Innopolis University

GUIDELINE FOR THE THESES

March 5, 2021

Curriculum Committee

CONTENTS

1 INTRODUCTION

A thesis is an essential part of the learning experience for students as it focuses on their ability to integrate knowledge acquired throughout courses into a concrete problem. The final thesis assessment will consist of two parts. The first part relates to the project outcome. The second part relates to the project documentation.

The part that relates to the project outcome can take two forms, depending on the nature of the goals of the project: system development (`thesis type 1`) or research-oriented investigation (`thesis type 2`).

In the case of a thesis that focuses on system development, the outcome will take the form of the design, implementation, test, and evaluation of a complete system. This type of thesis might be done based on an Industrial project.

Intellectual property is generally agreed between the student, company, and university on a case by case basis. An agreement has to be signed in order to clarify what access rights have the university over the source code. In most of the case, this agreement does not prevent the publication of a scientific article. The Center for Career Development is in charge of preparing the agreement and validate the compatibility between University and Company. The signature of the agreement should be executed before any research and development activity.

In the case of a thesis that focuses on a research-oriented investigation, the outcome will take the form of an analysis of the subject area, a synthesis of a specific conjecture or hypothesis, empirical validation of the proposed model, and critical appraisal of the empirical or theoretical results.

This document serves as guidelines to ensure the maximum quality of students' work and the possibility of them finishing their thesis in time. The thesis work will be developed incrementally: students will have a running prototype of the thesis by the end of the first academic term, and complete development by the end of the academic year.

Lastly, it is essential to emphasize that during the thesis, students are expected to meet regularly with their supervisor and to act diligently on them.

This document is organized as follows. Chapter 2 describes what needs to be done before starting the thesis work. Chapters 3 and give guidelines for the thesis document. Finally, chapter 4.3 presents the thesis defence procedure.

2 PREPARATION

First of all, students should open a list of potential topic (should be delivered during the first month of the academic year). They should choose interesting topics and organize a meeting with a potential supervisor. To propose the own topic is also acceptable. The goal of this meetings is to decide on the topic of the thesis, research questions, title, aims, objectives, and the general structure of the thesis project.

Students, with their potential supervisors' help, should provide a complete specification of the problem, listing objectives, requirements, and a work plan to develop. The specification should include the research question.

- For `thesis type 1`, students should provide a description of the functionality of the system to be designed. Along with a discussion of the parameters affecting the performance of the system, its limitations, and restrictions.
- For `thesis type 2`, students should describe the goals of the investigation to be carried out in the project. Along with a discussion of the criteria or metrics to be used to assess the outcome of the investigation.

3 DISSERTATION

The dissertation is an independently written scientific work. This chapter shows the general guidelines for the document (each section can be treated as a chapter of the dissertation).

3.1 Sample thesis structures

Below several examples of thesis structures are summarized, with sample content items. Please note that these are **not mandatory** and should be rather used as a guideline for the students and advisors. The final contents and structure of the thesis is subject to the student themself and their supervisor.

Current (default) contents

- Introduction
- Literature Review
- Design and Methodology
- Implementation
- Evaluation and Discussion
- Conclusion

Alternative contents #1 (when involves hardware experiments)

- Introduction (motivation, literature review, problem statement, assumptions, background)
- Theoretical Part / Benchmarking
- Evaluation / Experimental Study (experimental setup, methodology)
- Conclusion and Discussion

Alternative contents #2 ("research-based" or fundamental)

- Introduction
- Problem and Discussion
- Methods and Results
- Concluding Discussion

3.2 General guidelines

The thesis should be written in English language and have a minimum length of 40 pages. The annotation should be written in Russian language and be at maximum 15 pages long.

3.3 Title, abstract, acknowledgments, table of contents

The thesis template. If you have any enhancements, which can be useful for others, you can make a pull request.

3.4 Introduction

In this chapter, students should introduce their work. Students should

- mention what the topic is about;
- why there is a need to further research on this topic;
- what the hypotheses are;
- state the research questions.

3.5 Literature Review and Related Work

In this chapter, students should write a Literature Review and Related Work on the topics and domains related to the project. For this, students may consult books, research journals, conference proceedings, handbooks, and even online courses. Some of the questions to be covered in this chapter are

- What is the relevant prior work?
- Where can I find it? (citations are important)
- Why should it be done differently?
- Has anyone attempted your approach previously?
- Where is that work reported?
- What is the outline of your way.

3.6 Design and Methodology

In this chapter, students should describe the general structure of the study: methods, approaches, or processes followed during the study. The methodology should be linked back to the aims of the thesis and the literature to explain why you are using certain methods. In the case of system development, students should describe the Design of the system: describe each component and how they will interact with each other. They should also describe the different experiments carried out. The design and solution should be elegant and robust – consistent with industrial standards.

This chapter should answer:

- Why did you use this technology/method?
- How does the theory relate to your implementation?
- What are your underlying assumptions?
- What did you neglect, and what simplifications have you made?
- What tools and methods did you use?
- Why use these tools and methods?

3.7 Implementation and Results

In this chapter, students should describe in detail the implementation performed, as well as the results of applying the system implementation to a case study or an experiment undertaken.

