

## Guidelines for the elaboration of PhD theses

### 1. Legal context

The elaboration of a PhD thesis in Electrical and Computer Engineering needs to comply with the Portuguese legal framework, which is in line with the Bologna process. This framework establishes the requirements for awarding the PhD title:

<p><i>Dec.-Lei 74/2006, Art. 28º</i></p> <p>1—O grau de doutor é conferido aos que demonstrem:</p> <ol style="list-style-type: none"> <li>a. Capacidade de compreensão sistemática num domínio científico de estudo;</li> <li>b. Competências, aptidões e métodos de investigação associados a um domínio científico;</li> <li>c. Capacidade para conceber, projectar, adaptar e realizar uma investigação significativa respeitando as exigências impostas pelos padrões de qualidade e integridade académicas;</li> <li>d. Ter realizado um conjunto significativo de trabalhos de investigação original que tenha contribuído para o alargamento das fronteiras do conhecimento, parte do qual mereça a divulgação nacional ou internacional em publicações com comité de selecção;</li> <li>e. Ser capazes de analisar criticamente, avaliar e sintetizar ideias novas e complexas;</li> <li>f. Ser capazes de comunicar com os seus pares, a restante comunidade académica e a sociedade em geral sobre a área em que são especializados;</li> <li>g. Ser capazes de, numa sociedade baseada no conhecimento, promover, em contexto académico e ou profissional, o progresso tecnológico, social ou cultural.</li> </ol> <p>2—O grau de doutor é conferido num ramo do conhecimento ou numa sua especialidade.</p>	<p><i>(Free translation)</i></p> <p>1—The PhD degree is awarded to those candidates who demonstrate:</p> <ol style="list-style-type: none"> <li>a. The capacity for a systematic understanding of a scientific field;</li> <li>b. Competences, skills and research methods associated with a scientific field;</li> <li>c. Ability to conceive, design, adapt, and perform a significant research, respecting the academic levels of quality and integrity;</li> <li>d. To have done a significant amount of original research that has contributed to the expansion of the frontiers of knowledge, part of which merits national or international dissemination in peer reviewed publications ;</li> <li>e. To be able to critically analyze, evaluate and synthesize new and complex ideas;</li> <li>f. To be able to communicate with his/her peers, the academic community and society in general on the specialization area;</li> <li>g. To be able to promote, both in the academic and professional contexts, the technological, social or cultural progress under the framework of a knowledge-based society;</li> </ol> <p>2— The doctorate degree is conferred in a field of knowledge or in one of its specialization areas.</p>
---	---

Two modalities are allowed for the thesis:

- Elaboration of a dissertation
- Compilation of a set of relevant publications.

<p><i>Dec.-Lei 230/2009, Art. 31º</i></p> <p>1 — O ciclo de estudos conducente ao grau de doutor integra a <b>elaboração de uma tese original</b> especialmente elaborada para este fim, adequada à natureza do ramo de conhecimento ou da especialidade.</p> <p>2 — Em alternativa, em <b>condições de exigência equivalentes</b>, e tendo igualmente em consideração a natureza do ramo de conhecimento ou da especialidade, o ciclo de estudos conducente ao grau de doutor pode, nas condições previstas no regulamento de cada instituição de ensino superior, ser integrado:</p> <ol style="list-style-type: none"> <li>a) Pela <u>compilação, devidamente enquadrada, de um conjunto coerente e relevante de trabalhos de investigação</u>, já objecto de publicação em revistas com comités de selecção de reconhecido mérito internacional;</li> <li>b) ...</li> </ol>	<p><i>(Free translation)</i></p> <p>1 — The cycle of studies leading to a doctoral degree entails the preparation of an original thesis especially elaborated for this purpose, and appropriate to the branch of knowledge or specialization area.</p> <p>2 — Alternatively, in <b>equivalent demand conditions</b>, and also taking into account the nature of the branch of knowledge or specialization area, the cycle of studies leading to a doctoral degree can, in accordance with the regulations of each higher education institution, be composed of:</p> <ol style="list-style-type: none"> <li>a) A <u>properly framed compilation of a coherent and relevant set of research</u>, already subject of publication in journals with peer reviewing of internationally recognized merit;</li> <li>b) ...</li> </ol>
---	---

## **2. Recommended guidelines**

### **Modality 1: Elaboration of a dissertation**

*When:* This is the recommended modality for the PhD theses in Electrical and Computer Engineering at FCT-UNL.

