

MSFEA Guidelines for Writing in Engineering

Prepared by: Niveen AbiGhannam

(To be) Reviewed by:

The MSFEA Writing Task Force

The Communication Skills Program (ENGL 206 instructors)

The Writing in the Disciplines Program

This document presents the MSFEA guidelines for writing technical documents. These guidelines were developed to address the weaknesses in student writing as identified by MSFEA faculty surveys and interviews. Specifically, the guidelines address means to enhance the technical writing **process, content style and structure**, and **form**. MSFEA students are encouraged to follow these guidelines in order to improve their writing throughout their coursework and professional experiences at MSFEA and beyond.

3. The Style and Structure of Technical Writing

Developing your technical style

Style pertains to the way that you choose to present your messages. This includes language (word choice) as well as sentence and paragraph structure (overall written structure/organization, depth, and transitions). Your goal while revising your document is to rewrite your content with a style that appeals to your readers. Remember that technical writing uses a style that is different from other genres of writing that you may have used in other classes/ settings. The below sections include some thorough guidelines relating to the language, structure, and illustrations used in technical writing.

Language: Word choice in technical writing

You are expected to use words that are:	This means they need to:	Examples
Clear	Lack ambiguity	Consider the following sentences: The lab manager had to lower the temperature <u>as</u> the experiment was progressing. <i>(In this example, "as" is used to mean "because," but it can be easily mistaken to mean "while." Replacing "as" with "because" eliminates ambiguity.)</i> Because the linear actuator controlled the opening and closing of the valve, <u>it</u> was designed based on DIN 3358. <i>(In this example, "it" refers to the "valve," but it can be easily</i>

You are expected to use words that are:	This means they need to:	Examples
	<p>Be defined</p> <p>Lack complexity (jargon-free)</p>	<p><i>mistaken to refer to the “actuator.” Replacing “it” with “the latter” or simply “which was designed...” eliminates ambiguity.)</i></p> <p>To avoid confusion about what technical terms mean, define such terms according to the following formula:</p> <p style="text-align: center;">Technical term + category + explanation.</p> <p>Tensile strength is the capacity of a material or structure to withstand loads tending to elongate it.</p> <p>Compare the following explanations of Shear Strength tests:</p> <p>Shear strength is the capacity of a material to withstand loads that tend to produce a sliding failure along a plane on a material. Ductile materials are preferred because they are able to withstand significant deformation.</p> <p><i>(Some aspects of this explanation are complex, such as “produce a sliding failure along a plane on a material.”)</i></p> <p>Shear strength tests determine the failure type –either brittle or ductile – of the specimen tested. While ductile failures occur slowly and lead to significant deformation in the specimen, brittle failures occur abruptly with little to no deformation in the material. Ductile specimen can thus be twisted before fractures (failure) occur. Additionally, the fracture plane (i.e. where the specimen breaks) occurs where the torsion/twisting stress is applied.</p> <p><i>(This is a more efficient explanation of the tests. Notice how the occurrence of complex words (jargon) is minimized and whenever technical words are used, they are explained using simple terms.)</i></p>
Precise	Mean exactly what is intended by the author	<p>Consider the following sentences:</p> <p>Please send a <u>very detailed</u> report. After recognizing <u>some problems</u> with the code, we took <u>subsequent measures</u>.</p> <p><i>(“Very detailed,” “some problems,” and “subsequent measures” are not precise terms and may be interpreted differently by different readers.)</i></p>

You are expected to use words that are:	This means they need to:	Examples
	Avoid inaccurate and flowery language	<p>Ambient lightening of the tunnel will remove the <u>oppressive feeling</u> that drivers had experienced with the earlier design.</p> <p><i>(In this case, the metaphor is used to mean “dark.” However, this meaning may not be understood by all readers.)</i></p>
	Be as specific as needed, not more	<p>The sample included 63,940,334,323 molecules of CO₂.</p> <p><i>(Too much specificity can overwhelm readers. For instance, “the sample included about 64 trillion molecules of CO₂” can be more easily understood.)</i></p>
	Take into account word denotations (dictionary meaning) and connotations (meaning in context)	<p>Consider the following sentences: The design uses <u>cheap</u> material. The design uses <u>inexpensive</u> material. The design uses <u>cost-effective</u> material.</p> <p><i>(Although “cheap,” “inexpensive,” and “cost-effective” mean “low in price,” each word has a different implication. “Cheap” may be understood to mean that something is not only low in price, but that also its quality is low. “Inexpensive” has a more neutral meaning in that it does not imply that the quality is good or bad. “Cost-effective” implies that the quality is very high relative to the cost.)</i></p>
	Avoid absolute terms	<p>Consider the following sentences: This landfill will <u>ensure the intake</u> of all wastes produced by the city over the next 50 years.</p> <p>This landfill will <u>accommodate the estimated wastes</u> to be produced by the city over the next 50 years.</p> <p><i>(Absolute terms, such as “always,” “never,” and “guarantee,” rarely indicate the right level of uncertainty. In the first example above, “ensure” indicates full certainty that the landfill will accommodate all wastes produced in the next 50 years. The second example, on the other hand, explains that the landfill will work based on the expected wastes that are estimated by the designer, which is a more precise statement.)</i></p>
Concise	Avoid unnecessarily long words	<p>Consider the following words:</p> <p>familiarization, has the functionality, has the operationability, firstly, secondly, etc.</p> <p><i>(Such words are unnecessarily long and complex. Because technical writing includes complex technical terminology, make sure the rest of the words used are concise.)</i></p>

