THE UMALAYATHESIS LATEX DOCUMENT CLASS

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FACULTY OF SCIENCE
UNIVERSITI MALAYA
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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF PHYSICS
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2025

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ABSTRACT

An abstract must not exceed 500 words, typed in a single paragraph with double- spacing, and written in English language. A maximum of five (5) keywords should also be listed below the abstract.

Keywords: Keyword, keyword, keyword.

KELAS DOKUMEN LATEX UMALAYATHESIS

ABSTRAK

Abstrak Bahasa Malaysia perlu ditulis dalam satu perenggan menggunakan *double-spacing* dan tidak melebihi 500 patah perkataan.

Kata kunci: Kata kunci, kata kunci, kata kunci.

ACKNOWLEDGEMENTS

Thanks guys, I owe you many.

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θ_D	:	Diffraction limit
α	:	Spectral index
ALMA	:	Atacama Large Millimeter/submillimeter Array
VLBI	:	Very Long Baseline Interferometry

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

`umalayathesis` is a LaTeX class for authoring theses that fulfil formatting specifications required by Universiti Malaya, Malaysia. This updated version of the document class is written based on the original `umalayathesis` written by Lim Lian Tze (which can be accessed on https://github.com/liantze/umalayathesis and https://www.overleaf.com/latex/templates/universiti-malaya-thesis-template/kbdmvkbnjchb),

This version simplified and written to match the Faculty of Science thesis preparation guide as of 2024, which can be accessed at https://fs.um.edu.my/thesis. This version also implements the usage of `biblatex` which provides various functionalities required for special formatting of the references.

CHAPTER 2: PREAMBLES

2.1 Activation

To 'activate' the class, start with `\documentclass{umalayathesis}` in the main document file.

2.2 Packages

LaTeX packages can be loaded using the usual `\usepackage` command. Below are a few highly-recommended packages:

```
\usepackage{pdflscape} % landscape pages
\usepackage{graphicx} % advanced graphics options
\usepackage{tabularx} % advanced table options
\usepackage{longtable} % multi-page tables
\usepackage{amsmath} % complex equation environments
```

2.3 Author Information

Author information for the thesis has to be provided in the preamble with the following commands:

```
\author{Affan Adly Bin Nazri}
\identification{}
\matric{}
\title{The umalayathesis \LaTeX{} Document Class}
\tajuk{Kelas Dokumen \LaTeX{} umalayathesis}
\fieldofstudy{}

\university{Universiti Malaya}
\department{Department of Physics}
\faculty{Faculty of Science}
\submissionyear{2025}
\degree{Doctor of Philosophy}
```

`\identification` should be filled with either your I.C. or your passport number. `\matric` should be filled with either your registration or your matric number. `\tajuk` can be filled with the Bahasa Malaysia version of your title (to be written above your Bahasa Malaysia abstract), but is not required.

2.4 Bibliography Files

Before entering the main document body, call all bibliography files (`.bib` files) using the `\addbibresource{file.bib}`. If there are multiple bibliography files, call the command repeatedly for each file. See Section 5.1 for more information on the preparation of these `.bib` files.

CHAPTER 3: FRONT MATTER

Once in the main document body i.e. using `\begin{document}`, setup the front matter using the following commands:

```
\frontmatter
% \makecoverandtitlepage{\mastercoursework}
% \makecoverandtitlepage{\mastermixedmode}
% \makecoverandtitlepage{\masterresearch}
% \makecoverandtitlepage{\doctoralcoursework}
\makecoverandtitlepage{\doctoralresearch}
% \makecoverandtitlepage{\doctoralmixedmode}
\declarationpage
```

Uncomment the correct `\makecoverandtitle` line to generate the correct statement on the title page based on the thesis type.

3.1 Abstracts

Write the English and Bahasa Malaysia abstracts in the `abstract` and `abstrak` environments respectively. If `\tajuk` is defined, the Bahasa Malaysia abstract title will be prepended with that. A maximum of five (5) keywords should be listed below the abstract within their respective environments with the following format:

```
\textbf{Keywords: } Keyword, keyword, keyword.
```

3.2 Acknowledgements

Write the acknowledgements as the argument to the `\acknowledgements{}` command.

