RESEARCH GUIDE BOOK

2024

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Department of Chemical Engineering FTI UII

RESEARCH GUIDE BOOK

CHEMICAL ENGINEERING STUDY PROGRAM – UNDERGRADUATE PROGRAM

CHEMICAL ENGINEERING STUDY PROGRAM – UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMICAL ENGINEERING

FACULTY OF INDUSTRIAL TECHNOLOGY

UNIVERSITAS ISLAM INDONESIA

2024

FOREWORD

This Research Guidebook for the Strata 1 Study Program of the Chemical Engineering Study Program, Faculty of Industrial Technology, Islamic University of Indonesia is compiled to provide information about Research activities in the 2020 curriculum. The content of the guide includes technical instructions for pre-, process- and post-research activities for students, supervisors, heads of research laboratories, laboratories, and study program administrators.

The drafting team realizes that there are many shortcomings, suggestions for improvement are highly anticipated from all parties. Hope it is useful.

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I. INTRODUCTION

Research is one of the final projects for undergraduate students that must be taken in the 2020 curriculum. The research aims to improve the *ability* to design and carry out laboratory and/or field experiments as well as analyze and interpret data to strengthen technical assessment and the ability to communicate effectively both verbally and in writing.

The research activities are divided into three stages:

a. The Pre-experiment stage is in the form of verification of the fulfillment of the requirements for participating in the research, the selection of research titles, the appointment of supervisors and the preparation of research proposals;

b. The Experimental Process stage is in the form of registration for laboratory entry permits, equipment loans, experimental implementation, equipment returns, laboratory exit permits, guidance, writing reports and results seminar manuscripts (ISChES);

c. The Post-Experiment Stage is in the form of registration and implementation of seminars (ISCHES), followed by publication in national or international journals or proceedings

In the semester credit system, research can be carried out in conjunction with credit unit fulfillment activities (SKS) for S-1 undergraduates. The research assessment is carried out after all academic requirements are met.

I.1. Purpose and Purpose

The purpose of the research is as a means for students to implement the knowledge that has been obtained in the process of solving problems related to the field of chemical engineering through experimental activities in the laboratory, simulations, or through observations in the chemical industry.

I.2. Research Topics

Based on the proposer, the research topic can be:

a. Topics from the Supervisor

b. Topics from Students

Based on the implementation technique, the research topics can be in the form of:

a. Research in the laboratory

b. Field research

c. Simulation research

I.3. Research Outputs

Research outputs are in the form of research reports and manuscripts of ISChES publications or proceedings of international/national scale seminars/journals. Students who have participated in national/international seminars or have published international/national journals in accordance with the results of the research carried out, are allowed not to participate in ISChES on the condition that they attach the results of the seminar or journal when ISChES registration is opened.

I.4. Research Submission Requirements

a. Registered as an active student of the Chemical Engineering Study Program, Undergraduate Program, Faculty of Industrial Technology, Islamic University of Indonesia (not on college leave).

b. Have taken the Research Methodology course.

c. Have taken all practicum courses with a minimum score of C.

d. Have entered (*key-in*) Research courses in KRS *on-line*.

e. Have completed administrative and financial procedures.

f. Attach a research proposal.

g. Have a K3 webinar/*workshop certificate* /have filled out *a risk assessment.*

h. Students can submit a conversion of the Student Creativity Week (PKM) – Exact Research (RE) activities as a substitute for the Research Course on the condition of sending research proposals and contracts, progress reports and final reports, a letter of introduction from the Director of Student Development of UII, and proof *of the Research key-in* to the email of the research coordinator (study program secretary).

I.5. Research Period

a) The research was conducted over a period of 6 months starting from September (for Odd Semesters) and March (for Even Semesters).

b) If during that period the student is unable to complete his research, he is obliged to provide a written report on the progress of the research to the research coordinator with the knowledge of the Supervisor as a condition for applying for an extension of the research time.

c) Students are entitled to an extension of the research period for a maximum of 2 times 6 months to complete their research.

d) The research is declared aborted and students are required to submit a new proposal if the research is not completed within the extension period.

I.6. Research Guidance

Research Guidance is a discussion activity between students and supervisors in planning, implementing, monitoring and evaluating as well as follow-up and research development. This discussion activity is recorded in the Guidance Sheet containing the date, content of the guidance and the paragraph of the supervisor. The details of each activity are as follows:

I.6.1. Planning

a) Students read literature and journal articles according to the research topic of interest

b) Students submit 2 or more choices of research titles (topics) to be worked on to the supervisor based on the results of the literature study in Step (a),

c) The supervisor examines, weighs and approves one of the topics proposed by students to be researched,

d) Students prepare research proposals and are endorsed by the supervisor

I.6.2. Implementation

a) Students register for permission to enter the laboratory: submit an application letter for a laboratory access permit for research, a Letter of Assignment from the Supervisor, a

