PREFACE

An engineer always endeavours to design structural or machine members that are safe, durable and economical. To accomplish this, he has to evaluate the load-carrying capacity of the members so that they are able to withstand the various forces acting on them. The subject *Strength of Materials* deals with the strength, stability and rigidity of various structural or machine members such as beams, columns, shafts, springs, cylinders, etc. These days, a number of books on the subject are available in the market. However, it is observed that most of the books are feature-wise fine when considered on parameters like coverage of a topic, lucidity of writing, variety of solved and unsolved problems, quality of diagrams, etc., but usually, the students have to supplement a book with another book for one reason or the other. The present book aims to cover all good features in a single book.

The book is mainly aimed to be useful to degree-level students of mechanical and civil engineering as well as those preparing for AMIE and various other competitive examinations. However, diploma-level students will also find the book to be of immense use. The book will also benefit post-graduate students to some extent as it also contains some advance topics like bending of curved bars, rotating discs and cylinders, plastic bending and circular plates, etc. The salient features of the book are the following:

- A moderately concise and compact book covering all major topics
- Simple language to make it useful even to the average and weak students
- Logical and evolutionary approach in descriptions for better imagination and visualisation
- Physical concepts from simple and readily comprehensible principles
- Large number of solved examples
- Theoretical questions as well as sufficient number of unsolved problems at the end of each chapter
- Summary at the end of each chapter
- An appendix containing objective-type questions
- Another appendix containing important relations and results

It is expected that students using this book might have completed a course in applied mechanics. Chapters 1 and 2 introduce the concept of simple and compound stresses at a point. It is shown that an axial load may produce shear stresses along with normal stresses depending upon the section considered. The utility of Mohr's circle in transformation of stress at a point is also discussed. Chapter 3 explains the concept of strain energy that forms the basis of analysis in many cases. Chapters 4 to 8 are related to beams which may be simply supported, fixed at one or both ends or continuous having more than two supports. The analysis includes the computations of bending moment, shear force and bending and shear stresses under transverse loads. The concept of plastic deformations of beams beyond the elastic limit, being an advanced topic is taken up later and is discussed in Chapter 16. Sometimes, curved members such as rings and hooks are also loaded. Chapter 9 discusses the stresses developed in such members. The theory of torsion is developed in Chapter 10 which

also includes its application to shafts transmitting power. The springs based on the same theory are discussed in the subsequent chapter. Columns are important members of structures. Chapter 12 discusses the equilibrium of columns and struts. However, the computation of stress in plane frame structures which is mostly included in the civil engineering curriculum is discussed later in Chapter 17. Some other important machine members include cylinders and spheres under internal or external pressures; flywheels, discs and cylinders which rotate while performing the required function; circular plates under concentrated or uniform loads. These topics are covered in chapters 13 to15. Chapter 18 discusses the properties of materials as well as the methods to determine the same.

Though students are expected to exert and solve the numerical problems given at the end of each chapter, hints to most of these are available at the publisher's website of the book for the benefit of average and weak students. However, full solutions of the unsolved problems are available to the faculty members at the same site. The facility can be availed by logging on to http://www.mhhe.com/rattan

In preparing the script, I relied heavily on the works of renowned authors whose writings are considered classics in the field. I am indeed indebted to them. I sincerely acknowledge the help of my many colleagues, who helped me in one form or the other in preparing this treatise. I also acknowledge the efforts of the editorial and production staff at Tata McGraw-Hill for taking pains in bringing out this book in an excellent format.

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A creation by a human being can never be perfect. A number of mistakes might have crept in the text. I shall be highly grateful to the readers and the users of the book for their uninhibited comments and pointing out the errors. Do feel free to contact me at ss_rattan@hotmail.com

<div align="right">S S Rattan</div>