3.3 Table of Contents and Lists

The table of contents, list of figures, list of tables, list of symbols and abbreviations, and list of appendices are generated using the following commands:

```
{\clearpage
\tableofcontents\clearpage
\listoffigures\clearpage
```

```
\listoftables\clearpage
\begin{listofacronyms}
    ...
\end{listofacronyms}\clearpage
\listofappendices\clearpage
}
```

The `listofacronyms` environment is a wrapper for the `tabular` environment, with settings meant for the list of symbols and abbreviations. Each row should be written in alphabetical order in the following format:

```
Symbol/Abbr. & Explanation for the symbol/abbreviation \\
Symbol/Abbr. & Explanation for the symbol/abbreviation
```

Note that the list should not end with double backslashes.

CHAPTER 4: MAIN CHAPTERS

The main chapters of the thesis should start with the `\mainmatter` command. Then, the usual commands i.e. `\chapter`, `\section`, `\subsection`, `\subsubsection` can be used. Fifth level headings are also possible using `\subsubsubsection`, but it will not appear in the Table of Contents (and not recommended in general). It is recommended that each chapter/section is split into different `tex` files and loaded into the main document file using the `\input` command.

4.1 Figures

Figures can be added as usual using the `figure` environment. If a figure is too wide, it can be placed in a `landscape` environment (assuming that `pdflscape` has been loaded into the preamble). Inline equations are also supported within a figure's caption. The following is an example command for the `figure` environment, followed by the output in Figure 4.1:

```
\begin{figure}
    \centering
    \includegraphics[width=0.75\linewidth]{example-image-a}
    \caption{Example figure.}
    \label{fig:figure}
\end{figure}
```

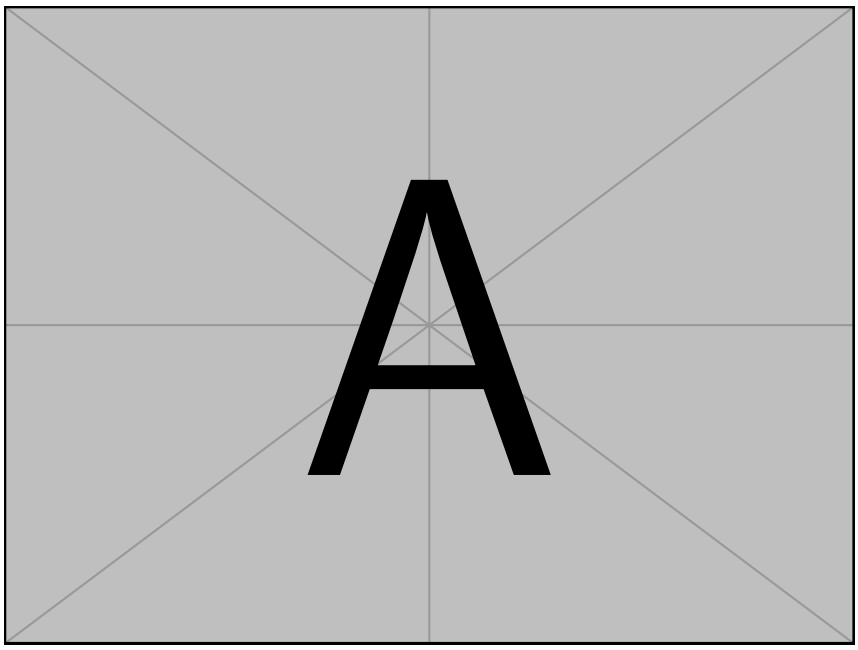
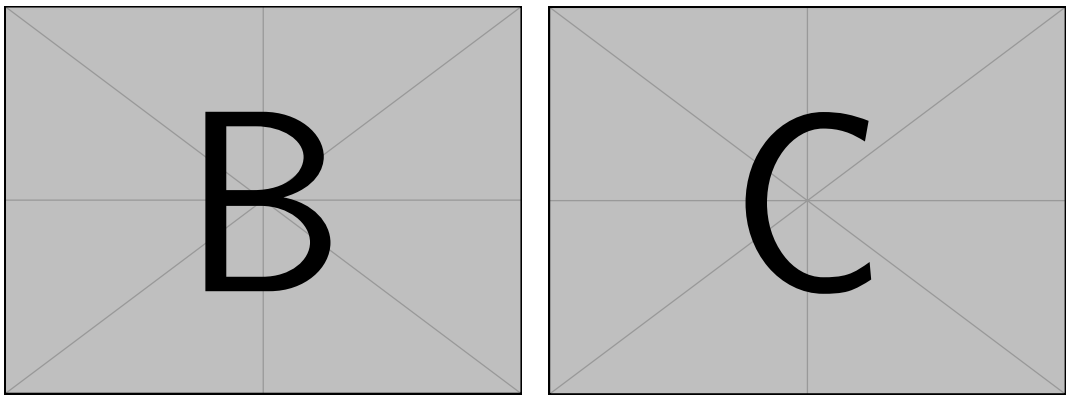