Research Proposal that has been signed by the Supervisor, and a *time plan*/schedule of the research plan in three to six months to the Laboratory, a certificate of webinar/K3 workshop/has filled out *a risk assessment.*

b) If they have received a slot/place in the Laboratory for research, students immediately pay the cost of using the Laboratory and submit proof of payment to the Laboratory to process the Laboratory entrance permit.

c) Students borrow tools according to the needs of experiments in the laboratory

d) Students start research experiments in accordance with the procedures that have been approved by the supervisor in the research proposal,

e) Students record the implementation of research in the logbook and report its progress to the supervisor at least 1 time per week

I.6.3. Monitoring and Evaluation

a) The Supervisor has the right to request a report on the progress of the week to the student

b) The Supervisor directs, provides solutions if there are obstacles to the implementation of laboratory experiments,

c) The supervisor comes to monitor the implementation of the research directly to the laboratory if needed

d) The Supervisor evaluates the progress of the research and states that it is completed if there is no improvement

I.6.4. Follow-up and Development

a) Students and Supervisors discuss the results of the experiment, conclude follow-up and improvement of the experiment if the data obtained is not feasible or still lacks

b) Students repeat the experiment to update the data

I.7. Replacement of Title/Supervisor

a) Title replacement must be made if it has passed the research extension period as written in point 1.5. item c,

b) A change of research title can be done if the research proposal is declared not to meet the requirements of scientific principles,

c) The replacement of the supervisor can be done in the event that the supervisor is permanently disabled, so that he cannot carry out his duties,

d) The proposal of the new supervisor is submitted to the research coordinator accompanied by the reasons and name of the new supervisor in the next research registration period.

I.8. Submission of Research Reports

a) The research report is submitted after being approved by the supervisor,

b) The research report was uploaded through the link provided by the ISChES committee

c) The research report is uploaded a maximum of 2 weeks before the implementation of the results seminar (ISChES)

I.9. Research Assessment

a) The research assessment was carried out after students presented the results of the research in the results seminar (ISChES)

b) The supervisor has the right to provide 3 kinds of grades, namely the guidance value, the presentation value, and the manuscript value

c) The examiner has the right to provide 2 kinds of grades, namely the presentation value and the value of the manuscript

d) The range of values ranges from 0 – 100 for each type of assessment

e) The Final Value in numbers is calculated based on the following formula:

$$\text{Nilai Akhir} = 0{,}3(\text{rerata nilai presentasi} + \text{rerata nilai manuskrip}) + 0{,}4(\text{nilai bimbingan})$$

f) The final score in letters follows the Assessment Reference Guidelines according to UII Regulations

I.10. Authority and Responsibilities

Head of Study Program	:	a. Responsible for the smooth running of research
Research Coordinator	:	a. Determining the supervisor of the research student b. Approve new supervisors on student proposals
Head of Laboratory	:	a. Getting research proposals from students as a condition for starting activities in the laboratory b. Assess the suitability of the research topic with the tools available in the laboratory c. Coordinate with laboratories regarding the schedule of use of laboratories in accordance with the capacity and availability of equipment. d. Granting permission for students to enter and exit the research laboratory e. Issue a letter of free use of the laboratory for students who have completed research f. Sanctioning students if they are found to have violated the rules g. Responsible for the availability of the main equipment and supporting laboratory experiments
Supervisor	:	a. Getting regular reports from guidance students related to the development of research assignments. b. Provide consideration and approval of research proposals c. Prepare a schedule and plan of guidance activities. d. Provide direction and input to students for guidance related to the research process and report writing.

		e. Monitor and evaluate guidance students related to the development of the research process and report writing. f. Motivate guidance students to complete research assignments on time. g. Provide guidance value, presentation value and manuscript value
Examiner Lecturer		a. Provide suggestions for improvements b. Provide presentation value and manuscript value
Student	:	a. Get help from the supervisor in formulating research topics. b. Get a regular guidance time allocation from the supervisor. c. Receive direction and input from the supervisor regarding the research process and report writing. d. Getting an evaluation from the supervisor regarding the development of the research process and report writing. e. Get motivation from the supervisor to complete the research assignment on time. f. Get grades from the supervisor. g. Gain access to use the laboratory according to the research topic h. Make a research proposal with the direction of the supervisor. i. Carry out research activities according to a predetermined schedule. j. Follow procedures related to working safety in the laboratory. k. Use laboratory equipment responsibly. l. Carry out research guidance according to mutual agreement with the supervisor. m. Comply with the ethics of writing scientific papers.

		n. Adhere to suggestions for improvement as a result of the mentoring process.
Laboratory	:	a. Be informed about the duration of the research (when the research starts and ends) b. Prepare the tools needed by students. c. To give instructions to students on the correct procedure for using the tool. d. Supervise student research activities and provide information to the head of the laboratory if violations are found.

