This book represents a combined abridged version of two of the author’s books, namely *Engineering Mechanics: Statics, Twelfth Edition* and *Mechanics of Materials, Eighth Edition*. It provides a clear and thorough presentation of both the theory and application of the important fundamental topics of this material, that are often used in many engineering disciplines. The development emphasizes the importance of satisfying equilibrium, compatibility of deformation, and material behavior requirements. The hallmark of the book, however, remains the same as the author’s unabridged versions, and that is, strong emphasis is placed on drawing a free-body diagram, and the importance of selecting an appropriate coordinate system and an associated sign convention is stressed when the equations of mechanics are applied. Throughout the book, many analysis and design applications are presented, which involve mechanical elements and structural members often encountered in engineering practice.

**New to This Edition**

- **Content Revisions.** Each section of the text was carefully reviewed and, in many areas, the material has been redeveloped to better explain the concepts. Also, many new topics have been added to this edition. These include belt and screw friction, stress concentrations, torsion of noncircular shafts, using discontinuity functions to find beam deflections, and using the secant formula for eccentrically loaded columns.

- **New Photos.** The relevance of knowing the subject matter is reflected by the real-world applications depicted in many new or updated photos placed throughout the book. These photos generally are used to explain how the relevant principles apply to real-world situations, how to make an idealized model for analysis, and how materials behave under load.

- **Fundamental Problems.** These problem sets are located just after each group of example problems. They offer students simple applications of the concepts covered in each section and, therefore, provide them with the chance to develop their problem-solving skills before attempting to solve any of the standard problems that follow. The fundamental problems may be considered as extended examples, since the key equations and answers are all listed in the back of the book. Additionally, when assigned, these problems offer students an excellent means of preparing for exams, and they can be used at a later time as a review when studying for the Fundamentals of Engineering Exam.
• Conceptual Problems. Throughout the text, usually at the end of each chapter, there is a set of problems that involve conceptual situations related to the application of the principles contained in the chapter. These analysis and design problems are intended to engage students in thinking through a real-life situation as depicted in a photo. They can be assigned after the students have developed some expertise in the subject matter and they work well either for individual or team projects.

• New Problems. Almost all the problems in this edition are new. They involve applications to many different fields of engineering. Also, this new edition now has approximately 460 more problems than in the previous edition.

• New Example Problems. New example problems have been added throughout the book in order to provide more emphasis on the applications of important concepts.

• Problems with Hints. With the additional homework problems in this new edition, every problem indicated with a bullet (•) before the problem number includes a suggestion, key equation, or additional numerical result that is given along with the answer in the back of the book. These problems further encourage students to solve problems on their own by providing them with additional checks to the solution.

• End of Chapter Review. Here the contents of each chapter are summarized, and the key equations are highlighted so that students can focus on the main concepts and principles.

Hallmark Features

Besides the new features mentioned above, other outstanding features that define the contents of the text include the following.

Organization and Approach. Each chapter is organized into well-defined sections that contain an explanation of specific topics, illustrative example problems, and a set of homework problems. The topics within each section are placed into subgroups defined by boldface titles. The purpose of this is to present a structured method for introducing each new definition or concept and to make the book convenient for later reference and review.

Chapter Contents. Each chapter begins with a photo demonstrating a broad-range application of the material within the chapter. A bulleted list of the chapter contents is provided to give a general overview of the material that will be covered.

Emphasis on Free-Body Diagrams. Drawing a free-body diagram is particularly important when solving problems, and for this reason this step is strongly emphasized throughout the book. In particular, within the statics coverage some sections are devoted to show how to draw free-body diagrams. Specific homework problems have also been added to develop this practice.
Procedures for Analysis. A general procedure for analyzing any mechanics problem is presented at the end of the first chapter. Then this procedure is customized to relate to specific types of problems that are covered throughout the book. This unique feature provides the student with a logical and orderly method to follow when applying the theory. The example problems are solved using this outlined method in order to clarify its numerical application. Realize, however, that once the relevant principles have been mastered and enough confidence and judgment have been obtained, the student can then develop his or her own procedures for solving problems.

Important Points. This feature provides a review or summary of the most important concepts in a section and highlights the most significant points that should be realized when applying the theory to solve problems.

Conceptual Understanding. Through the use of photographs placed throughout the book, the theory is applied in a simplified way in order to illustrate some of its more important conceptual features and instill the physical meaning of many of the terms used in the equations. These simplified applications increase interest in the subject matter and better prepare the student to understand the examples and solve problems.

Homework Problems. Apart from the Fundamental and Conceptual type problems mentioned previously, other types of problems contained in the book include the following:

- General Analysis and Design Problems. The majority of problems in the book depict realistic situations encountered in engineering practice. Some of these problems come from actual products used in industry. It is hoped that this realism will both stimulate the student's interest in engineering mechanics and provide a means for developing the skill to reduce any such problem from its physical description to a model or symbolic representation to which the principles of mechanics may be applied.

  Throughout the book, there is an approximate balance of problems using either SI or FPS units. Furthermore, in any set, an attempt has been made to arrange the problems in order of increasing difficulty, except for the end of chapter review problems, which are presented in random order. Problems that are simply indicated by a problem number have an answer given in the back of the book. If a bullet (•) precedes the problem number, then a suggestion, key equation, or additional numerical result is given along with the answer. Finally, an asterisk (*) before every fourth problem number indicates a problem without an answer.

