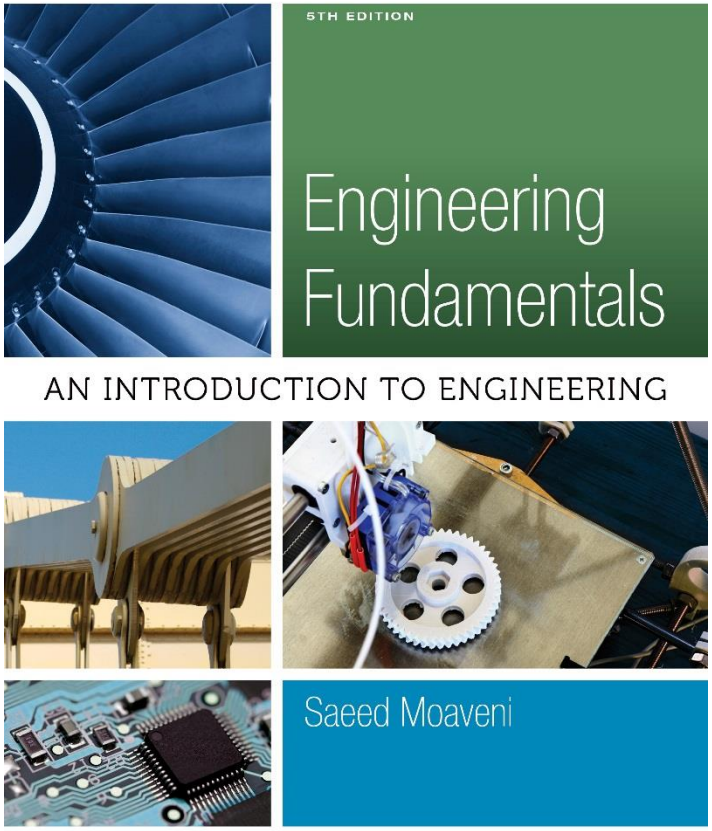

Engineering Fundamentals

An Introduction to Engineering

Chapter 4

Engineering Communication

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Learning Objectives

1. Communication Skills and Presentation of Engineering Work

Explain why you should have good written and oral communication skills as an engineer

2. Basic Steps Involved in the Solution of Engineering Problems

Describe the basic steps that you need to follow to solve an engineering problem

3. Written Communication

Explain different modes of written communication in engineering and their purposes

Learning Objectives

(Cont.)

4. Oral Communication

Describe the key concepts that must be followed when giving an oral presentation

5. Graphical Communication

Realize the importance of graphical communication (drawings) in conveying ideas and design information

Discussion Starter

Read the discussion starter for Chapter 4 on page 103 (10 minutes). You may discuss your thoughts with the student sitting next to you.

- Do you agree with what is said here? What are your thoughts?
- Electronic communication (e.g., text messages, e-mail(s), electronic file marking and sharing, etc.) is becoming increasingly important. What type of communication changes do you anticipate to occur within the next 30 years?

Communication Skills and Presentation of Engineering Work

As an engineering student, you need to develop good written and oral communication skills

Learn how to

- Express your thoughts
- Present a concept for a product or a service
- Present an engineering analysis of a problem and its solution
- Show your findings from an experimental work
- Communicate design ideas by means of engineering drawings or computer-aided modeling techniques

Communication Skills and Presentation of Engineering Work

Most engineers are required to write reports that might

- be lengthy and detailed
- contain charts, graphs, and engineering drawings
- take the form of a brief memorandum or executive summary

Examples of Written Communication Categories

- Homework
- Weekly progress reports
- Technical reports
- Lab reports
- Design project reports

Basic Steps Involved in the Solution of Engineering Problems

4 basic steps to analyze an engineering problem

Step 1: Define the problem

Step 2: Simplify the problem

Step 3: Perform the solution or analysis

Step 4: Verify the results

Step 1: Defining the Problem

Understand the problem

- What is it exactly that you want to analyze?
- What do you really *know* about the problem?
- What are some of the things *known* about the problem?
- What are you looking for?
- What exactly are you trying to find a solution to?