You are expected to use words that are:	This means they need to:	Examples
Formal	Avoid informal and unprofessional language	<p>Technical writing should not include:</p> <ul style="list-style-type: none"> Contractions (won't, can't, shouldn't, etc.) Phrasal verbs (come up with, got over, mixed up, wrap up) Slang and clichés (a lot of, piece of cake, bucks) First person pronouns (especially "I") <p><i>(The above list includes examples of informal language. Such language gives your text an unprofessional tone.)</i></p>

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Structure and organization: sentences in technical writing

You are expected to write sentences that are:	This means they need to:	Examples
Clear	Avoid needlessly complex phrases	<p>We used a <u>150mbps wireless nano WPS-compatible power saving USB adapter</u>.</p> <p><i>(Long chains of adjectives and noun modifiers added before nouns can unnecessarily complicate your documents. Instead, add such defining adjectives and noun modifiers after the noun and/or split them over multiple linked sentences.)</i></p>
Concise	<p>Avoid longwinded sentences with needless adjectives, adverbs, and verb phrases</p> <p>Avoid empty and unnecessary expressions</p>	<p>The successful implementation of our design by the construction team relies <u>very heavily on a rather thorough understanding of the somewhat complex</u> nuances of our progressive approach.</p> <p><i>(Details are not always informative. Avoid descriptions that do not add meaning to your sentences. Removing the underlined words in this example will still deliver the same meaning. Long-winded sentences usually include unnecessary words that can be easily removed.)</i></p> <p>Consider the following expressions:</p> <ul style="list-style-type: none"> at this point in time (<i>now</i>) has the ability to (<i>can</i>) in the event that (<i>if</i>) in the vicinity of (<i>near</i>) owing to the fact that (<i>because</i>) there is no doubt but that (<i>No doubt</i>) it is my intent to show that (<i>Results show...</i>) <p><i>(Prepositional phrases and phrasal verbs lead to long and convoluted sentences. Usually, such expressions can be replaced by single words, or can be completely removed without affecting the meaning.)</i></p>
Familiar	Start with what is known and add new content towards the end of the sentence	<p>The design team considered three alternatives for the cell tower location and evaluated them based on five design criteria. The <u>alternatives</u> were:</p> <ol style="list-style-type: none"> 1) The east slope of the hill 2) The west slope of the hill 3) The peak of the hill <p>Based on the evaluation of the <u>design criteria</u>, alternative 1 fulfills....</p> <p><i>(In technical writing, sentences usually start with known information that was introduced earlier in the text. This helps contextualize the new information and helps readers process information faster.)</i></p>

You are expected to write sentences that are:	This means they need to:	Examples
Direct	<p>Include short subjects that are close to their verbs (do not separate subjects and verbs with details)</p>	<p>The ability of the freeway to accommodate nature- and human-induced wear and tear given the longevity and effectiveness of the material used <u>is</u> one of the considerations that the City will discuss prior to approving the project.</p> <p><i>(The verb “are” in the above sentence occurs too far from its subject: “the ability of the freeway.” This impedes understanding the content. In this case, flipping the sentence will allow for a shorted subject: Prior to approving the project, the City will consider the ability of the freeway to)</i></p>
	<p>List items at the end (rather than at the beginning or middle) of the sentence.</p>	<p>Consider the following sentences:</p> <p>Understanding the collection of programs that deliver the machine learning functionality, managing the machine learning risk, and ensuring machine learning compliance were influential in assessing the effectiveness of machine learning initiatives.</p> <p>Several factors were influential in assessing the effectiveness of machine learning initiatives, such as: understanding the collection of programs that deliver the machine learning functionality, managing the machine learning risk, and ensuring machine learning compliance.</p> <p><i>(The first sentence starts with listing items. As a result, the main idea of the sentence is not understood until the very end. To avoid crowding your sentences and confusing your readers, start your sentences with the main idea, and list items at the end.)</i></p>
	<p>Eliminate the needlessly passive voice* and use the active voice to establish responsibility.</p>	<p>Consider the following sentences:</p> <p>For testing static stability, it was determined appropriate by the research team to initiate and release perturbations in the structures.</p> <p>In order to test the static stability, the research team decided to initiate and release perturbations in the structures.</p> <p><i>(Generally, the active voice is more direct and straightforward. Notice in the above examples how the active voice allows the writer to: use a stronger verb [decided vs. was determined] and to express the main idea more effectively and concisely. This structure is easier for readers to follow and understand.)</i></p>