Figure 4.1: Example figure.

Subfigures are also pre-loaded into this class, and they can be invoked by splitting a `figure` environment using the `minipage` environment. The following is an example command for the `subfigure` environment, followed by the output in Figure 4.2:

```
\begin{figure}[h]
    \centering
    \begin{minipage}{0.48\textwidth}
        \centering
        \includegraphics[width=0.95\linewidth]{example-image-b}
        \subcaption{Example subfigure with subcaption.}
    \end{minipage}%
    \begin{minipage}{0.48\textwidth}
        \centering
        \includegraphics[width=0.95\linewidth]{example-image-c}
        \subcaption{}
    \end{minipage}
    \caption{Example subfigures, with the left subfigure with a subcaption,
    ↪  and the right subfigure without a subcaption, which means it can be
    ↪  explained in the main caption.}
    \label{fig:subfigures}
\end{figure}
```



(a) Example subfigure with subcaption. (b)

Figure 4.2: Example subfigures, with the left subfigure with a subcaption, and the right subfigure without a subcaption, which means it can be explained in the main caption.

The following is an example command for a landscape figure, and it is rendered in Appendix A:

```
\begin{landscape}
    \begin{figure}[h]
        \centering
        \includegraphics[width=0.7\linewidth]{example-image-a}
        \caption{Example landscape figure.}
        \label{fig:landscapefigure}
    \end{figure}
\end{landscape}
```

4.2 Tables

Tables can also be added as usual using the `table` and `tabular` environments. For more advanced customization, the `tabularx` environment can be used (assuming that it has been loaded into the preamble). Subtables are also possible, the same way as subfigures. The following is an example command for the `table` and `tabular` environment, followed by the output in Table 4.1:

```
\begin{table}[h]
    \centering
    \caption{Example table using the tabular environment.}
    \label{tab:table}
    \begin{tabular}{cc}
        \hline
        First header & Second header \\
        \hline
```

```
        1 & A \\
        2 & B \\
        3 & C \\
        \hline
    \end{tabular}
\end{table}
```

Table 4.1: Example table using the tabular environment.

First header	Second header
1	A
2	B
3	C

Similar to figures, if a table is too wide, it can be placed in a `landscape` environment. The following is an example command for a landscape table, and it is rendered in Appendix B:

```
\begin{landscape}
    \begin{table}[h]
        \centering
        \begin{tabular}{cccccccc}
            \hline
            First column & Second column & Third column & Fourth column &
            ↪  Fifth column & Sixth column & Seventh column & Eight column
            ↪  \\
            \hline
            A & B & C & D & E & F & G & H \\
            1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 \\
            I & II & III & IV & V & VI & VII & VIII \\
            \hline
        \end{tabular}
        \caption{Example landscape table.}
        \label{tab:landscapetable}
    \end{table}
\end{landscape}
```

