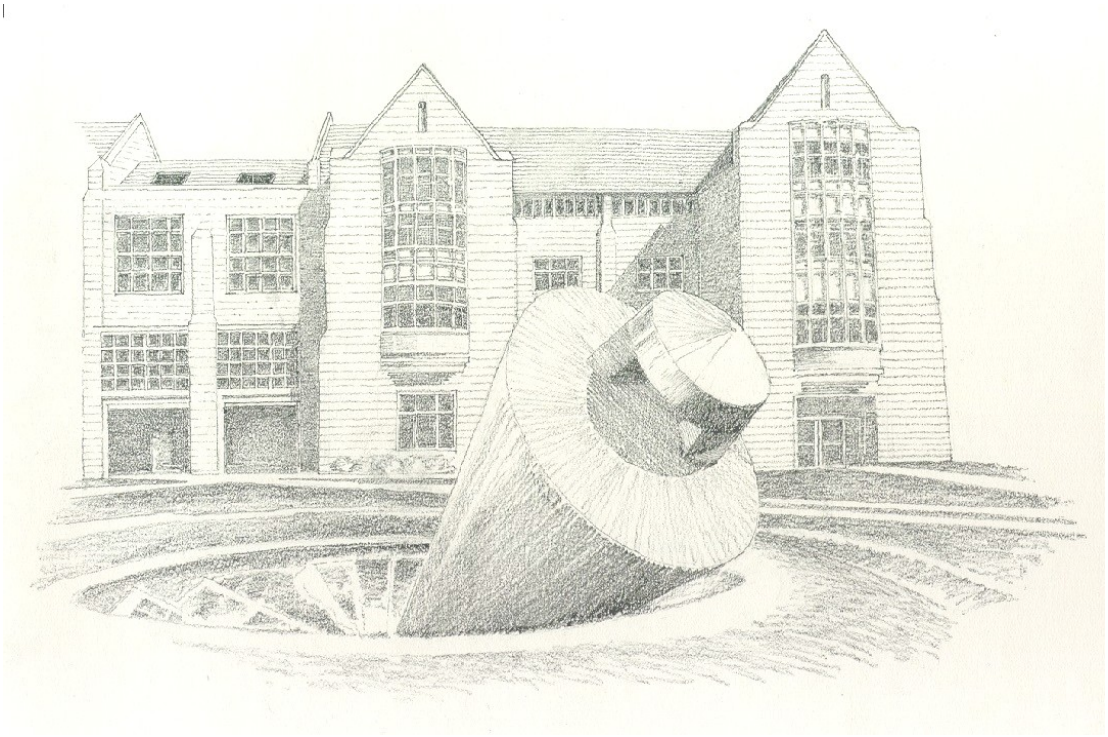
Engineering Project Workbook



Master of Manufacturing Systems Engineering 2005-2006

University of St. Thomas
Minnesota

Guidelines for Engineering Project

What is an Engineering Project?

The engineering project is an in-depth paper on a very focused unique topic that is supported through documented research.

ABET Requirement

I.E.3.c The program must include an engineering project or engineering research activity (experimental or analytical) of significant depth requiring innovation and creativity and resulting in a report that demonstrates mastery of the subject matter and a high level of written communication skills.

Characteristic	*Engineering Project*
Focus	Solving a specific problem
Literature search	Broad but shallow
Activity	Development
Applicability	Specific
Approach	Applied
Arguments	Convincing
Results	Practical conclusions
Application	Direct application to immediate problem

Keep it in perspective

The engineering project is more than another requirement to be completed. It represents an opportunity for you to express your thoughts in a formal manner on a subject or project you propose, which employs the work of others as a foundation. It will be certified by scholars in your field, published, copyrighted, and held for permanent referral by others interested in your work. The project is what you give back to the community from which you obtained the rest of your education.

People often misunderstand the requirement of a project. There seems to be two conflicting misperceptions. One group sees it as an obstacle to be surmounted, sometimes a rather meaningless step. Others seem to worry about the requirement thinking that it requires some sort of divine brilliance in order to reach fruition. Both of these perceptions are off target. The project requirement is a rigorous, but manageable endeavor.