I.11. Categories and Sanctions for Violations

Category	Description	Penalty
Heavy	• Plagiarism with a Similarity Index > 85% • Plagiarism of lecturers' signatures	Research value F
Keep	Plagiarism with Similarity Index: 50% < SI < 80%	Research value decreased by 2 levels
Light	Plagiarism with Similarity Index: 30% < SI < 50%	Research score down 1 level

II. RESEARCH SUBMISSION PROCEDURE

II.1. Research Flow

The flow of the research is illustrated in Figure 2.1. Every student is required to obey each stage of the research flow in an orderly manner.

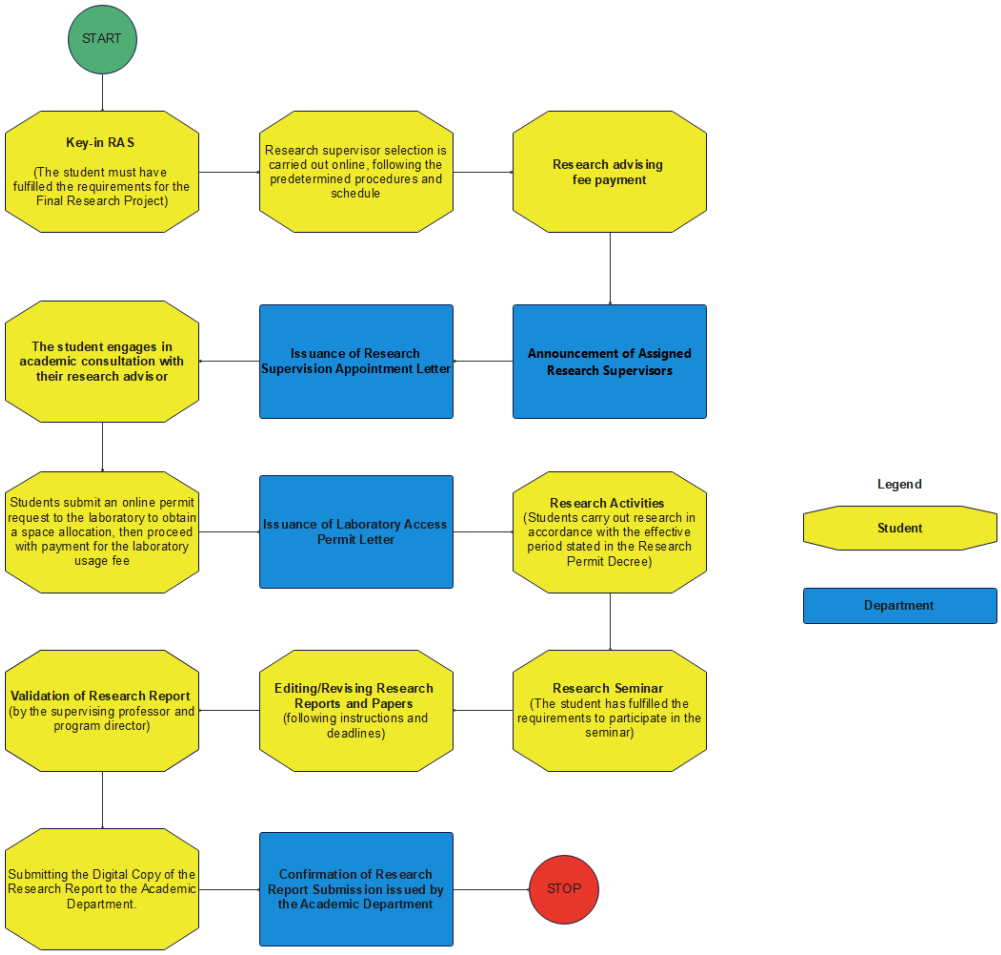


Figure 2.1. Research Flow of Undergraduate Chemical Engineering Study Program

Regulations for Issuance of Research Supervisor Assignment Letter

The following requirements must be fulfilled for the issuance of the Research Supervisor Assignment Letter:

a. Official Research Supervisor Appointment

- The student must have been formally assigned a research supervisor through the official procedures of the Study Program.

b. Payment of Research Supervision and Laboratory Fees

Supervision Fee Payment Details:

- **Bank:** Mandiri
- **Account Number:** 1370002283907
- **Account Holder:** Universitas Islam Indonesia, Faculty of Industrial Technology
- **Verification:** The payment code must be checked on the Study Program's website/research group platform before transferring.

Payment Receipt Requirements:

- Must include the **student's full name, NIM (Student ID)**, and **payment purpose** (e.g., *"Budi Budiman – Research Supervision Payment"*).

Research Fee Structure:

a) **For a research group of 2 students:** Each student is charged **Rp 400,000**.

b) **For an individual researcher (1 student):** The fee is **Rp 800,000**.

c. Submission of Payment Proof

A scanned copy or screenshot of the payment receipt must be submitted to the Study Program's admin via email: **teknik.kimia@uii.ac.id**.

d. Obtaining the Research Supervisor Assignment Letter

The letter will be issued electronically and can be accessed/downloaded through **https://simtekim-uii.id/**

II.2. Title Selection

The selection of research titles is carried out in accordance with the agreement between students and supervisors through https://simtekim-uii.id/. The title of the research can come from the recommendations of the supervisor or student proposals. The title of the research that has been approved by the supervisor, is described and formulated the research experiment in the form of a research proposal.