If a table is too long to fit in a single page, the table should be created with a `longtable` environment instead (assuming that it has been loaded into the preamble). The following is an example command for the `longtable` environment, and it is rendered in Appendix C:

```
\begin{longtable}{ccc}
    \caption{Example longtable.}\label{tab:longtable} \\
    \hline
    First column & Second column & Third column \\
    (units) & (units) & (units) \\
    \hline
    \endfirsthead
    \caption*{Example longtable (continued \dots)} \\
    \hline
```

```
    First column & Second column & Third column \\
    \hline
    \endhead
    \hline
    continued \dots
    \endfoot
    \hline
    \endlastfoot
    ...
\end{longtable}
```

Both environments can also be combined to accomodate a wide and long table, by applying the `landscape` environment first.

4.3 Equations

Mathematical expressions can be included in the thesis using standard LaTeX math environments. The `umalayathesis` class does not impose any restrictions on mathematical formatting, so users can freely utilize LaTeX's math modes. The following are the common types of equations and their usage.

Inline Equations: For short expressions within a paragraph, use the inline mode by enclosing the expression within single dollar signs. For example:

```
The speed of light is (approximately) given by $c = 3.00 \times
↪  10^8~\mathrm{m}~\mathrm{s}^{-1}$
```

is rendered as – The speed of light is (approximately) given by $c = 3.00 \times 10^8$ m s^{-1}.

Numbered Equations: For standalone equations with numbering, use the `equation` environment. For example:

```
\begin{equation}
    E^2 = m^2c^4 + p^2c^2 \label{eq:energy}
\end{equation}
```

is rendered as

$$E^2 = m_0^2 c^4 + p^2 c^2 \tag{4.1}$$

Note that to call a reference to the equation, the label command i.e. `\label{...}` should be set. In this case, `Equation \ref{eq:energy}` would return – Equation 4.1. To remove the numbering for the entire environment, use the starred version i.e. `\begin{equation*}...\end{equation*}`. For equations with multiple lines (without any necessary alignment), use the `gather` environment, and similarly, to remove the numbering for the entire environment, use the starred version.

Aligned Equations: When dealing with multiple equations that need to be aligned, use the 'align' environment from the 'amsmath' package. For example:

```
\begin{align}
    S_{\nu} &= \int_{\Omega} I_{\nu}~\mathrm{d}\Omega
    ↪  \label{eq:fluxdensity} \\
    &= I_{\nu} \cdot 2\pi \int_0^{\theta_T} \sin{\theta}
    ↪  \cos{\theta}~\mathrm{d}\theta \nonumber \\
    &= \pi I_{\nu}\left(\frac{R}{r}\right)^2 \label{eq:spherefluxdensity}
\end{align}
```

is rendered as

$$S_\nu = \int_\Omega I_\nu \, \mathrm{d}\Omega \tag{4.2}$$

$$= I_\nu \cdot 2\pi \int_0^{\theta_T} \sin\theta \cos\theta \, \mathrm{d}\theta$$

$$= \pi I_\nu \left(\frac{R}{r}\right)^2 \tag{4.3}$$

Note that the ampersand (`&`) acts as the alignment marker, and the `\nonumber` (or `\notag`) suppresses the equation number for a specific line (can be used in `gather` as well). Similarly, to remove numbering for the entire environment, use the starred version.

4.4 Code

To display code, the `minted` package can be used. The `minted` package should be initialized in the preamble using the following command:

```
\usepackage{minted}
\usemintedstyle{vs}
\setminted{%
    autogobble=true,
    breaklines=true,
    fontsize=\small,
    fontfamily=tt,
    formatcom=\setstretch{1.0},
    frame=single,
    framesep=6pt,
    tabsize=4
}
```

For multi-line code, use the `minted` environment, with the argument denoting the language of the code. For single line code, the `\mint` acts as a shortform of the `minted` environment. For inline code, use the `\mintinline` command. To read and format entire code files, use the `\inputminted` command. In all these commands, the formats can be temporarily changed via their optional arguments.

The `minted` environment can be enclosed within a `listing` environment, analogous to `figure` and `table` environments, with the possibility of adding captions and labels.