Get it done

Some students seem to have difficulty finishing the project. Once degree candidates progress to the project point, faculty hope students do well and follow through. They are willing to work closely with you to ensure you finish successfully. Students have three years to complete their project write-up after taking their final class. Students are encouraged to complete the project prior to the end of their coursework.

Choose a manageable topic

Many people struggle when choosing a topic. Some pick a subject that is too broad to be practical such as "The Origin and Present Status of MRP Systems" or "Transaction Costs in U.S. Industry." These topics would be difficult to research in detail. Most successful projects are focused, specific and clearly defined. And their specificity is usually reflected in long titles that carefully delineate the scope of the paper. Specificity is essential for clarity and will aid you as you formulate your project and then attempt to solve it with your research.

We encourage students to select topics that relate to their jobs and/or companies. The engineering project is a contribution to the engineering community and your company. It should be a topic that interests you. The project should investigate a new subject or solve an engineering problem that has not been solved before.

Is this project company confidential or proprietary?

There are issues you will need to consider if your topic is proprietary. Will your project remain in the hands of your employer if you move on to another company? Will your company permit the University of St. Thomas to keep a copy? Will you be able to share an abstract of your research with a wider audience?

A company proprietary or confidential work must be identified as such as soon as the committee is chosen. Members of the committee must be acceptable to the company and should be informed that the work will be company confidential or proprietary.

The student is responsible for writing a short letter stating that their project will be confidential. Any confidentiality paperwork must to be completed before the written work is submitted.

The student will note on the front of the final work that it is company confidential and which company.

The project abstract will contain the title, the student's name, the date of the formal presentation, the fact that it is company confidential or proprietary work and to which company along with the final abstract of the work.

Selection of your Advisor and Committee

It is recommended that you choose someone who is familiar with the field you will be working in. You choose your project advisor and committee. One of the members must have a Ph.D. If you are unaware of someone who is knowledgeable in a field, you can contact the Engineering Office for a suggestion. You will work closely with you're advisor throughout the project. The two additional readers review your work after the chapters 1-3 are done and when your report is complete. They are present at your formal presentation and sign off on your report.

How does ETLS 881 relate to the Engineering Project?

ETLS 881 is an independent study course that includes the completion of your engineering project. You should register for ETLS 881, Engineering Project Credits, during the semester you anticipate completion of the entire project and formal presentation. If there is any question about completion of your project, plan on registering for the ETLS 881 course during the following semester. ETLS 881 Engineering Project Credits course is graded Satisfactory or Repeat. Once you have turned in the final corrected copy of your report for printing, your grade will be issued for ETLS 881 and if all requirements are met, your diploma will be issued.

Graduation

A request to graduate card must be completed no later than two weeks from the start of the semester in which you hope to graduate. The card can be filled out by telephone by calling Student Services at 651/962-5756.

Students have one month after the date of graduation to complete all requirements including all changes recommended by the formal presentation committee and revised, printable copy turned into Student Services in order to have a diploma dated that graduation date. Students must complete and submit all work to Student Services before the diploma will be issued. Any exceptions to this policy must have departmental approval.

Procedures

Step 1: Select a general topic and discuss it with your proposed advisor. Students who are beginning the process may submit a proposal form for review and be contacted by a faculty member to discuss the topic. That person could become your advisor. After selecting a topic present an engineering project to your proposed advisor. Make sure the topic interests you, is a new subject and a manageable one.

Step 2: Create a Concept Sheet as described in "How to Write a Paper by Mike Ashby".

Step 3: Choose a committee. Each engineering project is reviewed by a committee of three faculty members - one advisor and two readers. We require that at least one member of your committee have a Ph.D. You will want to select committee members who have experience with your subject area. Contact them and obtain their permission. If your engineering project is confidential to your company, arrangements can be easily made to legally protect this confidentiality or you can select committee members associated with and acceptable to your company.

Step 4: Do your research and refine the topic.

Step 5: Write the first three chapters of the project.

- **a.** Chapter II should include your research, write this first.
- **b.** Second, write Chapter I which should be your introduction.
- **c.** Lastly, Chapter III should discuss your research methodology

Step 6: Review Chapters I through III with your advisor and committee members. This is an excellent opportunity to request help from your advisor and committee members.