II.3. Proposal Preparation

The preparation of research proposals is the task of students with the guidance of the supervisor. Proposals must follow the format specified in this guide, and be endorsed by the

supervisor and the head of the study program. The proposal that has been ratified by the supervisor is uploaded on https://simtekim-uii.id/.

II.4. Selection of Supervisors

a. Students who have the right to choose a Research Supervisor are those who have done the KEY IN Research in that semester.

b. The selection of research supervisors for students of the S1 Chemical Engineering Study Program was carried out online according to a predetermined schedule.

c. Students who elect supervisors before that day and time are considered to be disqualified.

d. The selection is carried out by filling out an online form at the address (*link*) that will be submitted on the website of the study program/research group.

e. Students must read the quota for the availability of the Supervisor.

f. Students have the right to choose Prospective Supervisors from a number of quotas for the availability of Supervisors provided.

g. Each group consists of 2 (two) students or only 1 (one) student is allowed.

h. For a group of 2 students, only 1 student fills out the online form.

i. The determination of the selected Supervisor is determined based on filling out the form with the fastest time and the order of choice.

III. FORMAT OF RESEARCH PROPOSAL

Title, Material and Scope of Proposal Discussion

The title of the research is arranged in the form of short, clear sentences and in accordance with the research topic.

The scope of discussion that must be present in the submission of a research proposal includes:

CHAPTER 1 INTRODUCTION

1.1. Background

1.2. Problem Formulation

1.3. Research Limitations

1.4. Research Objectives

1.5. Research Benefits

CHAPTER 2 LITERATURE REVIEW

2.1. Theoretical Basis

2.2. Previous Research (covering state-of-the-art and development of research topics)

CHAPTER 3 RESEARCH METHODS

3.1. Place and Time of Research (schedule of research activities)

3.2. Research Variables

3.3. Tools and Materials

3.4. How It Works

BIBLIOGRAPHY

The research proposal is prepared in a concise, concise, clear and precise manner according to the purpose and needs of each subtopic, containing the following things:

CHAPTER 1 INTRODUCTION

1.1. Background

The background of the research explains the root of the problem that is suspected to require problem solving. The explanation of the origin of the problem is clearly written based on data from reliable references or sound reasoning. Starting with a broad description of the problem until narrowing down to the specific problem to be researched. Background clarity will make it easier to formulate the problem.

1.2. Problem Formulation

The formulation of the problem can be written in the form of a question that wants to be answered through the experiments conducted in this study or in the form of a picture of the correlation of the relationship between two or more variables.

Example questions:

Does the concentration of raw materials affect the speed of chemical reactions?

1.3. Research Limitations

The limitation of the problem is that the scope of research is adjusted to the ability of the researcher to carry out laboratory experiments.

1.4. Research Objectives

The purpose of the research is to find answers to the problems being researched in the form of a clear relationship between the research objectives and the formulation of the problem.

1.5. Research Benefits

The benefits of research are felt for researchers, for the wider community, related agencies and scientific development.

CHAPTER 2 LITERATURE REVIEW

4.1. Theoretical Basis

Contains theories in general and in detail from various related references that are used as the basis for the preparation of the research.

4.2. Prior Research (state-of-the-art)

Previous research is a resume of several previous studies with topics that are similar or identical to the research to be conducted. The reference sources used can come from scientific journal articles, proceedings articles or books.

CHAPTER 3 RESEARCH METHODS

6.1. Place and Time of Research (schedule of research activities)

The research place is the laboratory where the research is carried out, the research schedule is made with clear stages in the form of a barchart. The schedule can be focused on processes, activities or details of tasks/jobs to be done.

6.2. Research Variables

It is a parameter that will be tested through a selected experiment of different values

6.3. Tools and Materials

It is the tools and materials used in the implementation of the experiment, written in detail and complete.

6.4. How It Works

It is an experimental procedure in the form of a flowchart and the analysis of the calculation is described in detail.

BIBLIOGRAPHY

The Bibliography is a list of references to scientific articles that are used as a reference in writing research reports. Bibliography writing is done with the help of citation software, including Mendeley, Zotero, EndNote.

IV. FORM OF WRITING A RESEARCH REPORT

The format of the research report follows the following rules:

IV.1. Initial Parts

The initial section consists of Cover, Title Page, Endorsement Sheet, Foreword, Abstract, Table of Contents, Table List, Image List, and Appendix List

IV.2. Center

The middle part consists of: Chapter 1 INTRODUCTION, Chapter 2 LITERATURE REVIEW, Chapter 3 RESEARCH METHODS, Chapter 4 RESULTS AND DISCUSSION, Chapter 5 CONCLUSIONS AND SUGGESTIONS

IV.3. The Final Section

This final section consists of: Bibliography and Appendices

V. RESEARCH REPORT WRITING TECHNIQUES

V.1. GENERAL RULES IN FORMAL WRITING

The preparation of formal writing in various forms (e.g., reports, seminar manuscripts, etc.) is an integral part of various professions. The difference between a formal report and an informal delivery of information is not in the essence conveyed, but in the expectations of the reader when they read the information written in the report. Because there are many things that need to be displayed in a report (e.g. tables, pictures, and so on), it is necessary to pay attention to the procedure for submitting a formal report. The following are some things that need to be considered in the preparation of a formal writing.

