THE PREPARATION OF ENGINEERING PROBLEM SETS

The professional engineering community expects certain standards in the presentation of problem solutions. The format specified here is intended to satisfy those expectations; to make problem solving easier and more accurate for you; and to make sure that your homework will serve as understandable reference material for you in the future.

The first set of requirements are external ones—matters of form rather than of problem solving method. They follow with a brief explanation of their purposes, below:

1. All problems should be submitted on "Engineer's Pad" paper, using only the front side. (This is made by various companies. The paper we refer to has tinted cast—usually green—with graph paper on the back: 5 lines to the inch with 1-inch major divisions. The grid lines are faintly visible against a light background and they vanish against a dark background).

   Reason: Accurate graph paper is always available for sketches and plots when it is needed, but it does not obscure other writing on the page.

2. The following information appears in the blocks at the top of the page:
<table>
<thead>
<tr>
<th>Problem Set #6</th>
<th>Jane Q. Public</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>something to identify the contents</td>
<td>The Author's name</td>
<td>The page number/The total no. of pages in the Set</td>
</tr>
</tbody>
</table>

**Reason.** The reader should know, at a glance, what he is reading and who is responsible for it. He should be able to keep the pages in order, and he should know whether or not they are all there.

3. **Only the front side of the paper will be used.**
   
   **Reason.** a) The required paper can only be used on one side.
   
   b) It is far easier to follow a complex argument from the bottom of page 7 to the top of page 8 when you can look at both simultaneously.

4. **Problem sets are to be folded vertically, when they are submitted.**
   
   The "front cover" should have on it the student's name, the course and section number, the problem set number, and the due date.
   
   **Reason.** Instructors have to handle a lot of problem sets. This helps them to avoid errors and will ultimately protect the interests of the students.
5. Work should be done in pencil (preferably No. 2 or 2-1/2 grade.)

**Reason.** This requirement does not apply to students who never err. The rest will be expected to erase and correct--rather than to cross out--their errors. (in original data books we often require entries to be made in ink to prevent any erasure of an original perception, but those are different kinds of documents.)

6. Work should be legible and uncrowded. (hand-lettering is preferable.)

**Reason.** Handwriting can be very hard to read.

7. Never use different colors to clarify your work. Always stay out of the margins.

**Reason.** Engineering calculations are very frequently xeroxed or otherwise copied. Color will not reproduce in the common processes and these processes tend to lose material near the edges. Furthermore, the material near the left margin of papers put in notebooks cannot be seen.

The second set of requirements deals with the problem solution itself.

8. a) Write the underlined word **Given:** and follow it with a complete statement of the known circumstances of the problem.

b) Write the underlined word **Req'd.:** and follow it with a complete statement of those things that are to be determined.

**Reason.** A problem well-posed is a problem half solved. This exercise will serve to clarify the situation in your own mind as well as that of the reader. You should normally paraphrase the problem given to you when you do this.
9. Include a sketch and/or process diagram to illuminate the problem. (Use a straightedge.) Label diagrams with known information—flow rates, dimensions, etc. Use additional sketches as you go along, to clarify things.

**Reason.** One picture is worth a thousand words. Any situation can be clarified (in your own eyes as well as those of your readers) with the help of a picture. You should build the habit of clarifying your thinking with sketches.

10. Explain in words what you are doing as you go along. State and justify any assumptions you must make.

**Reason.** This is the only way in which a reader will be able to follow you.

11. Write down any equations in symbolic form before you substitute numbers.

**Reason.** This will protect you from making errors of substitution.

12. Be careful about units. Identify the units of all terms and conversion factors.

**Reason.** Your equations must be dimensionally consistent. One of the most frequent sources of error arises in manipulating units.

13. Underline all significant intermediate results. Double underline, and note with an arrow from the right, the final answers, including their units, e.g.:

\[
\frac{928 \text{ N}}{\text{m}^2} \rightarrow \text{final pressure}
\]

**Reason.** This is what your reader is most interested in.
14. The ordinate and abscissa of graphs should both be placed within (not on) the margins. If data points appear, they should be designated, not with points, but with small circles, squares, triangles, etc. Calculated curves should have no such marks on them. A French curve should be used to draw curves. The ordinate and abscissa should be labeled and dimensions should be given. Everything on the curve should be identified so that the curve will stand alone.

**Reason.** These requirements are made in the interests of clarity. They are also made so that when someone xeroxes the curve independently of the rest of the solution, it will make sense.

15. Look at your answer and ask "Is this result self-explanatory or should it be interpreted? Should its ramifications be discussed?" Then add whatever explanation is warranted.

**Reason.** Whatever insight you have gained working the problem may well be forgotten tomorrow. Often the most important information given by a solution lies above and beyond the numerical answer.

16. Your instructor may, for convenience, alter this format in ways which better suit a given class.

**Reason.** This format is only one of many ways to keep a standard of clarity and accuracy.