4.5 Citations

As this version of the `umalayathesis` document class utilizes `biblatex` (See Section 5.1 for more information), `biblatex` cite commands should be used. All `biblatex` citation commands take one mandatory arguments i.e. `key` and two optional arguments i.e. `prenote` and `postnote` with the following syntax:

```
\command[prenote][postnote]{key}
```

`key` corresponds to the entry keys in the bibliography file(s), `prenote` is printed at the beginning of the citation, and `postnote` is printed at the end of citation. If the bibliographic entry begins with a lowercase, the citation command can be forced to

uppercase using `\Command` i.e. if the citation begins a sentence (this is overriden if the command has a prenote). Multiple citations can be done by listing all the keys, but unique pre- and/or postnotes for each key can be invoked using `\commands` with the following syntax:

```
\commands[prenote1][post1]{key1}[prenote2][postnote2]{key2} ...
```

The next subsections will show the common APA in-text citation commands in `biblatex`, followed by examples of their output (and respective variants). The bibliographic entries used in the examples are:

- Usual: `\command{Rosli2023}`
- With pre- and postnotes: `\command[pre][post]{Zhou2024}`
- Forcing uppercase: `\Command[pre][post]{vanderTak1999}`
- Multiple citations: `\command[pre][post]{Nita2010, Umar2012, Abidin2021}`
- Unique pre- and postnotes:

  `\commands[pre1][post1]{Burns2017}[pre2][post2]{Sugiyama2022}`

4.5.1 Citation Commands

`\parencite` This creates the usual APA style citation in parentheses: (Rosli et al., 2023).

- With pre- and postnotes: (pre Zhou et al., 2024, post)
- Forcing uppercase: (Van der Tak, van Dishoeck, Evans II, Bakker, & Blake, 1999)
- Multiple citations: (pre Nita & Gary, 2010; Umar et al., 2012; Abidin et al., 2021, post)
- Unique pre- and postnotes: (pre1 Burns et al., 2017, post1; pre2 Sugiyama et al., 2022, post2)

`\textcite` This creates the in-text APA style citation which puts only the year in parentheses, usually for usage in text to refer to the author of a specific reference: Rosli et al. (2023).

- With pre- and postnotes: Zhou et al. (pre 2024, post)
- Forcing uppercase: Van der Tak et al. (1999)
- Multiple citations: Nita and Gary (pre 2010), Umar et al. (2012), and Abidin et al. (2021, post)
- Unique pre- and postnotes: Burns et al. (pre1 2017, post1) and Sugiyama et al. (pre2 2022, post2)

`\cite` This creates APA style citation without parentheses, usually for usage in text to refer to the exact reference: Rosli et al., 2023

- With pre- and postnotes: pre Zhou et al., 2024, post
- Forcing uppercase: Van der Tak et al., 1999
- Multiple citations: pre Nita and Gary, 2010; Umar et al., 2012; Abidin et al., 2021, post
- Unique pre- and postnotes: pre1 Burns et al., 2017, post1; pre2 Sugiyama et al., 2022, post2

4.5.2 Text Commands

These are special commands to place citations in the flow of text. Note that these citations will not appear in the full references as they are excluded in tracking. Pre- and/or postnotes, forcing uppercase, and multiple citations are called as usual (though advanced multiple citations is not possible).

`\citeauthor` This prints only the author of the reference without brackets for usage in natural textual flow: Rosli et al.

`\citeyear` This prints only the year of the reference without brackets for usage in natural textual flow: 2023.

4.5.3 Special Commands

These are special commands provided by the core of `biblatex`. These commands do not have any special variants.

`\nocite` This forces a specific reference(s) specified by `key` to appear in citations even if they are not cited in-text. If the `key` is set to `*`, all references will appear in the citations (though this is usually not recommended).

`\fullcite` This prints out the full citation of a specific reference(s) specified by `key` similar to the bibliography output.

CHAPTER 5: BACK MATTER

After the last chapter and its contents, the remaining components of the thesis are the references and the appendices.