*** Using the proper voice in technical writing:**

There are several misconceptions regarding the use of the passive voice in technical writing. Many students assume that technical and professional writing is mostly passive. In reality, however, the choice to use either the passive or the active voice has to be strategic. In other words, writers should structure sentences based on the meaning that they intend to communicate.

Remember, the subject of the sentence determines whether that sentence is active or passive:

Active voice

FCB Engineering completed the site's environmental assessment.

The subject is the entity performing the action.

Passive voice

The site's environmental assessment was completed by FCB Engineering.

The subject is the entity receiving the action.

By structuring your sentence in the **active** voice, you are emphasizing the performer, or the agent, of the action (in the above example, FCB Engineering). This emphasis is especially important in situations where you want to establish **responsibility for engineering-related actions** (such as observations, decisions, recommendations, etc.). In those cases, your readers need to identify the agent responsible for the actions because it will help them assess the credibility and salience of the information communicated.

By structuring your sentence in the **passive** voice, you are emphasizing the object, or the recipient, of the action (in the above example, the site's environmental assessment). This emphasis is especially important in situations where the performer of the action is either unknown or unimportant, or when you have already established who the agent is and the object of the action is the main topic of interest. This is why the methods sections in technical papers mostly use the passive voice. In this section, the readers already know who performed the procedures (the engineers, the technicians, etc.), and they are more interested in learning about the procedures themselves. (For example, it is repetitive and wordy to write: The research team drilled the borings to provide stability... The research team drilled the boreholes to depths ranging between 10 to 15 meters.)

Therefore, using the active or the passive voice is dependent on the subjects of your sentences. Choose your subjects to be:

1. Short (as explained above, avoid long subjects that are too far from their verbs)
2. Known information (as explained above, sentences should start with known information)
3. The main focus of the sentences (as explained above, the main idea of the sentence should be identified at the beginning of the sentence).

By choosing the proper subjects, you will be automatically using the proper voice in your sentences.

You are expected to write sentences that are:	This means they need to:	Examples
Simple**	Include only one main idea per sentence.	<p>Consider the following sentences:</p> <p>Flooding is an extreme weather condition that has increased in frequency due to climate change, and through both direct and indirect means, the public’s safety is threatened as a direct cause of the rise in moisture content.</p> <p>Flooding is an extreme weather condition that has increased in frequency due to climate change. Beside their direct impacts on public safety, floods can also have indirect effects on public health. For instance, the resulting increase in the moisture content of indoor environments may lead to asthma.</p> <p><i>(In the second example, different ideas are included in independent sentences, which makes the sentences easier to understand.)</i></p>

****Exceptions to using simple sentences:**

Two (or more) ideas can effectively be connected in a single, complex sentence when:

1. each idea is relatively simple, and
2. the relationship between the ideas is important and serves one of the following functions:

Basis of information	<p><u>Based on</u> our initial observations, we conclude that...</p> <p>The technical team examined the design codes <u>provided by</u> the...</p>
Method	In this experiment, the response of clay to various forces was measured <u>using</u> a rheometer.
Purpose	We monitored the water quality over a ten-year period <u>to observe</u> any changes in water composition.
Condition	<u>If</u> air quality monitors are misplaced, they can lead to inaccurate readings.
Specific detail	Over 100 buildings were offered water-damage treatments, <u>including</u> grey water treatments, black water treatments, and mold remediation.
Reason or cause	Porous pavements are commonly used in areas prone to flashfloods <u>because</u> of their ability to absorb large amounts of rainwater.
An evaluation or comparison	In 2017, the annual rainfall recorded at the station was 239 millimeters, <u>which</u> is 27% lower than the annual rainfall recorded in 2016.