1. Writing the title in the form of a positive sentence

The choice of title is very important because the title is the first part to be read and this will direct the reader's mind to what is conveyed next in the script. A good title is one that is able to relate the problem, purpose, and outcome of the work being reported. Although it is expected to be inclusive of the entire content of the manuscript, it is necessary to note that the title is not too long (at most 15 words).

Example:

Increased Speed of Solid-Liquid Catalytic Reaction with Stirring

The above headings are more descriptive than the following examples (the following headings are not incorrect but less specific):

Effects of Stirring on the Velocity of Solid-Liquid Catalytic Reactions

Solid-liquid catalytic reaction velocity studies

(As much as possible, it is best to avoid titles that begin with the cliché words 'Effect...', 'Study...')

Examples of titles that are not common in formal (pop-style) writing:

Does stirring have an effect on the speed of solid-liquid catalytic reactions?

2. All sentences in a scientific paper are news sentences and do not use first-person pronouns, command sentences, or question sentences. All sentences intended to inform the author's activities are delivered as passive sentences.

Example:

PHB production is carried out in a fermenter with a total capacity of 2 L equipped with a magnetic stirrer. During the experiment, the fermenter was kept at 30oC. Air is flowed into the fermenter at a rate of 0.3 L/min to reach a saturated concentration of dissolved oxygen in the medium. Sampling is done every specific time interval. The cells in the sample are separated from the rest of the medium by *a centrifuge* at a speed of 4000 rpm, for 15 minutes so that the cell pellets are obtained and clear.

Example Error 1 (the style of practicum instructions should not be used in scientific papers):

PHB production is carried out in a fermenter with a total capacity of 2 L equipped with a magnetic stirrer with the following procedure:

1. During the experiment, keep the fermenter temperature at 30oC.
2. Flow air into the fermenter at a rate of 0.3 L/min to reach a saturated concentration of dissolved oxygen in the medium.
3. Sample each specific time interval.
4. Separate the cells in the sample from the rest of the medium with *a centrifuge* at 4000 rpm, for 15 minutes so that the cell pellets are clear and clear.

Example False 2 (using first-person pronouns and question sentences):

I take samples at any given time interval, then *I* separate the cells from the rest of the medium with a centrifuge. *What is the most effective way of separation*? Experience in the laboratory shows a minimum *centrifuge* speed of 4000 rpm and a process time of not less than 15 minutes.

3. All information written in a scientific paper must have a strong foundation, whether in the form of primary data, secondary data, or other references. A formal report presents facts, not speculation.

Even things that are conjectural must be supported by strong arguments. Dubious words such as 'may' or 'seemingly' should be avoided as far as possible. The writing will be more professional if it uses firm sentences, for example: "Although the data obtained is very limited, the tendency of the data is in accordance with the results of previous research (Bahua, 2003, Paramesti, 2003, and Putra, 2004). This indicates that the concentration of hydrogen peroxide has a significant effect on lysis efficiency". Such a way of delivering is more professional than the popular language style such as the following example: "Based on the data obtained, it ***appears that*** the concentration of hydrogen peroxide has an effect on lysis efficiency" (this feels like unconvincing chatter).

4. Foreign words are only used for technical terms that have no equivalent in Indonesian and if forced to be translated into Indonesian, it is feared that it will cause confusion in meaning. The use of these foreign words must be in italics.

Example:

At a column diameter of 5 cm, the distillation operation in this study is very sensitive to the volumetric flow rate of the steam phase. A slight increase in the steam flow rate has caused *flooding* in the distillation column.

Example of a misnomer:

The feed for the reactor is fed at a *flow rate* of 20 mL/*second*.

(Supposedly: The reactor feed is fed at a flow rate of 20 mL/sec)

0. All figures and tables are in support of the information presented in the narrative of the report. Thus, all the pictures and tables must be told in the narrative. It is not allowed to paste pictures and tables that are not mentioned in the narrative. The image is written using a central flat format. Each image must be numbered and titled and referred to in the writing. The number and title of the image are placed below the image, as seen in Figure 1.

Figure 1. Intermetallic Coating at 7000C Aluminum Liquid Temperature

The table number and title are placed on top of the table in question in a left-aligned position (*Align Text Left*). Table 1 shows an example of writing numbers and table titles. To facilitate numbering and giving titles of images and tables, the Caption facility can be used. The colors in the images and tables will be tried to be maintained in the journal in CD form, but for printed journals it is only available in black *and white format*.