5.1 Bibliography

Unlike the original `umalayathesis` class, this version utilizes the more modern `biblatex` for bibliography management which allows for more complex functions. Here, `biblatex` is utilized for splitting author's own publications (articles and conference proceedings) from the other references, and highlighting author's own name in their own publications list. For more information, refer to https://ctan.org/pkg/biblatex.

5.1.1 Bibliography Files

Bibliography files (`.bib` files) follow the standard `bibtex` formatting. For author's own publications, the entries should be modified by the following rules:

- Add the '`keywords`' key and set its value to '`own`' e.g.

```
@article{...,
    keywords={own},
}
```

- Add the author annotation key (`author+an`) and set its value to highlight the author's name e.g. if the author's name is the third name in the author list, write

```
@article{...,
    author+an={3=highlight},
}
```

- If the entry is a conference proceeding, add the keyword '`conf`' to the keywords e.g.

```
@article{...,
    keywords={own,conf},
}
```

5.1.2 References

The reference lists are printed out using the commands `\references` for all other references and `\ownreferences` for author's own publications. `\ownreferences` will split the author's own journal articles (and other types of bibliography) and conference proceedings into two lists. If any of the lists are empty, the list titles will not appear (but warnings will be raised when compiling).

5.2 Appendices

The appendices are written as chapters within an `appendices` environment, and the list of appendices in the front matter will update accordingly.

REFERENCES

Abidin, Z. Z., Rosli, Z., Radzi, M. S. M., Shah, N. M., Dahari, M., Ramadhani, F., ... Hashim, N. (2021). Radio quiet and radio notification zones characteristics for radio astronomy in medium densely populated areas and humid tropical countries. *Journal of Astronomical Telescopes, Instruments, and Systems*, *7*(02). doi:10.1117/1.jatis.7.2.027001

Burns, R. A., Handa, T., Imai, H., Nagayama, T., Omodaka, T., Hirota, T., ... Baan, W. A. (2017). Trigonometric distance and proper motions of H_2O maser bowshocks in AFGL 5142. *Monthly Notices of the Royal Astronomical Society*, stx216. doi:10.1093/mnras/stx216

Nita, G. M., & Gary, D. E. (2010). The generalized spectral kurtosis estimator. *Monthly Notices of the Royal Astronomical Society: Letters*, *406*(1), L60–L64. doi:10.1111/j.1745-3933.2010.00882.x

Sugiyama, K., Jaroenjittichai, P., Leckngam, A., Kramer, B. H., Rujopakarn, W., Soonthornthum, B., ... Poshyachinda, S. (2022). The 40-m Thai National Radio Telescope with its key sciences and a future South-East Asian VLBI Network. *Proceedings of the International Astronomical Union*, *18*(S380), 461–469. doi:10.1017/s1743921323002909

Umar, R., Abidin, Z. Z., Ibrahim, Z. A., Hassan, M. S. R., Rosli, Z., & Hamidi, Z. S. (2012). Population density effect on radio frequencies interference (RFI) in radio astronomy. In *AIP conference proceedings*. doi:10.1063/1.4730683

van der Tak, F. F. S., van Dishoeck, E. F., Evans II, N. J., Bakker, E. J., & Blake, G. A. (1999). The impact of the massive young star GL 2591 on its circumstellar material: Temperature, density, and velocity structure. *The Astrophysical Journal*, *522*(2), 991–1010. doi:10.1086/307666

LIST OF PUBLICATIONS AND PAPERS PRESENTED

Journal Articles

1. Rosli, Z., Burns, R. A., **Nazri**, **A. A.**, Sugiyama, K., Hirota, T., Kim, K.-T., ... Abidin, Z. Z. (2023). Limits of water maser kinematics: Insights from the high-mass protostar AFGL 5142-MM1. *Monthly Notices of the Royal Astronomical Society*, *527*(4), 10031–10037. doi:10.1093/mnras/stad3767

2. Zhou, D., Greve, T. R., Gullberg, B., Lee, M. M., Mascolo, L. D., Dicker, S. R., ... Ibrahim, U. F. S. U. (2024). The RAdio Galaxy Environment Reference Survey (RAGERS): Evidence of an anisotropic distribution of submillimeter galaxies in the 4C 23.56 protocluster at z = 2.48. *Astronomy & Astrophysics*. Accepted on 18 July 2024. doi:10.1051/0004-6361/202348500

Conference Proceedings

1. Ross, A. B. (2024, December). VLBI observations of 6.7 GHz methanol masers during maser flares. *East Asian VLBI Network 2024*.