Structure and organization: Paragraphs in technical writing

You are expected to write paragraphs that are:	This means they need to:	Examples
Focused	<p>Revolve around one theme <i>(In this example, the paragraph focuses on fine aggregate characteristics that can be determined by ASTM C1X5X)</i></p>	
Organized	<p>Paragraphs should start with a topic statement(s) <i>(sentence 1)</i>, followed by details and explanations relevant to that topic <i>(sentences 2-6)</i>, and should end with a summary/ evaluation <i>(sentence 7)</i>.</p>	<p>(1) In this study, fine aggregate characteristics were evaluated according to ASTM C1X5X. (2) <u>This standard lists</u> three procedures (Methods A, B, and C) to measure the void content of fine aggregate. (3) <u>While</u> Methods A and C use graded fine aggregate (consisting of different sizes of aggregate), Method B uses several individual size fractions (each aggregate size is tested on its own for void content). (4) <u>Depending on the method used</u>, the measured void content may provide further indications of the aggregate's characteristics. (5) <u>For instance</u>, using Method A to measure the void content of an aggregate of a known grading, the results can further indicate the aggregate's angularity, sphericity, and surface texture. (6) <u>On the other hand</u>, when void content is measured on an as-received fine-aggregate grading (Method C), the results can predict the aggregate's performance (workability) when used in the field. (7) <u>Therefore</u>, various tests should be conducted under various conditions.</p>
Cohesive	<p>Use transitions and connective devices between ideas <i>(Notice how the underlined transitions enhance the flow of ideas and help achieving the known-new contract in sentences)</i></p>	
Balanced	<p>Balance general statements with specific details <i>(General statements should provide the context and specific statements should provide details. For instance, sentence 2 provides a general statement about the the various procedures listed in the standard. Then, sentence 3 provides specific comparisons between the three methods)</i></p>	
Varied in terms of verb tenses	<p>Use different tenses when reporting different types of information <i>(Notice the change of tenses and verb types in this paragraph. Descriptions of the actual procedures conducted are reported in the past tense (were evaluated). However, the descriptions of the methods are reported using the present tense because they include general facts about those methods (lists, use, uses.) Also, when discussing possibilities and necessities, modal verbs are used (may, can, should).)</i></p>	

Structure and organization: Overall sections and subsections in technical reports

Typical Report Structure	Section Description
Abstract/ Summary	<ul style="list-style-type: none"> • Identifies the problem/questions that the project addresses • States the objectives of the project • Describes the general procedures • Includes key results (quantitative results and key trends) • Evaluates results in light of the problem/ questions • Lists the main conclusions • Suggests future work or implementation
Introduction (and Theoretical Background)	<ul style="list-style-type: none"> • Identifies the problem/ questions that the project addresses • Describes related work done on the topic (previous work, theoretical background, key parameters, equations, etc.) • States the (specific and measurable) objectives of the current project • Lists the general procedures (including the measurements and calculations) that will be used to achieve the objectives
Methods/ Procedures	<ul style="list-style-type: none"> • Describes the scientific method/ approach used to collect data • Describes the materials and equipment used to collect data • Describes the detailed procedures followed to collect data in a way that would allow someone else to reproduce such procedures • Describes the process by which measurements were recorded, preserved, and analyzed
Results/ Data/ Findings (and Analysis)	<ul style="list-style-type: none"> • Reports key results and explains their meaning • Explains data derivations and transformations obtained from the measured data • Presents key results visually (tables, figures, graphs) • Reports discrepancies and anomalies in the results
Discussion	<ul style="list-style-type: none"> • Compares measured results to predicted values • Explains the discrepancies and anomalies in the results
Conclusions and Recommendations	<ul style="list-style-type: none"> • Summarizes the most important results reported in the report • Assesses the success of the project • Suggests possible future improvements (e.g. address error sources, safety issues, alternative approaches) • Ends with a bottom line statement (why should the reader care about the results?)
Additional sections	<ul style="list-style-type: none"> • References (lists the external sources cited in the report) • Appendices (includes raw data, sample calculations, error analysis, etc.)

Structure and organization: Overall sections and subsections in research papers

Typical Research Paper Structure	Section Description
Abstract/ Summary	<ul style="list-style-type: none"> Provides an overview of the paper: background, purpose, methods, findings, conclusions, value/implications
Introduction and Literature Review	<ul style="list-style-type: none"> Establishes the topic (narrows down the topic from general explanations to a specific angle/scope/problem) Reviews the literature (reviews aspects of the problem that have been previously studied and organizes them thematically) States the gap (identifies the need for further investigation/research with respect to a particular aspect of the problem) States the purpose (explicitly states the purpose/ objective/ hypotheses of the study)
Methods	<ul style="list-style-type: none"> Details the methods, materials, and procedures used in the study
Results/ Findings	<ul style="list-style-type: none"> Presents the findings by theme Reports the data and interprets their meaning in light of the purpose of the paper
Discussion	<ul style="list-style-type: none"> Expands on the major interpretations Compares findings to the literature
Conclusions	<ul style="list-style-type: none"> Presents the importance of the findings and how they may be applied in broader contexts (other contexts, disciplines, real-life scenarios, etc.) Includes limitations and suggestions for future work
Acknowledgements	<ul style="list-style-type: none"> Gives thanks and credit to contributors other than the listed authors
References	<ul style="list-style-type: none"> Documents the sources using an acceptable style

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