*Typical structure:* Although the specific structure of each thesis as well as the titles of each section shall be defined by the candidate, following the advice of his/her supervisor(s), and taking into account the specific nature of the performed work, a typical structure can include:

- Preliminaries  
[*Abstract in Portuguese and English, Acknowledgements, Table of contents, List of Figures, List of Tables, Glossary, ...*]
- Introduction  
[*Motivation, Research question(s), Hypothesis(es), research method, Structure of the dissertation, etc.*]
- Background information (optional)  
[*An optional section, especially in the case of research of a multi-disciplinary nature, giving a brief overview of the other disciplinary area(s) to facilitate understanding of the thesis by experts in Electrical and Computer Engineering*]
- Literature review  
[*Comprehensive synthesis of the state of the art related to the thesis, showing a critical spirit, and identifying current gaps / limitations. A good number of recent references shall be included; in other words, the literature review should not only reflect the state of the art when the PhD program started. This section will show the capacity of systematic understanding, critical analysis and synthesis*]
- Conceptual contribution  
[*Formulation of concepts, definitions, theories; Elaboration of innovative frameworks, models, architectures*]
- Experimental developments  
[*High-level (cleaned up) description of the research experiment*]
- Validation / Discussion  
[*Section collecting (enough) evidence, using a proper (systematic) method, to validate the hypothesis(es); Organized argumentation to convince the other researchers about the validity of the thesis*]
- Conclusions and future work  
[*What is the strongest and most important statement that you can make from your work? set of recommendations (to overcome limitations) or directions for future research (maybe new directions opened by this work)*]
- References
- Annexes (optional)  
[*Only if necessary to convince the reader or help others replicate the experiments. E.g. Implementation details, Detailed experimental data, etc.*]

*Size:* A typical size for an engineering thesis is between **150** and **200** pages.

*Language:* **English** is recommended, as it allows wider dissemination. Alternatively, **Portuguese** can be used.

*Requirements before submission:* In order to submit the dissertation, the candidate must have:

- Finished all courses of the PhD program.
- At least **1** article (as first author) in a peer-reviewed journal in the Science Citation Index, and some papers in relevant peer-reviewed and indexed conferences. Only published or definitely accepted articles can be considered.  
Materials from publications of the candidate can be reused in the preparation of the chapters of the dissertation.
- Submitted all annual progress reports.
- A positive endorsement by the Thesis Accompanying Committee, stating that the dissertation is ready for public defence.

## **Modality 2: Compilation of a set of relevant publications**

*When:* Although allowed, this modality is **not recommended** for a PhD in Electrical and Computer Engineering at FCT-UNL and shall only be used in exceptional cases. In any case, this modality shall never be taken as a less demanding option.

*Typical structure:* In order to organize a proper compilation of materials, the following structure is recommended:

- Preliminaries  
[Abstract in Portuguese and English, Acknowledgements, Table of contents, List of Figures, List of Tables, Glossary, ...]
- Introduction  
[Motivation, Research question(s), Hypotheses, research method, Structure of the dissertation]
- Background information (optional)  
[An optional section, especially in the case of research of a multi-disciplinary nature, giving a brief overview of the other disciplinary area(s), to facilitate understanding of the thesis by experts in Electrical and Computer Engineering]
- Summary of achievements  
[An extended summary ( $\geq 20$  pages) of the main innovative achievements]
- Literature review [including references] (conditional)  
[Comprehensive synthesis of the state of the art related to the thesis, showing a critical spirit, and identifying current gaps / limitations. A good number of recent references shall be included; in other words, the literature review should not only reflect the state of the art when the PhD program started. This section will show the capacity of systematic understanding, critical analysis and synthesis]  
[This section can be skipped in case the candidate has published a substantial journal article of the type “literature survey”]
- Navigation map  
[A brief and well organized map guiding the reader through the attached papers, identifying the original contributions in those publications]
- Collection of relevant journal articles  
[Journal articles already published or definitely accepted where the PhD contributions and their validation are detailed]
- Conclusions and future work  
[What is the strongest and most important statement that you can make from your work? set of recommendations (to overcome limitations) or directions for future research (maybe new directions opened by this work)]
- Annexes (optional)  
[Impact of published works, e.g. citations to the included publications, number of downloads, etc.]

*Language:* **English** is recommended, as it allows wider dissemination. Alternatively, **Portuguese** can be used.

*Requirements before submission:* In order to submit the compilation/dissertation, the candidate must have:

- Finished all courses of the PhD program.
- **At least 3 articles** (as first author) of substantial size (typically  $\geq 16$  pages each) in relevant peer-reviewed journals in the Science Citation Index, and several papers in relevant peer-reviewed and indexed conferences. Only published or definitely accepted articles can be included. Small journal articles will not count for the above number. In case the chapter on Literature Review is not included, then **1 additional** journal survey article ( $\geq 16$  pages) [with the candidate as 1<sup>st</sup> author] is needed.
- Submitted all annual progress reports.
- A positive endorsement by the Thesis Accompanying Committee, stating that the dissertation is ready for public defence.