APPENDIX A: LANDSCAPE FIGURE EXAMPLE

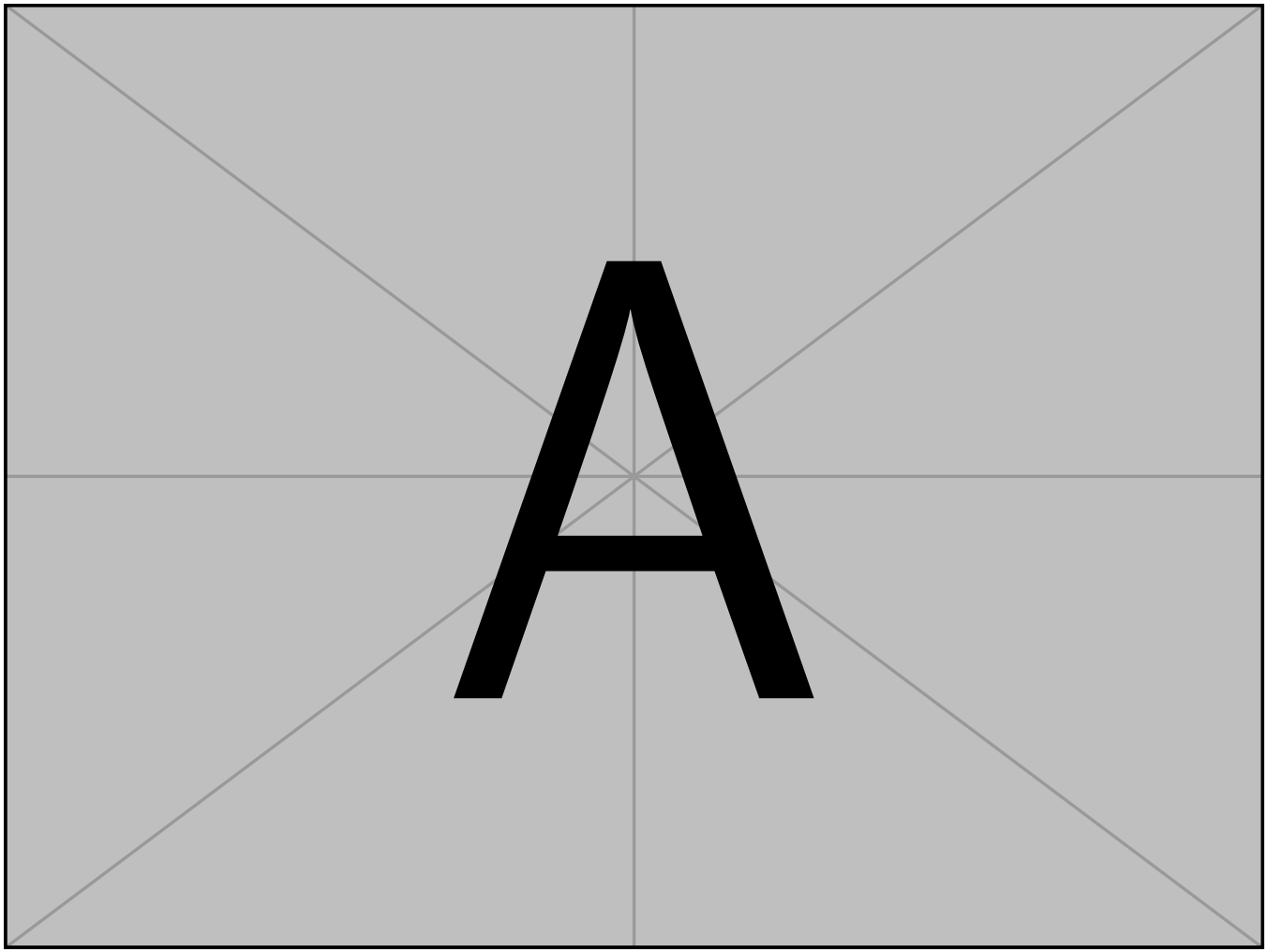


Figure A.1: Example landscape figure.