Step 7: Incorporate changes suggested by the advisor and committee members.

Step 8: Write Chapters IV and V. Register for ETLS 881 at the beginning of the semester of anticipated completion of these chapters. Chapter IV should discuss your findings and results. Chapter V should include discussion and ramifications. Submit chapters to your advisor and committee members.

Step 9: Make changes as indicated by your advisor and committee members. Make sure that you allow sufficient time for all members to review the final product before scheduling the formal presentation.

Step 10: Make arrangements for your formal presentation. Let Student Services know if you need audio-visual equipment or a computer for the formal presentation and the title, names of advisor, committee members and date of formal presentation.

Step 11: Present the completed project before the committee. One of three outcomes is possible:

1. Pass with no changes.
2. Pass with changes to be monitored by a member of the committee.
3. Fail. (This outcome is unlikely if you have worked closely with an advisor.)

Step 12: Make the suggested changes, if any, to the satisfaction of your advisor.

Step 13: Formally submit the engineering project report to the Student Services Office, noting if it is company proprietary and if you wish to pay for additional copies of the bound document. One copy is printed for you, one for the department and two for the library unless it is confidential.

Engineering Project Format

Abstract

The abstract is a simple two-thirds page synopsis of the project. It should describe why you chose the subject and give the reader an idea of your project and results. It is best written after the presentation. The abstract normally follows the title page.

Chapter I - Introduction

The introduction describes the problem that is to be solved. It should contain enough detail so the reader understands why this problem is important. Discuss the motivation leading up to the identification of the problem, the competitive ramifications of solving the problem and the financial consequences.

Chapter II - Research and Project Definition

This section contains in-depth research into the problem. Has this problem been solved before? Why is this an important problem? What work has been done that would help clarify the approach to the problem that would be most productive? In short, if the problem has already been solved, you don't want to reinvent the wheel. Research should be into any viable source of information for this project: patents, journal and magazine articles, company internal reports, supplier catalogues, expert opinions, etc. The research must be well documented. A discussion of the findings and shortcomings of the research should be included in this chapter. This chapter also contains a summary definition of the project.

Chapter III - Proposed Methodology to Solve the Problem

This chapter should begin with a discussion of possible alternative approaches to solving the problem, and argue convincing why one approach has been chosen over others. Include a detailed description of the project with a project plan, detailed specifications, project schedule, resource requirements and financial assessment. Think in terms of what information your management would need to make a decision about the priority of this project and resources they would provide.

Chapter IV - Findings and Results

This is the chapter where the actual results are reported and compared to the project plan in Chapter 3. This is essentially a data section.

Chapter V - Discussion and Ramifications

Chapter 5 is the final report of the project. Report the project results, comparison to the original plan, what could be done differently in the future and the significance of the outcome. Reiterate and summarize finds from Chapter 4. Explain how the results are important to business and what things should be done differently. Also include any insights learned from the project, any other related areas to explore and suggest further work to advance the art.

The Appendices

In addition to the materials provided in the project chapters, you will want to include appendices such as a glossary of terms and acronyms, supporting charts and graphs, diagrams, etc.

The Formal Presentation

The formal presentation meeting is arranged by you. You will need to give consideration to your committee members' other commitments and schedules. Allow sufficient time for everyone on the committee to read your work (usually one week). Make sure that you email the title, date of formal presentation and committee members to Student Services. The formal presentation sign-off form can be prepared that goes to your project advisor.

The project formal presentation generally begins with a short (around 15 minutes) presentation of your central proposition and the work you completed. With an engineering project, the formal presentation will take the form of an oral presentation of the project and, if appropriate, a demonstration. You may use overhead transparencies or computer projection. Committee members will then ask questions and make comments.

You will receive credit for completing ETLS 881 after all changes requested by the committee are made and a final printable copy of the report is turned into Student Services.