- Computer Problems. An effort has been made to include some problems that may be solved using a numerical procedure executed on either a desktop computer or a programmable pocket calculator. The intent here is to broaden the student's capacity for using other forms of mathematical analysis without sacrificing the time needed to focus on the application of the principles of mechanics. Problems of this type,
which either can or must be solved using numerical procedures, are identified by a “square” symbol (■) preceding the problem number.

**Accuracy.** In addition to the author, the text and problem solutions have been thoroughly checked for accuracy by four other parties: Scott Hendricks, Virginia Polytechnic Institute and State University; Karim Nohra, University of South Florida; Kurt Norlin, Laurel Tech Integrated Publishing Services; and finally Kai Beng Yap, a practicing engineer.

**Contents**

The book is divided into two parts, and the material is covered in the traditional manner.

**Statics.** The subject of statics is presented in 6 chapters. The text begins in Chapter 1 with an introduction to mechanics and a discussion of units. The notion of a vector and the properties of a concurrent force system are introduced in Chapter 2. Chapter 3 contains a general discussion of concentrated force systems and the methods used to simplify them. The principles of rigid-body equilibrium are developed in Chapter 4 and then applied to specific problems involving the equilibrium of trusses, frames, and machines in Chapter 5. Finally, topics related to the center of gravity, centroid, and moment of inertia are treated in Chapter 6.

**Mechanics of Materials.** This portion of the text is covered in 10 chapters. Chapter 7 begins with a formal definition of both normal and shear stress, and a discussion of normal stress in axially loaded members and average shear stress caused by direct shear; finally, normal and shear strain are defined. In Chapter 8 a discussion of some of the important mechanical properties of materials is given. Separate treatments of axial load, torsion, bending, and transverse shear are presented in Chapters 9, 10, 11, and 12, respectively. Chapter 13 provides a partial review of the material covered in the previous chapters, in which the state of stress resulting from combined loadings is discussed. In Chapter 14 the concepts for transforming stress and strain are presented. Chapter 15 provides a means for a further summary and review of previous material by covering design of beams based on allowable stress. In Chapter 16 various methods for computing deflections of beams are presented, including the method for finding the reactions on these members if they are statically indeterminate. Lastly, Chapter 17 provides a discussion of column buckling.

Sections of the book that contain more advanced material are indicated by a star (*). Time permitting, some of these topics may be included in the course. Furthermore, this material provides a suitable reference for basic principles when it is covered in other courses, and it can be used as a basis for assigning special projects.

**Alternative Method for Coverage of Mechanics of Materials.** It is possible to cover many of the topics in the text in several different sequences, depending upon the discussion of the instructor. For example, some instructors prefer to cover stress and strain transformations
first, before discussing specific applications of axial load, torsion, bending, and shear. One possible method for doing this would be first to cover stress and strain and its transformations, Chapter 7 and Chapter 14. The discussion and example problems in Chapter 14 have been styled so that this is possible. Chapters 8 through 13 can then be covered with no loss in continuity.

Problems. Numerous problems in the book depict realistic situations encountered in engineering practice. It is hoped that this realism will both stimulate the student’s interest in the subject and provide a means for developing the skill to reduce any such problem from its physical description to a model or symbolic representation to which the principles may be applied.

Throughout the text there is an approximate balance of problems using either SI of FPS units. Furthermore, in any set, an attempt has been made to arrange the problems in order of increasing difficulty. The answers to all but every fourth problem are listed in the back of the book. To alert the user to a problem without a reported answer, an asterisk (*) is placed before the problem number. Answers are reported to three significant figures, even though the data for material properties may be known with less accuracy. Although this might appear to be poor practice, it is done simply to be consistent and to allow the student a better chance to validate his or her solution. All the problems and their solutions have been independently checked four times for accuracy.

Acknowledgments

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Russell Charles Hibbeler
Resources for Instructors

- **Instructor’s Solutions Manual.** An instructor’s solutions manual was prepared by the author. The manual includes homework assignment lists and was also checked as part of the accuracy checking program.

- **Presentation Resources.** All art from the text is available in PowerPoint slide and JPEG format. These files are available for download from the Instructor Resource Center at http://www.pearsonhighered.com. If you are in need of a login and password for this site, please contact your local Pearson representative.

Resources for Students

- **Companion Website**—The Companion Website, located at http://www.pearsonhighered.com/hibbeler includes opportunities for practice and review including:

  - **Video Solutions**—Complete, step-by-step solution walkthroughs of representative homework problems from each section, developed by Professor Edward Berger of University of Virginia. Videos offer:

    - **Fully worked Solutions**—Showing every step of representative homework problems, to help students make vital connections between concepts.

    - **Self-paced Instruction**—Students can navigate each problem and select, play, rewind, fast-forward, stop, and jump-to-sections within each problem’s solution.

    - **24/7 Access**—Help whenever students need it with over 20 hours of helpful review.

An access code for the Statics and Mechanics of Materials, Third Edition website was included with this text. To redeem the code and gain access to the site, go to http://www.pearsonhighered.com/hibbeler and follow the directions on the access code card. Access can also be purchased directly from the site.
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