- For `thesis type 1`: Test suites implemented and documented. Faults also documented and cataloged. Comparison of the system performance to those other systems described in Section 3.5 or with benchmark metrics.
- For `thesis type 2`: Results presented in a manner that makes explicit their relationship to the research question. Including some estimate of error or reliability, and a comparison to those other systems described in Section 3.5 or with benchmark metrics.

This chapter should answer:

- Did you build it?
- How can you test it?
- How did you test it?
- Why did you test it this way?

3.8 Analysis and Discussion

In this chapter, the student should describe in detail the analysis and discussion of the findings from previous chapters. Students should discuss the accuracy and relevance of the results; compare with other researchers' results.

Are the results satisfactory? How do you define success in your thesis work? Why should you (not) test it more? What compensations had to be made to interpret the results? Why did you succeed/fail?

3.9 Conclusion

In this chapter, students should state the consequences of the achieved results. They should also mention whether the results are satisfactory and how they can be improved. This chapter is a short account of the results of your work, emphasizing mainly what is new.

Students should align the conclusion to the Introduction, in which the problem was described. They should also mention the limitations of the work and suggest what further work might be done. Make a synthesis of the contributions and impact of your work and recommendations.

3.10 Bibliography

References should be consistently cited in the text. (Plagiarism is unacceptable). References of the dissertation should follow IEEE style (it is already provided in the latex template). References to the World Wide Web, Wikipedia, non-peer-reviewed sites, non-academic manuscripts, and other blogs/social networks **should be avoided**.

Some of the questions this chapter should answer are:

- What is the background reading list?
- Where is the related work?
- Where is the prior work?
- Where can I find important material?

4 THESIS DEFENCE

4.1 Formal criteria to be admitted to thesis defence

For admission to the graduation thesis defense, you must submit the following documents to the Department of Education office :

- Bound graduation thesis, signed by the supervisor on the title page, drawn up following the requirements doc;
- Graduation thesis annotation in Russian is on 10-15 pages doc.
- Graduation thesis and Abstract in soft copy (pdf with a text layer and link to LaTex doc) uploaded to Moodle;
- **ONLY FOR MASTERS** Supervisor's review signed by the supervisor doc;
- The grading form final thesis assessment.

The graduation thesis will be checked by the anti-plagiarism system. If its authenticity is insufficient, it shall be returned for revision.

4.2 Presentation

Students, in addition to submitting the thesis document, need to make a presentation to their supervisors describing the thesis work. Supervisors arrange the presentation's schedule and location. They might invite other IU Faculty to attend the presentation.

The presentation should focus on the problem of the thesis, the research questions, the work performed, what was discovered, what are the lessons learned, and the recommendations.

This is the recommended structure of the presentation.

- General context
- Open problem you addressed – research questions
- Literature review and background
- Your proposed solution to the problem – design and methodologies
- Implementation and experiments
- Results and discussion

- Conclusions – contribution, impact, future work

4.3 Evaluation Criteria for thesis assessment

These are the criteria:

For `thesis type 1`:

- Does the student show that the design meets the requirements & specifications?
- Has a theoretical model been used or developed?
- Has a formal design methodology been adopted and, if so, properly used?
- Is the design well structured (e.g., is it hierarchical, are there well-identified interfaces, and is there a functional specification for each sub-system)?
- Is the design of the software or hardware fully implemented?
- Is the implementation modular?
- Is the final system of high quality (i.e., elegant or robust implementation consistent with industrial standards)?

For `thesis type 2`

- Are all the factors, empirical or theoretical, affecting the investigation analyzed and coherently summarized?
- Has a theoretical model been used or developed?
- Is a clear research question in the form of an explicit conjecture or hypothesis formulated and discussed?
- Are appropriate validation criteria identified and described?
- Have appropriate studies been conducted sufficiently well to address the research question (by simulation or other means)?
- Are the empirical tests well designed with clearly defined parameters and measurable outcomes?
- Are the empirical tests sufficient to arrive at a convincing conclusion or answer to the research question?

For the thesis document: Organization & Clarity

- Is the abstract representative of the content of the report?
- Is there evidence that the student has read a representative amount of relevant material?
- Is this material properly cited?

- Is the report logical in its development of the material?
- Are grammar and spelling generally correct?
- Is the phraseology clear and concise?

Technical Content

- Does the student demonstrate mastery of the domain?
- Is the student's synthesis of the relevant material compelling?
- Has the student explained all the issues in his or her own words or recycled a significant amount of the text from other sources?

Conclusions and Future Work

- Are conclusions well written?
- Are the student's conclusions or insights significant?
- Has he or she presented an objective and thorough appraisal of his or her achievements?
- Does the student make clear what he or she has learned from the project?
- Does he or she present ideas on future work related to his or her project?
- Does he or she understand the relevance and importance of the work presented in the Thesis?

For the Presentation

- Has the student covered all of the relevant issues?
- Was the presentation clear and concise?
- Was the student confident in his or her subject matter?
- Did he or she make the subject matter interesting?
- Did he or she answer questions well?

4.4 Panel of Experts

The Committee includes Professors from Innopolis University and Industry Representatives.

The graduation thesis defense shall be held in English.

Students will have 5-7 minutes only for the presentation. It will be followed by 10 minutes of questions/answers. Students might use the same guidelines as for the Supervisor's presentation.

The grades from Experts will be announced on the same day after the panel.