Step 2: Simplifying the Problem

- Make appropriate assumptions
- Understanding the physical laws and the fundamental concepts, as well as where and when to apply them and their limitations will benefit you greatly in making assumptions and solving the problem

Step 3: Performing the Solution or Analysis

- Apply the physical laws and fundamental concepts
- Set up the problem in symbolic or parametric form
- Wait until the very end to substitute for the given values

Step 4: Verifying the Results

- Before you present your solution or the results, ask the following questions
  - ✓ Do the results make sense?
  - ✓ What if I change one of the given parameters? How would that change the result?
- You need to develop the means to check your results by asking yourself the appropriate questions

Remember, once you start working for hire, there are no answer books!

Homework Presentation

All homework presentations should include

- Given:
  - Problem statement
  - Extracted information
- Find:
  - The information that is to be found
- Solution:
  - Appropriate model(s)
  - Diagrams
  - Step by step calculations
  - Answers with proper units highlighted

An Example of Engineering Problem Presentation

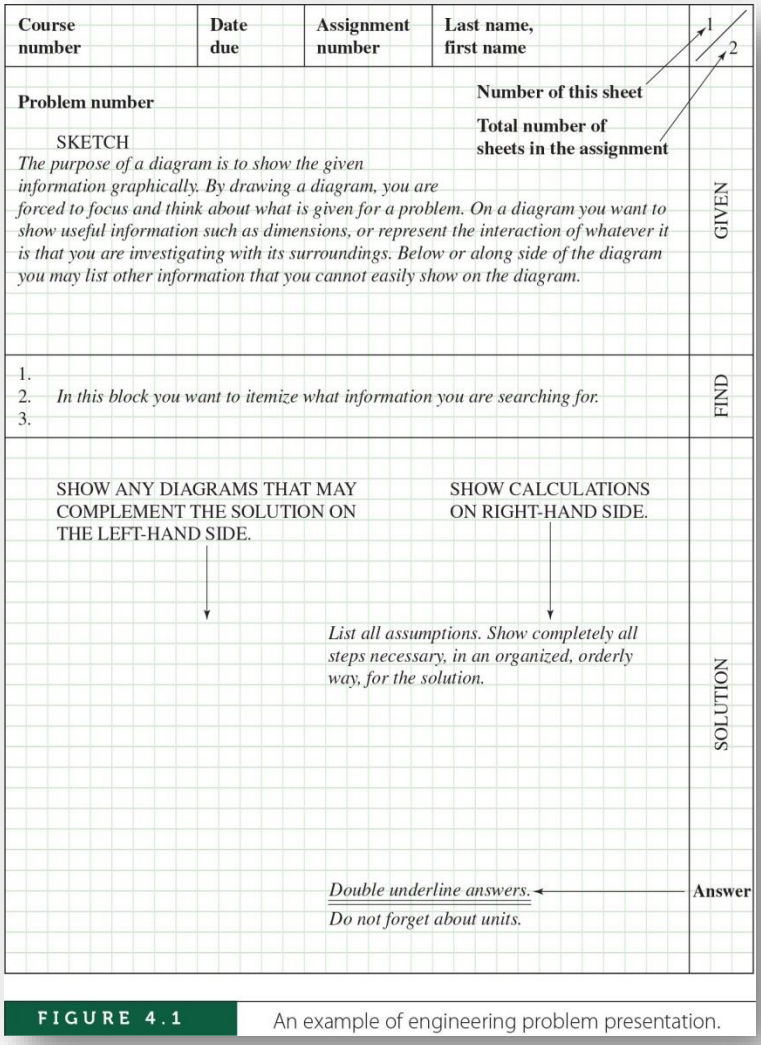


FIGURE 4.1 An example of engineering problem presentation.