Table 1. Example of Writing Table Numbers and Titles

No.	Information	Information

V.2.FORMAT OF RESEARCH REPORT

The number of pages in the Research Report is limited to a maximum of 40 pages. The report is written with a font size that reads clearly Times New Roman 12. Spacing between lines is 1.5 except for Digest which is allowed to use *single spaces*. The size of the left margin is 3 cm, the top 3 cm, the right 3 cm and the bottom 3 cm. For Research Reports, the font size variation for the Title Page must follow the template available in the Download Center at the FTI UII Chemical Engineering Study Program. For chapter titles and other sections in the body of the report, the font size variation follows the report template. The Research Report must include the following components.

I. FRONT

The page numbering in this section uses lowercase Roman numerals (i, ii, iii, iv, and so on), with the number i for the title page but not appeared. So the page number that appears first is 'ii' for the Confirmation Sheet page. The contents of the Front of the Research Report are as follows.

1. **Title Page**
2. **Verification Sheet**
3. **Table of Contents**
4. **List of Tables**
5. **List of Images**
6. **List of Emblems**
7. **Foreword**
8. In this Preface, the author is basically free to express his gratitude to any party who is considered to have contributed to the completion of his research. However, it is recommended that the way of writing the Introduction still uses formal language according to the standard rules and does not use 'slang'.
9. **Essence**
10. The digest is written a maximum of 1 (ONE) page with the same font size as the font size in the body section of the Research Report, with *single* spaces. The digest is a summary of the entire content of the Research Report in narrative form (there should be no pictures and tables). The inclusion of mathematical equations in the core is unusual, even if the research is a mathematical modeling or simulation. The Digest must include the research background, problems, objectives, expected benefits, how it works, discussion of results, and conclusions. The Digest is a '*stand alone format*', which means that by just reading one page of the Digest, the reader can get an overview of the entire content of the Research Report. Keywords are written at the end of the digest with a maximum of five words.

II. CONTENTS SECTION

This section is arranged in the form of chapters, with page numbering using Arabic numbers and starting from the number 1 for the first page of the first chapter. The details of the content of each chapter are as follows.

Chapter I. Introduction

Sub Chapter:

1. **Background**
2. This section explains the question *'What prompted you to do this research?'*
3. **Problem Formulation**
4. In the Background section, the macro problem is implied. In the Problem Formulation section, the scope of the problem to be solved with this research is clearly written. It could be that the problems defined in this section are only part of the macro problems described in Background.
5. **Research Objectives**
6. This section is closely related to Problem Formulation, which answers the question *'What will you do to solve the problem you defined earlier?'*
7. **Expected Benefits**
8. This section outlines the things that will be gained if the research objectives are achieved. Usually, benefits are reviewed from several aspects, namely benefits for science, benefits for the State, and benefits for society.

Chapter II. Literature Review

The Literature Review summarizes the results of literature studies related to the research conducted. All references used in the Library Review must be written in the Bibliography following the format specified in this guide. Some things to consider in writing a Literature Review:

Free and consistent writing style, recommended using mendeley, zotero, end note, etc. software.

1. The paragraphs should be well related to each other. It often happens because it takes references from various sources, the series of various information is not presented in a cohesive manner (it looks like just *copy-pasting* here and there).
2. The two commonly used reference writing models are as follows:

Example 1:

Temperature and pH are the two things that most affect the performance of enzymes (Shuler and Kargi, 2002).

Example 2:

Shuler and Kargi (2002) state that temperature and pH are the two things that most affect the performance of enzymes.

Note: If the number of reference authors is more than 2 people, then it is used by et al. (and friends). For writing in Indonesian, it is better to consistently use 'and' (not '*and*') for the number of writers 2 people and 'et al' (not '*et al.*') for the number of authors more than 2 people.

Chapter III. Theoretical Foundations (in the same chapter as a literature review)

The Theoretical Foundation is NOT the same as the Literature Review. The author needs to be careful that the Theoretical Foundations are not a repetition of the Literature Review. In the Literature Review, the author presents the results or theories that have been developed by others. On the other hand, in the Foundations of Theory, the author presents his own original ideas, both in the form of new theories, elaborations of mathematical models, and so on. In the Foundations of Theory it is possible to have references to existing theories, but they are minimal in number and are more dominant on the author's new ideas.