APPENDIX B: LANDSCAPE TABLE EXAMPLE

First column	Second column	Third column	Fourth column	Fifth column	Sixth column	Seventh column	Eight column
A	B	C	D	E	F	G	H
1	2	3	4	5	6	7	8
I	II	III	IV	V	VI	VII	VIII

Table B.1: Example landscape table.

APPENDIX C: LONGTABLE EXAMPLE

Table C.1: Example longtable.

First column (units)	Second column (units)	Third column (units)
A	1	I
B	2	II
C	3	III
D	4	IV
E	5	V
F	6	VI
G	7	VII
H	8	VIII
I	9	IX
J	10	X
K	11	XI
L	12	XII
M	13	XIII
N	14	XIV
O	15	XV
P	16	XVI
Q	17	XVII
R	18	XVIII
S	19	XIX

continued . . .

Example longtable (continued . . .)

First column	Second column	Third column
T	20	XX
U	21	XXI
V	22	XXII
W	23	XXIII
X	24	XXIV
Y	25	XXV
Z	26	XXVI
A	27	XXVII
B	28	XXVIII
C	29	XXIX
D	30	XXX
E	31	XXXI
F	32	XXXII
G	33	XXXIII
H	34	XXXIV
I	35	XXXV
J	36	XXXVI
K	37	XXXVII
L	38	XXXVIII
M	39	XXXIX
N	40	XL
O	41	XLI

continued . . .

Example longtable (continued . . .)

First column	Second column	Third column
P	42	XLII
Q	43	XLIII
R	44	XLIV
S	45	XLV
T	46	XLVI
U	47	XLVII
V	48	XLVIII
W	49	XLIX
X	50	L
Y	51	LI
Z	52	LII
A	53	LIII
B	54	LIV
C	55	LV
D	56	LVI
E	57	LVII
F	58	LVIII
G	59	LIX
H	60	LX
I	61	LXI
J	62	LXII
K	63	LXIII

continued . . .

Example longtable (continued . . .)

First column	Second column	Third column
L	64	LXIV
M	65	LXV
N	66	LXVI
O	67	LXVII
P	68	LXVIII
Q	69	LXIX
R	70	LXX
S	71	LXXI
T	72	LXXII
U	73	LXXIII
V	74	LXXIV
W	75	LXXV
X	76	LXXVI
Y	77	LXXVII
Z	78	LXXVIII

APPENDIX D: BAREBONES UMALAYATHESIS EXAMPLE

```
\documentclass{umalayathesis}

\usepackage{pdflscape}
\usepackage{tabularx}
\usepackage{longtable}
\usepackage{graphicx}

\author{}
\identification{}
\matric{}
\title{The umalayathesis \LaTeX{} Document Class}
\tajuk{Kelas Dokumen \LaTeX{} umalayathesis}
\fieldofstudy{}

\university{Universiti Malaya}
\department{Department of Physics}
\faculty{Faculty of Science}
\submissionyear{2025}
\degree{Doctor of Philosophy}

\addbibresource{...}

\begin{document}

\frontmatter
\makecoverandtitlepage{\doctoralresearch}
\declarationpage

\begin{abstract}
...
\end{abstract}

\begin{abstrak}
...
\end{abstrak}

\acknowledgements{}

{\clearpage
\tableofcontents\clearpage
\listoffigures\clearpage
\listoftables\clearpage
\begin{listofacronyms}
    ...
\end{listofacronyms}\clearpage
\listofappendices\clearpage
}

\mainmatter
```

```
\chapter{...}
...

\references
\ownreferences

\begin{appendices}
\chapter{...}
...
\end{appendices}
```