An Example of Engineering Problem Presentation

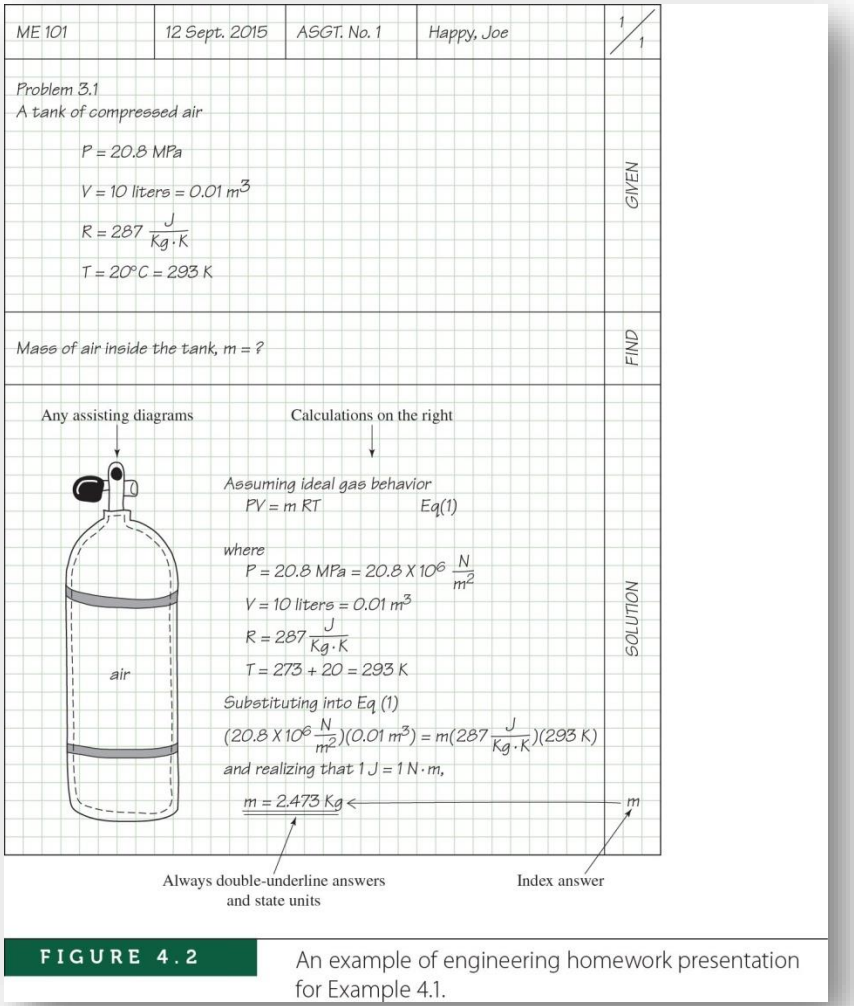


FIGURE 4.2 An example of engineering homework presentation for Example 4.1.

Before You Go On

Answer the following questions to test your understanding of the preceding section.

1. Describe the basic steps that are involved in the solution of engineering problems.

2. Explain how you should present your engineering homework problems.

Written Communication

Written and oral presentations are important parts of engineering. Written communications might be brief, as in progress reports or short memos, or longer and follow a certain format requiring calculations, graphs, charts, and engineering drawings.

Progress Report

A short form of communication to others in an organization or to the sponsors of a project

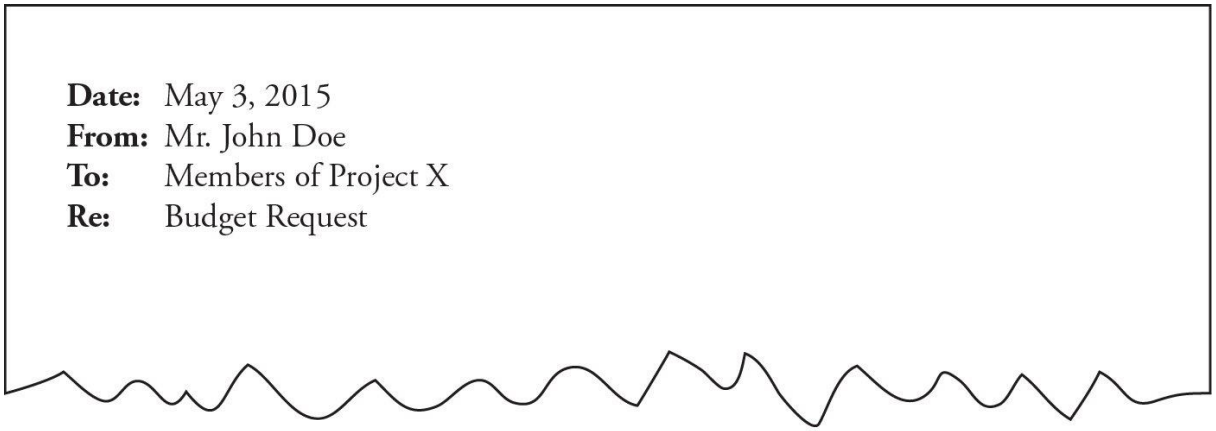
- Work completed so far
- Work expected to be completed during the next reporting period
- Any problems that may have come up, and the recommended solutions

