Preface

The overwhelming response received by the third edition of this book inspired me to bring out the fourth edition. This new edition has been revised and updated based on the valuable suggestions and feedback received from the students and teachers using this book.

The book is written in a simple and lucid manner with systematic arrangement of chapters, enabling the readers to get thorough knowledge, starting from the basic concepts to the sophisticated advanced techniques of instrumentation and measurement.

With the advancement of technology in integrated circuits, instruments are becoming increasingly compact and accurate. In view of this, various digital and microprocessor-based instruments are dealt in an organised manner for easy understanding. The basic concepts, working operation, capabilities and limitations of the instruments discussed in the book will also guide the users in selecting the right instrument for different applications.

New to this Edition

❖ Inclusion of new topics on Instrument transformers, ac and dc Potentiometers
❖ A new chapter on Biomedical Instrumentation
❖ A brief Introduction to Virtual Instrumentation
❖ Thoroughly revised pedagogy, including
   ☞ 300+ Review Questions
   ☞ 200+ Objective-type Questions
   ☞ 125+ Solved Examples, with easy step-by-step solutions examples

Chapter Organisation

Chapter 1 covers the basic characteristics and the errors associated with instruments. Different types of indicating and display devices are dealt with in detail in **Chapter 2**. This chapter also discusses different types of printers and printer heads used with computers.

The basic analog-type ammeters for both dc and RF frequencies and different types of voltmeters, ohmmeters and multimeters are discussed in **Chapters 3** and **4**.

Digital instruments ranging from a simple digital voltmeter to a microprocessor-based instrument and their measurement techniques are presented in a comprehensible manner for easy understanding in **Chapters 5** and **6**.

Chapter 7 covers different measuring instruments such as Q meter, vector impedance meter, etc.

In industry, it is required to transmit signals or the changes in parameters from the measurement site location to the control room. Hence, in **Chapter 7**, telemetry systems have also been covered to get a brief insight of the various transmission methods used in industry.

Chapter 8 on oscilloscopes has been dealt with in-depth from the basics, to familiarize the students with the working of all types of Cathode Ray Oscilloscopes (CROs), analog and digital, and their measurement techniques. **Chapter 9** pertains to instruments of different types of signal waveform generation and its operation.

Chapter 10 analyses the frequency component of a generated fundamental wave, and its distortion.

Most instruments used in process control plants measure various parameters such as resistance, inductance, capacitance, dissipation factor, temperature, etc. To obtain accurate measurement of the changes in parameters, bridges are used. Hence, **Chapter 11** covers most of the types of bridges used for measurement of different parameters, for example, Wheatstone's bridge, Maxwell's Bridge, Hay's Bridge, Schering Bridge, etc. Instruments and the instrumentation systems also use bridges as the input stage.

Chapters 12, 13 and **14** cover the essential components such as recorders, different types of transducers used in process plants and signal conditioning used in industrial instrumentation and process, for measurements and their usage.

Details of different types of analog and digital filters are covered in **Chapter 15**. A mathematical approach to explaining analog and digital filters has been adopted to provide the students a clear insight into their working. A detailed discussion on the data acquisition system along with the latest data logger used in industry is covered in **Chapter 16**.

Instruments from remote places transmit signals over long distances to a master control room where they are controlled and displayed. This transmission of signals has been explained in detail in **Chapter 17**.

Chapter 18 discusses control systems, electronic control systems in particular. This chapter covers the basic control systems, electronic control systems, electronic controllers, PLC and advanced control systems such as DCS used in process control plants.

Chapter 19 covers different types of frequency standards and atomic clock.

Measurements of microwave frequencies and types of modulation are dealt in **Chapters 20**. Measurement of power at RF has been thoroughly discussed in **Chapter 21**.

Chapter 22 discusses biomedical instrumentation such as blood pressure measurement, ECG measurements and biosensors, etc.

The pedagogy is arranged as per levels of difficulty—All questions and problems are marked with Levels of Difficulty (LOD), to help students better assess their learning. This assessment of Levels of difficulty is derived from Bloom's taxonomy.

- ✦ indicates Level 1 and Level 2, i.e., Knowledge and Comprehension based easy-to-solve problems.
- ✦✦ indicates Level 3 and Level 4, i.e., Application and Analysis based medium-difficulty problems.
- ✦✦✦ indicates Level 5 and Level 6, i.e., Synthesis and Evaluation based high-difficulty problems

Web Supplements

The web supplements can be accessed at *http://www.mhhe.com/kalsi/ei4*, which contains the following:

For Instructors: Solution Manual, PowerPoint Lecture Slides

For Students: Additional Review Questions and Web links for useful reference materials

Acknowledgements

First of all, I express my deepest thanks and gratitude to my younger brother who gave me all his support, without which it would have been difficult to complete this project. Secondly, I thank all the reviewers for their important and valuable suggestions which immensely helped me in revising this book. Their names are as follows:

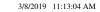|	
Dr. Pritesh kumar Biharilal Shah	*Symbiosis Institute of Technology, Symbiosis International University, Pune*
Mr. Chandrashekhar Annasaheb Chougule	*Watumull Institute of Electronics Engineering & Computer Technology, Mumbai University*
Deepti Ganesh Patne	*Vidysvardhini's College of Engineering and Technology, Mumbai University*
Rajesh Dey	*Brainware Group of Institutions – SDET – Kolkata*
Sanjeev Natvar Jain	*SSVPS B S Deore College of Engineering, Dhule (North Maharashtra University)*
Neeraj Sharma	*IIT (BHU), Varanasi*

Signetics Electronics Ltd., who made available the photographs of instruments, deserves a special note of appreciation.

I am deeply indebted to my wife and other family members for their never ending encouragement, moral support and patience during the preparation of this book.

I appreciate the efforts of all the members of McGraw Hill Education (India) family, especially Shalini Jha, Satinder S Baveja, Vaishali Thapliyal and Anuj Kumar Shrivastava, whose help and cooperation shaped the book in all its stages.

Last, but not the least, I would like to thank my friends and colleagues who helped me in the writing of this book.

I hope that this edition of the book will prove useful to all readers, students as well as teachers. All suggestions for further improvement of the book are welcome and will be gratefully acknowledged. You can send your feedback at hs_kalsi@yahoo.com.

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