Engineering Graphics

Herbert W. Yankee

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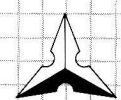

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To Rosemary, whom I will always miss.

Preface

Engineering Graphics was written to provide student engineers and industrial drafters with a competency-based, hands-on treatment of engineering graphics and basic computer graphics. The book assumes no prerequisites. It contains a practical sequence with emphasis on current topics in graphics. The text is purposely confined to core topics—material that is needed and that can be reasonably assimilated during a 14-week term. The format is well suited for today's classroom needs. Its use will help students develop the professional literacy in graphics that every engineer needs when making sketches and when using and interpreting drawings.

Engineering graphics is the basis of all design and has an important place in all types of engineering practice. Concise graphical documents are required before virtually any product can be manufactured. Graphics also serves the engineer as a foundation for problem analysis and research.

Techniques for freehand sketching, a basic skill required by all engineers, are presented in the early chapters of this text, as are techniques for engineering lettering, a logical extension of freehand sketching. The text shows students how to utilize the various lettering techniques they will need in the preparation of engineering documents.

Chapter 5, Shape Description, is a particularly important chapter. It covers the essential elements of the logic of visualization in a manner not used in other texts. A sound knowledge of view projections is an invaluable tool for an engineer.

Chapter 8, Engineering Materials and Manufacturing Processes, provides a concise technical background for specifying complex parts and products. Chapter 11, Limit Dimensioning, and Chapter 12, Geometric Tolerancing, cover the symbols and precise meanings used in these highly specialized procedures. The information in these chapters is especially important for the preparation of drawings of machine parts.

One important aspect of this text is the use of the ANSI standards Y14.5M (Dimensioning and Tolerancing) and B4.1 and B4.2 (Preferred Limits and Fits). Recent changes in the Y14.5M standard deal with the reduction of time-consuming drafting activities, mainly geometric symbology, as well as improvements in clarity and increasing commonality with industrial companies all over the world.

The book is profusely illustrated with nearly 500 up-to-date, clearly understandable line drawings, sketches, photographs, charts, and tables (many abstracted from important publications), all of which are keyed to the text material. The artwork has been prepared to professional artist-quality standards, and many of the drawings have been reproduced from actual industrial prints in current use. Where appropriate, to aid in self-study, the artwork illustrates incorrect as well as correct examples. Each caption includes a reference to a specific section in the book in which the corresponding illustration is explained. In this way the student is carefully guided in the technique being illustrated.

Engineering Graphics contains over 600 high-quality end-of-the-chapter problems that provide thorough coverage and reinforcement of important principles. Many of the problems were adapted from industrial prints. These class-tested problems afford a wide variety of difficulty levels from which to choose. All chapter problems, with the exception of those in Chapter 13, may be drawn on 8½ × 11 sheets using layout A, shown on the inside front cover. Instructors may prefer to run off a supply of blank sheets of layout A and hand them out to students instead of requiring them to lay out the borders and record strip on each sheet for each problem. Problem solutions in Chapter 13 require 11 × 17 sheets using layout B (also shown on the inside of the front cover). A comprehensive student workbook keyed to the text is also available. The workbook contains a generous supply of alternate problems, and each page is a tearout sheet.

The Checkpoints, found in most of the chapters, are of particular importance in this text. These learning exercises are inserted at intervals in the chapters and are presented as a follow-up to all step-by-step procedures. The main advantage of

the Checkpoints is that students can make an immediate check on their progress instead of waiting to work the problems at the end of the chapter.

A procedural approach is used throughout the book that includes clearly stated step-by-step explanations, which in most cases, accompany corresponding illustrations placed on the same page. Students will find this procedural method complete and easy to understand and use. Some of the material in this book has served as the basis for a series of self-paced individual modules that were successfully used by hundreds of engineering students in graphics courses over a ten-year period at Worcester Polytechnic Institute.

This text also utilizes a two-color format, which promotes ease in reading and understanding and emphasizes important points in each illustration. Technical terms are defined as they are used and key words are given in italics. The proper use of the SI system is stressed throughout the book. The metric system and various drafting scales are carefully explained in Chapter 3, and differences in applying the English and metric systems of tolerancing are treated in Chapter 11.

The final chapter, Computer Graphics, pulls together the various computer applications referred to throughout the book. It explains the use of the computer—a standard tool of the engineer. The basic principles are carefully outlined, and modern computer hardware is carefully explained and illustrated. Several straightforward computer programs are given together with complete explanations. Chapter 15 was written by John T. Demel and Michael J. Miller of The Ohio State University; they are authors of *Introduction to Computer Graphics*, published in 1984 by the Brooks/Cole Engineering Division.

I wish to acknowledge the many valuable suggestions received from my former colleagues at Worcester Polytechnic Institute, notably those of Professors Ladislav H. Berka, Robert L. Norton, and Kenneth E. Scott. I am especially indebted to Greg Santini, WPI '85, for his careful work on the problem material. To the countless industrial plants across the nation who provided many of the engineering documents used in this book and to the many competent reviewers for their useful input, I express my grateful appreciation.

Herbert W. Yankee
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