Executive Summary

- A brief and concise form of communication to top management positions
- To convey the findings of a study or proposal
- Typically a few pages long
- References may be made to more comprehensive reports

Short Memos

Short memos are used to convey information in a brief way to interested individuals



Date: May 3, 2015
From: Mr. John Doe
To: Members of Project X
Re: Budget Request

An example of a memo format

Detailed Technical Report

Detailed technical reports generally contain the following items:

- Title
- Abstract
- Objectives
- Theory and Analysis
- Apparatus and Experimental Procedures
- Data and Results
- Discussion of the Results
- Conclusions and Recommendations
- Appendix
- References

Abstract

- Very important part of a report
- Complete and concise statements
  - Objectives
  - Significant findings
  - Conclusions and/or recommendations
- The last section to write

Objectives

- State what is to be investigated
- List your objectives explicitly
  (e.g.) 1., 2., 3., ...

Theory and Analysis

- State pertinent principles, laws, and equations (equations should be numbered)
- Present analytical models used
- Define unfamiliar terms and symbols
- List important assumptions

Apparatus and Experimental Procedures

- Present the list of apparatus and instrumentation to be used

  (e.g., instrument range, accuracy, and ID number)

- Describe how you performed the experiment
  - Procedure should be itemized
  - Include schematic diagram of the experimental setup

Data and Results

- Present the results of the experiment in a tabular or graphical form
- Tables and graphs must include titles, column or row headings, units, axis labels, and data points
- All figures and tables must be numbered and have a descriptive title
- The figure number and the title should be placed below the figures
- The table number and the title should be placed above the table

Discussion of the Results

- Emphasize and explain to the reader the important results of the experiment
- When applicable, compare experimental results with theoretical calculations

Conclusions and Recommendations

- Compare your objectives with your experimental results
- Support your conclusions with appropriate reference materials
- State recommendations based on the conclusions

Appendix

- Provide the reader with copies of all original data sheets, diagrams, and supplementary notes
- Display sample calculations used in processing the data

References

- Books

  Author, title, publisher, place of publication, date (year), page(s)

- Articles

  Author, “title of article,” name of journal, volume number, issue number, year, page(s)