Research/Library Information

Engineering and Technology Management Department Liaison:

Eric Kallas
Reference Librarian
O'Shaughnessy – Frey Library
University of St. Thomas
2115 Summit Avenue Mail #5004
Saint Paul, MN 55105-1096

epkallas@stthomas.edu
voice: 651/962-5013
fax: 651/962-5406

UST Information Resources & Technology Tech Desk: 651/962-6230

O'Shaughnessy-Frey Library Reference Desk: 651/962-5001

Important URL's

Obtain a UST "new user" account: (required for remote access)

http://www.stthomas.edu/new

O'Shaughnessy-Frey Library

http://www.stthomas.edu/libraries/osf/index.htm

RefWorks – Automatic Bibliography Software

http://www.stthomas.edu/libraries/refworks

UST Libraries – Interlibrary Loan Department (with online forms)

http://www.stthomas.edu/libraries/interlibraryloan/

UST Libraries' database list:

http://www.stthomas.edu/libraries/databases

CLIC (Cooperation Libraries in Consortium) –

http://www.stthomas.edu/libraries/catalog/

General Library Research Guide: (Outlines various research strategies)

www.stthomas.edu/libraries/guides/e_guide/index.htm

Research database available via UST Libraries web page

Science/Technology/Engineering databases:

- Applied Science& Technology Full Text
- Cambridge Scientific Abstracts
  - -Bioengineering Abstracts
  - -Computer & Information Systems Abstracts
  - - Engineering Materials Abstracts
  - -Environmental Engineering Abstracts
  - -GeoRef
  - -Mechanical & Transportation Engineering Abstracts
- Digital Dissertations (abstracts)
- General Science Full Text
- Science Direct (Scholarly Engineering Journals)

WWW ENGINEERING/MANUFACTURING WEBSITES

***ANSI American National Standards Institute (ANSI Online)**

http://ansi.org/

***Best Manufacturing Practices Center of Excellence**

http://www.bmpcoe.org

***Engineering Technical Data Reference Tables**

http://ourworld.compuserve.com/homepages/mjvanvoorhis/techdata.htm

*** Einet Galaxy**

A guide to engineering, manufacturing, and technology sources via the World Wide Web.
http://galaxy.einet.net/galaxy/./Engineering-and-Technology.html

*** Fedworld**

NTIS gateway to over 100 federal government electronic bulletin boards, including all technical agencies. Users are required to register online to use this service.
www.fedworld.gov

*** IEEE**

IEEE chapter and membership information, calls for papers, tables of contents for society publications, and advance conference programs.
www.ieee.org

*** NASA**

Large amounts of technical information on aeronautics and space shuttle missions, as well as historical information on NASA space flight.
www.nasa.gov

*** National Center for Manufacturing Sciences**

www.ncms.org

*** National Institute of Standards and Technology**

Information on NIST programs, including the Malcolm Baldrige National Quality Award, and descriptions of research at NIST laboratories.
www.nist.gov

*** National Technology Transfer Center**

http://iridium.nttc.edu

*** Patent Database**

www.uspto.gov

***Society of Manufacturing Engineers**

http://www.sme.org

*** WWW Virtual Library - Engineering**

Engineering domain-specific virtual libraries and information resources.
www.eevl.ac.uk/wwwvl.html

Style Requirements

The content of your project will be your primary concern as you write and do research. But this doesn't mean you should ignore how that information is presented. Poor style and structure detract from content, while use of a few basic stylistic and structural conventions enhances readability and coherence.

We've listed a few style guidelines we consider essential and others we highly recommend. For more ideas on appropriate style for thesis and term papers, we recommend *A Manual for Writers of Term Papers, Theses, and Dissertations* by Kate L. Turabian.

Pay attention to style

The format for an acceptable project is standard at most academic institutions. It may be helpful for you to read others' published papers if you are unfamiliar with this format. Also, please pay attention to the details of spelling, grammar and overall presentation. Your paper is a work of lasting value, and will be better received if you adhere to the basics of a good and consistent style. Microsoft Word offers a document template that be used with a preset format for the project.

