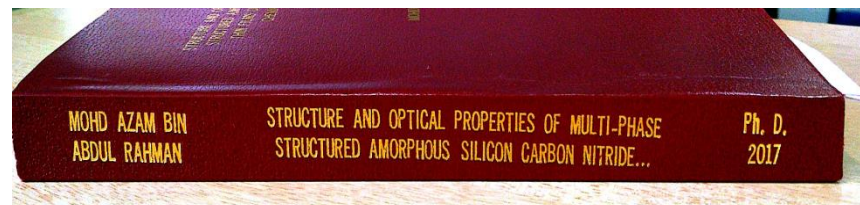
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