- Internet materials

  Author, title, date, URL address

An Example of Title (cover) Sheet

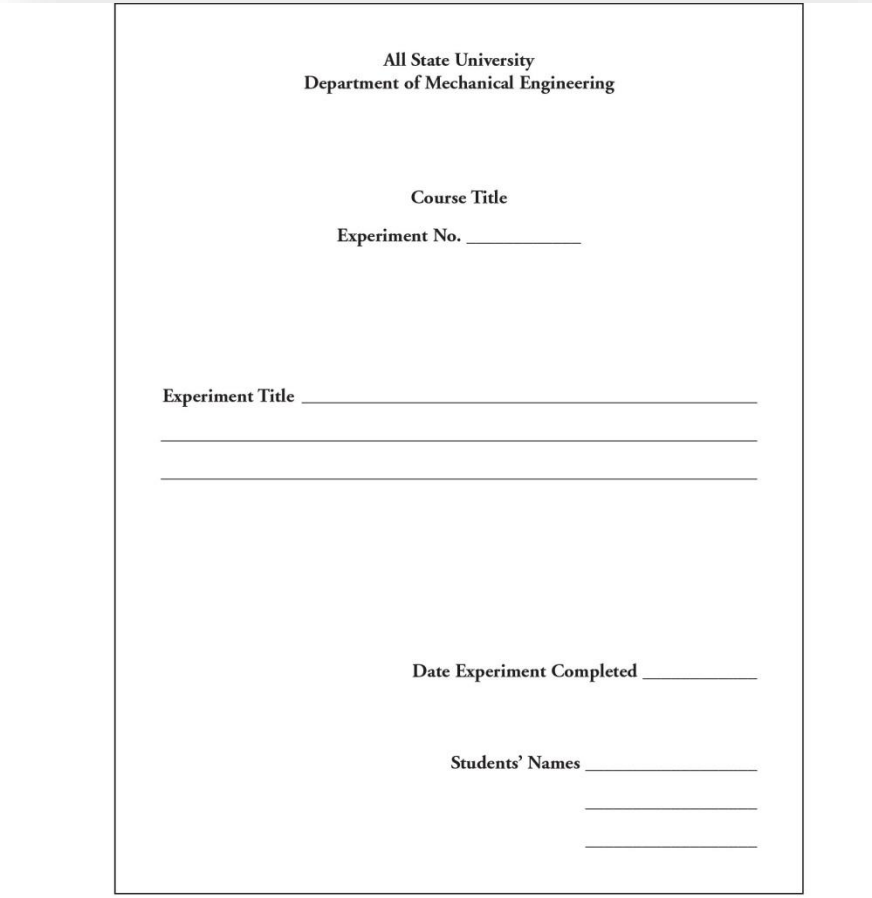


FIGURE 4.3 Example of title (cover) sheet.

Before You Go On

Answer the following questions to test your understanding of the preceding section.

1. What is the purpose of an executive summary?
2. What is the purpose of a progress report?
3. Describe the main components of a detailed technical report.

Oral Communication

Your oral presentation may show the results of all your efforts

- Consider the needs and expectations of your listeners
- Be organized
- Be prepared
- Make sure what is said (or sent) is what is understood (or received) by the listener

Oral Communication

- Rehearse your presentation
- Avoid using terminology or phrases that may be unfamiliar to listeners
- If possible, keep your talk to about half an hour or less
- Keep the audience's attention
- Maintain eye contact with the audience
- Use humor
- Use good visual aides
- If possible, get the audience involved

Oral Communication

- PowerPoint presentations
  - Use colorful charts, graphs, & tables
  - Use appropriate contrast
  - Use large fonts
  - Don’t overcrowd the “slide”
  - Use short phrases instead of paragraphs
- If available, use models and prototypes
- If possible, use video clips and animations

Graphical Communication

Engineers use drawings to convey their ideas and design information. These drawings provide information, such as the shape of a product, its size, type of material used, and assembly steps. For complicated systems made of various parts, the drawings also show how various parts of a product fit together.