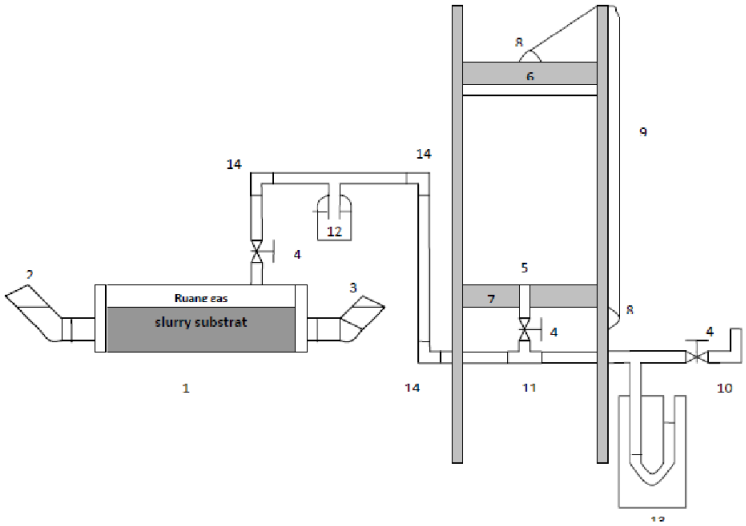
Chapter IV. Research Methodology

Sub Chapter:

1. **Tool**

The description of the tools referred to here is the MAIN TOOL used in the research. There is no need to list small tools that are commonly used, such as beakers, Erlenmeyers, pipettes, burettes, stirring rods, staves, and so on. If using a set of tools, it is necessary to include a complete tool schematic with a description of the image. The image description is included in the image (above the image title) as in the example below. The tool image should be presented in the form of a schema as in the example, NOT the tool photo. Please note that images should not be separated in different pages. The entire image section and the image title should be on the same page.

Example of presentation of a picture of the tool:



Keterangan gambar:

1. Digester	6. Pemberat	11. Pipa T ½"
2. *Inlet* digester	7. Alas	12. Perangkap air
3. *Outlet* digester	8. Katrol	13. Manometer
4. Kran aliran gas	9. Tali katrol	14. Kerangka gas holder
5. Gas holder	10. Kompor	

Figure 1. Research Tools Series

Material

All materials used in the study need to be mentioned, complete with their main specifications (technical or p.a., if technical what percentage of the level, specific gravity, molecular weight and so on are usually listed on the material packaging). It is also necessary to mention the manufacturer (e.g. Merck, Sigma Aldrich, etc.) and the product catalog number (which can be seen on the material packaging). This information is important for future research that intends to continue the research or simply compare the results. If using natural materials, the specifications are included.

How It Works

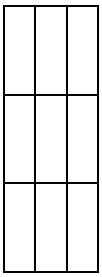
The Way of Work is presented in a narrative form, with passive sentences. It is not allowed to use the practicum instruction model (with imperative sentences) or sentences with first-person pronouns. Consider the example in Section B.2. above. The presentation of the working method in the form of a flowchart is allowed in the Research Report, but is treated as an image (titled an image). This means that there must still be a narrative and this flow chart only serves to clarify the narrative. In the Seminar Script, the way of working is presented with a narrative, without a flowchart.

Chapter V. Results and Discussion

In general, this section displays a lot of data in the form of tables and graphs. It is important to note that there is no duplication between the table and the chart. A table or graph must appear in its entirety on a single page. The format of writing tables and figures is as follows:

Example of a whole table:

Table 1. Table Title

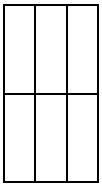


For very long tables, if they have to be cut into two pages, the table pieces on the second page need to be titled again with the note '(continued)' as in the following example:

Example of a truncated table:

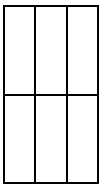
First page:

Table 2. Table Title



Followed on the next page:

Table 2. Table Title (Advanced)



Example picture:

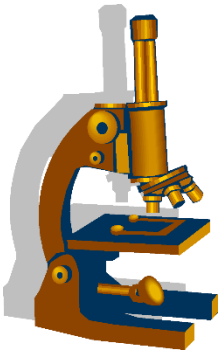


Figure 1. Image Title

Chapter VI. Conclusion

The conclusion must answer the hypothesis and be relevant to the research objectives that have been defined. Conclusions are written in the form of points or paragraphs related to the points in the formulation of the problem and the purpose of the research.

Bibliography

In the Bibliography, all authors of articles/books must be written (do not use abbreviations et al. as in writing references in the Literature Review). Bibliography writing follows the following rules:

Book:

Bailey, J.E. and Ollis, D.F., 1986, *Biochemical Engineering Fundamentals*, 2nd ed., McGraw-Hill Book Company, New York.

Journal:

Beun, J.J., F. Paletta, M.C.M. Van Loosdrecht, and J.J. Heijnen, 2000, *Stoichiometry and Kinetics of* Poly-β-Hydroxybutyrate Metabolism in Aerobic, Slow Growing, Activated Sludge Cultures**, Biotechnol. Bioeng.**, **67(4)**, 379-389.

Note:

The name of the journal is written as an official abbreviation. A list of official abbreviations of various scientific journal titles can be searched on the websites of international libraries, e.g.

Caltech Library Services in http://library.caltech.edu/reference/abbreviations/. Another way is to search through the Google *search engine* with the search keyword '*scientific journal abbreviations*'.