The Essentials (Our Ten Stylistic Commandments)

1. Use 1-inch margins on top, bottom and right sides of all pages, 1 ½ left margin. All pages are single sided.

2. Use unjustified or ragged right margins.

3. Double space your text. Headings can be single-spaced.

4. The pages of the manuscript should be assembled in the following order:

    a. Title Page (no page number appears on this page)
    b. Signature Page (provided by the department at formal presentation and inserted by department)
    c. Dedication (if desired)
    d. Table of Contents
    e. Abstract (350 words or three paragraph summary of manuscript)
    f. List of tables and figures
    g. Acknowledgements (if desired)
    h. Body of the work
    i. Appendixes
    j. Bibliography

5. The pages of the manuscript should be numbered with all pages preceding the body of the work numbered with Roman Numerals, beginning with the title page (although it has no number on it.) All other pages, including illustrations, appendices and the bibliography are numbered continuously to the last page

6. Number exhibits, tables and illustrations.

7. Make sure references in the text match those in your bibliography.

8. Use major headings, subheadings, chapter titles and numbers to help your reader through your text.

9. Spell check everything! **TWICE**!

10. **Be consistent**. Use the same typefaces throughout your document. Make sure your reference and bibliography style are consistent.

The department is responsible for making copies and binding your project. You will receive a copy for your personal use, the department will keep a copy and two copies will be provided to the University of St. Thomas library and archives. If the document is confidential or proprietary, copies will not be made

Also Recommended

1. Use a 12 point serif typeface for body text and a bold sans serif typeface for headings.

12 point serif type for body text

12 point bold sans serif type for headings

14 point bold sans serif type for headings

2. Use the APA or science style of parenthetical reference available at:

   www.stthomas.edu/libraries/guides/quickref/citing/APAstyle.htm

3. Set off your titles and subheadings with bold type, by centering them, and/or by using larger type.

Recommended forms for citations

It is recommended that you use The APA Style of reference which is available at the University of St. Thomas library website: www.stthomas.edu/libraries/guides/quickref/citing/APAstyle.htm

Also included is the APA Crib sheet with enhanced information that is a very complete help with the APA style sheet.

This includes the most recent information about citing all forms of material.

Writing Tips

- **Keep it simple and straightforward**
- **Say what you mean**
- **Reread and revise**
- **Double-check spelling**

Invest in a good dictionary such as the fourth college edition of The American Heritage Dictionary or the fourth college edition of Webster's New World Dictionary. Use the spell checker. It's simple and handy and it will make your corrections for you. Remember, you diminish your credibility when your paper is filled with misspellings and misused words. If you are not sure of particular word's meaning, don't use it. Presenting good ideas – badly, is definitely not in your best interest.

Punctuation

Punctuation serves four primary purposes:

1. Termination (period, question mark, exclamation point)

   What do you mean? You are leaving town.
   What? Do you mean you are leaving town?
   What! Do you mean you are leaving town!

2. Introduction (comma, colon, dash)

   I need only one thing, more time.
   Your task is simple: get a job and hold it.
   He has one passion in life- dancing.

3. Separation (comma, semicolon, dash, hyphen, apostrophe)

   If you wish me to go, please lend me some money.
   This man loves his work and is happy; that one hates his and is miserable.
   To separate parts of sentence - use a comma, semicolon, dash, hyphen, or apostrophe.
   He is now our president-elect.
   This store is crowded every day from noon until 2 o'clock.

4. Enclosure (comma, dash, quotation marks, single quotation marks, parentheses, and brackets)

   An unusual habit, eating two breakfasts every day, seemed to make him sluggish during morning hours.

He was not - and everyone else knew this - a well man.
"I am not an American," he said fatuously; "I am a citizen of the world."
"To say this dance is 'peachy' is not a useful comment," remarked the fireman.
When I am ready to go (and that will be soon), I shall let him know.
"The foreman on this job [Ned Stephens] is an excellent worker himself," remarked the Superintendent.

Run-on sentences

If you have a sentence of 30 words or more, delete any unnecessary words and rephrase it if necessary. If every word is essential, then break it into 2 or 3 sentences.