Example of Engineering Drawings

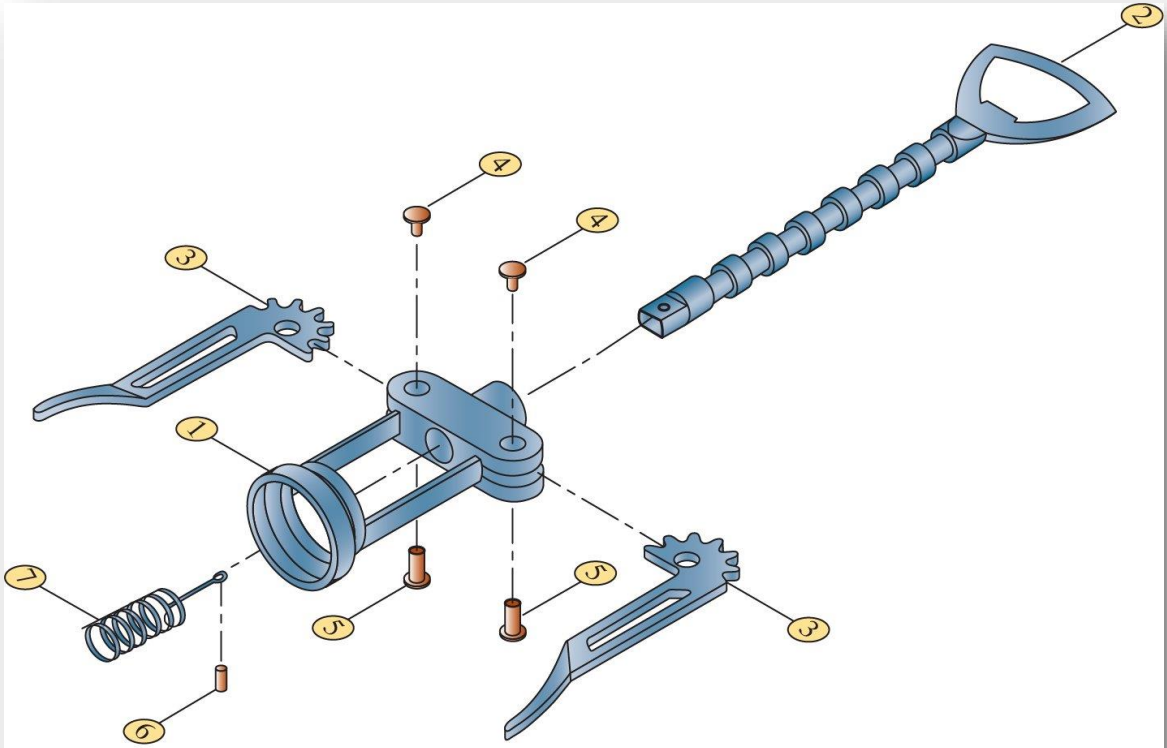


FIGURE 4.4 Assembly drawing of corkscrew

Example of Engineering Drawings

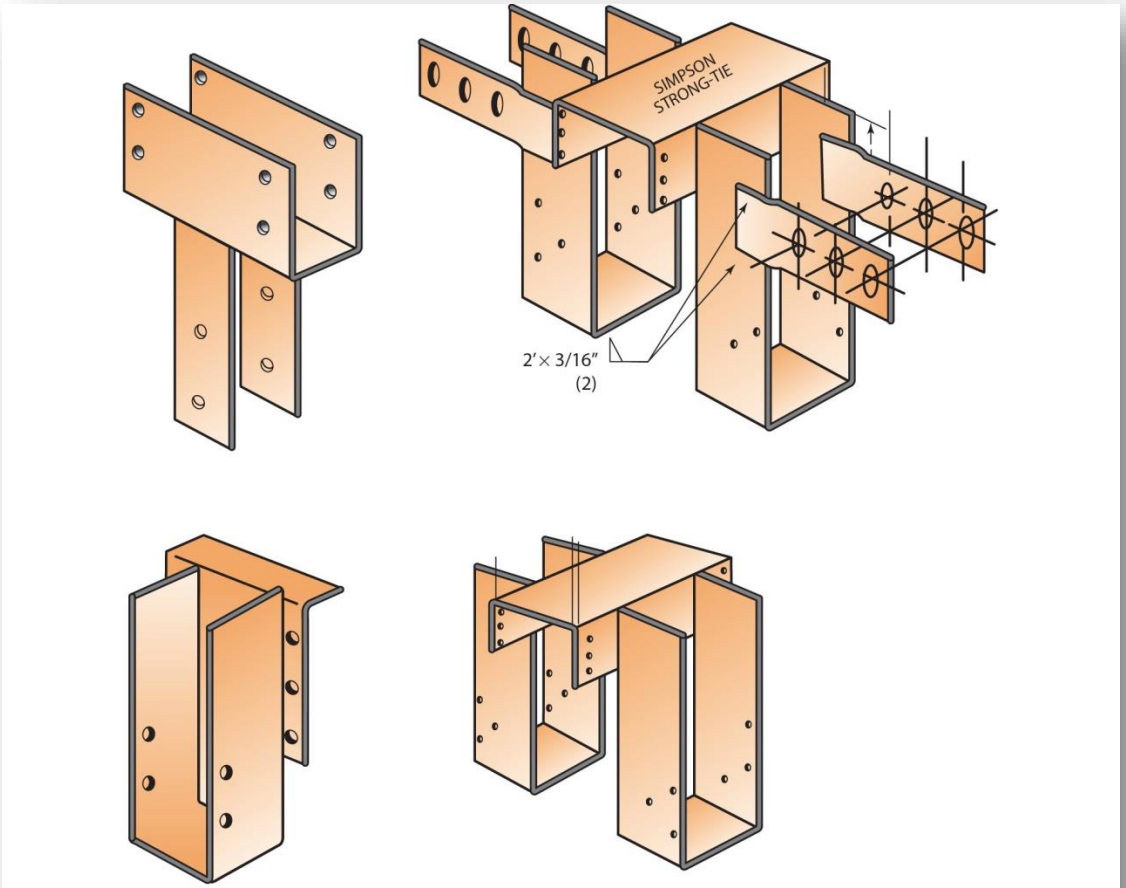


FIGURE 4.5 Common manufactured metal beam connectors

Oral Presentations (Cont.)

- Length of Presentation
  - Varies depending on the scope of the talk
  - Usually 20 – 30 minutes
- Prepare and rehearse your presentation
  - Ask a friend to critique your presentation
  - Practice, practice, practice!