Research Report:

Putra, J.A., 2004, *Mathematical Modeling of Lysis Process for Purification of Butyric Hydroxy Poly Using Hydrogen Peroxide and Chloroform*, Research Report of the Food and Bioprocess Engineering Laboratory, Chemical Engineering Study Program, Faculty of Engineering, Gadjah Mada University, Yogyakarta.

Website:

Archenbach, J., 2008, *At the Heart of All Matter*, www.nationalgeographic.com (accession date)

Notes for library resources from the internet:

Writers need to be careful if using sources from the internet as a reference. There are many sites on the internet where anyone can enter the writings and there are no peer reviews for the writings. Thus, there is not necessarily a guarantee that the information written there has been validated and trustworthy. Therefore, to ensure the professionalism of the report written, it is better to only take references from reliable sources, such as well-known media websites, and have the author's name (not anonymous)

Some of the bibliography writing styles that can be used include:

Harvard style:

Davis, L, Mohay, H & Edwards, H 2003, 'Mothers' involvement in caring for their premature infants: an historical overview', *Journal of Advanced Nursing*, vol. 42, no. 6, pp. 578–86.

APA style:

Mischel, W., & Baker, N. (1975). Cognitive transformations of reward objects through instructions. Journal of Personality and Social Psychology, 31, 254-261.

IEEE style:

R.R. Yager, "Multiple objective decision-making using fuzzy sets," *International Journal of Man-Machine Studies*, vol. 9, no. 4, pp.375-382, Jul. 1977.

III. BACK (APPENDIX)

The content of the Appendix cannot be standardized because it depends on the nature of each research. Basically, all evidence of information/data/photos relevant to the content of the Research Report needs to be attached so that there is no doubt about what the author displays in his report. The appendices that are usually included in the Research Report are as follows (but do not limit the author's creativity to include other documents depending on the nature of the research):

a. How to analyze and original data from data collection in the laboratory (e.g. standard curves,
b. diphragtograms, chromatograms, etc.)
c. Calculation methods and calculation results based on primary data
d. Computer programs (if any)
e. Seminar Manuscript according to *the Seminar Manuscript* Template **(must be attached)**

V.3. SOME IMPORTANT CLUES

a. Before starting to write, it is necessary to prepare an outline first of the things that will be conveyed in the writing. After a systematic outline is arranged, the elaboration of each point in the *outline* into neat paragraphs begins. It is important to note the importance of connecting sentences so that the transition from one paragraph to another feels smooth and there is a systematic connection between one paragraph and the next paragraph.
b. Each research student is guided by a lecturer. In terms of preparing reports, keep in mind that the function of the supervisor is to direct the TECHNICAL ASPECTS in the report, not to be a manuscript editing assistant for students. Thus, grammatical details are the responsibility of students and all students are considered to have knowledge of standard grammar from the previous level of education. If students feel that they have not mastered the rules of standard grammar, then students are responsible for improving their language skills. The supervisor is not responsible for correcting language errors in the report or seminar manuscript that is examined. The supervisor has the right to refuse to correct the

content of the report that does not follow this guideline and still contains many language errors.

c. Considering that the review process by the supervisor can take a long time, students are responsible for estimating for themselves when to submit the draft report and seminar manuscript so that they can complete the research before the deadline expires. Lecturers will approve the submitted draft if the draft meets the scientific writing standards. This standard will not be lowered just because the research deadline of the student concerned has expired.

d. To speed up the review process by the supervisor, students must try to make sure that the draft given to the supervisor is perfect in terms of language and presentation systematics, namely using a standard sentence pattern, using a formal written language style, and there are no typos. If the supervisor considers the draft not feasible because there are still many grammatical errors or not according to the guidelines, then the supervisor has the right to refuse to review until the student provides a good and correct draft.

VI. MANUSCRIPT WRITING OF SEMINAR RESULTS (ISCHES)

Writing a seminar manuscript (ISCHES) must use the template in the ISCHES Paper appendix. The template can be downloaded at the following link: http://bit.ly/ISChES-doc. The Seminar Manuscript is a summary of the Research Report, with a maximum number of pages limited to 6-14 A4 pages. Format provisions are given in the *Seminar Manuscript Template* file . In contrast to the Research Report, for this Seminar Manuscript, the layout, type/size of letters, size of spaces, and so on must follow the provisions in the Seminar Manuscript Template. To make it easier to write a Seminar Script, students can *download the* Seminar Script Template from the UII Chemical Engineering Study Program website and directly write the script in *the file*. The supervisor has the right to refuse to correct the seminar manuscript that does not follow the Seminar Manuscript Template. This Seminar Manuscript is a manuscript that is distributed to seminar participants and attached to the Research Report submitted to the supervisor and Study Program.

VII.CONCLUDING REMARKS

This research guide was prepared to provide information on the management of the Research Final Project with a weight of 2 credits in the Chemical Engineering Study Program, Undergraduate Program, FTI UII so as to help all parties carry out their responsibilities and authorities as well as possible. If in the future there are things that are not suitable, research guidelines can be revised to accommodate the needed changes.