- Run-on: It is considered that characteristics of the tool wear in the cutting CFRP may show a different tendency from those of tool wear in the cutting of GFRP because CFRP, which is a compound material in the same series of GFRP in the form of dispersing material, differs greatly from the GFRP in physical and mechanical properties. (59 words)
- Better: Characteristics of tool wear in CFRP cutting may be different from those in GFRP because CFRP, although coming from the same series, differs greatly in physical and mechanical properties. (29 words)

Paragraphs

An effective paragraph should exhibit three qualities. It should be:

1. Unified: it adheres to one idea.
2. Coherent: its parts relate clearly to one another.
3. Developed: its general statement is supported with detailed examples.

Use a topic sentence to alert readers to the essence of the paragraph by stating the central idea. The following sentences should help us better understand the writer's central idea. Relate every sentence both to the sentence before it and to the central idea of the topic sentence. The final sentence of a paragraph should be a closing sentence for that paragraph.

Language

Avoid the use of "insider language", elaborate or ornate prose. Scientists and engineers in particular fields learn to communicate with one another by using a special short-cut language. Be sure to define words both descriptively and analytically. When using acronyms as in the run-on sentence example, make sure that the initials are defined and spelled out the first time they are used. Adding these to a glossary is appropriate.

Active Voice

Using the active voice assures vigor and makes your writing more concise and more interesting. The active voice emphasizes who has performed the action while the passive voice focuses on who has received the action. For example:

- Active voice: The cat ate the rat.
  Dead leaves covered the ground.
- Passive voice: The rat was eaten by the cat.
  There were a great number of dead leaves lying on the ground.

Round-about construction

Weak, indirect construction and circuitous phrasing waste a reader's time. Even worse, they weaken thoughts, frequently the very thoughts that the writer wishes to stress. Many roundabout constructions begin with there is or there are and waste a sentence to state that something exists. Most of those constructions are easily improved. The following examples illustrate the gain in directness and strength achieved by eliminating weak indirect constructions:

- Avoid: There are three active ingredients in these tablets. They are. . .
  Use: The three active ingredients in these tablets are . . .
- Avoid: There were at least a hundred chemicals that were added to the list.
  Use: At least a hundred chemicals were added to the list.
- Avoid: In the case of polymer studies it was shown that. . .
  Use: Polymer studies showed. . .

Hedging and Intensifying

"It seems that it might possibly be very wise to follow this procedure if no better one is proposed," states a writer. He adds hedge to hedge (seems, might, possibly, if) without adding anything of interest or of value to the reader. Also avoid overusing intensives as they too create a poor impression - most unique, absolutely perfect, more paramount, very essential. Intensives worn out by overuse often weaken the sentence instead of strengthening it.

Resources

Effective Writing Strategies for Engineers and Scientists. Woolston, Robinson and Kutzbach, Lewis Publishers.
The Elements of Grammar. Margaret Shertzer, Collier Books, MacMillan
Publishing Company.
The Elements of Style. William Strunk, Jr., and E.B. White (third edition), MacMillan Publishing.
The Handbook of Good English. Edward D. Johnson, Facts on File Publications.
The Little, Brown Handbook. H. Ramsey Fowler (third edition), Little, Brown and Company.
Punctuate It Right! Harry Shaw, Perennial Library.
Report Technical Information. Kenneth W. Houp and Thomas E. Pearsal, MacMillan Publishing.
Roget's International Thesaurus (fourth edition). Harper and Row.

Example of:

Title Page
Table of Contents
Abstract

Table of Contents

Chapter 1
INTRODUCTION**……..1**

Chapter 2
BACKGROUND……2

AGE1-10……..2
AGE10-20……2
AGE20-30……2

Chapter 3
MY LIFE IN MANUFACTURING ……3

STRESS……3
HOMEWORK……4
PROJECT……..4

Chapter 4
MY LIFE AFTER MANUFACTURING……5

MORE STRESS ……..5
MORE MONEY ……6
MORE STRESS……..6

Chapter 5
RETIREMENT ……...7

LIST OF TABLES AND FIGURES……12

APPENDIX ……14

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(title page)

The Application of Manufacturing Mish Mash into Practical Uses in the Real World

Jane Q. Doe

An Engineering Project submitted to the faculty of the School of Engineering in partial fulfillment of the requirements of the Master of Manufacturing Systems Engineering degree

University of St. Thomas
St. Paul, Minnesota
(Month/Year of Graduation)