Example of Engineering Drawings

Examples of drawings used in electrical and electronic engineering

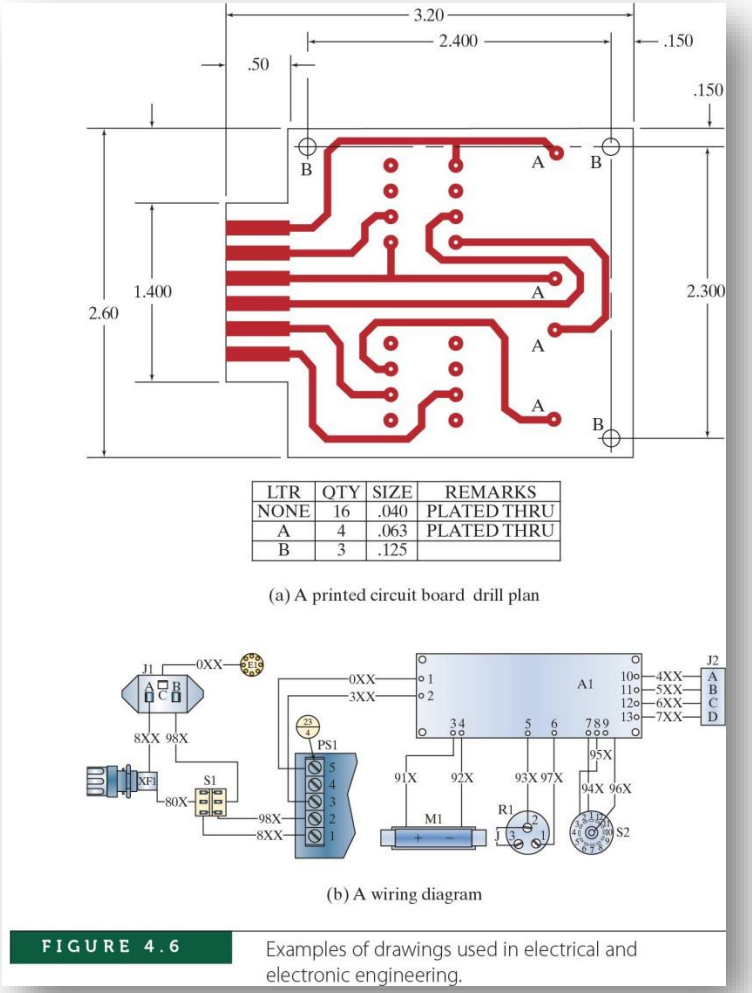


FIGURE 4.6 Examples of drawings used in electrical and electronic engineering.

Before You Go On

Answer the following questions to test your understanding of the preceding section.

1. What are some of the important concepts that you should consider when preparing for an oral presentation?
2. Explain what we mean by engineering graphical communication and why it is important.