BOOKS

Introduction to Material & Energy Balances, by G. V. Reklaitis (with contributions by Daniel R. Schneider), John Wiley & Sons, 1983, 683 pages, $33.95.

This book offers a novel approach for the instruction of material and energy balances at a sophomore level in chemical engineering. While covering the same major conceptual points as other material and energy balance texts, this book also develops a framework for flowsheet analysis. As a result, this text anticipates the use of material and energy balances in the context of a process design course. This book also covers the major concepts involved in computer-oriented procedures for solving balance equations. Consequently, this text might also allow for reinforcement of computer skills learned in nonchemical engineering courses. (No programming details or coding are provided in the text, so students with a background in any computer language may benefit.)

Chapter 1 discusses the role of the chemical engineer, the basic ideas involved in stoichiometry including the development of Reklaitis' "gold-brick mole," basic equation solving techniques, and the concept of dimensionless quantities. The only shortcoming is that this chapter introduces the conservation principle in a manner which students may find abstract instead of introducing it in terms of "accumulation = input − output + sources − sinks."

Chapters 2 and 3 cover material balances in nonreacting and reacting systems. Reklaitis anticipates the application of material balances in flowsheet analysis by introducing degree-of-freedom analysis for single-unit and multiunit problems. Chapter 4 is concerned with element balances, a topic often given insufficient coverage in other texts. Ample explanation is provided in this chapter for students who have little background in matrix manipulation. Chapter 5 applies the background obtained in the previous chapters to process flowsheets. In particular, the manual and computer calculations involved in solving multiunit problems which cannot be solved as a sequence of zero-degree-of-freedom balances are emphasized.

Chapters 6, 7, and 8 discuss the concept of energy, and energy balances in nonreacting and reacting systems. These chapters are well developed, quite complete in coverage, and similar to the mass balance chapters in including a degree-of-freedom analysis. Chapter 9 concerns the simultaneous use of material and energy balances in process flowsheets, and it discusses methods for use in manual and computer calculations.

An ample listing of physical property data is given in an appendix at the end of the book. Students may find this section useful as a reference in a number of their other chemical engineering courses.

Reklaitis has been careful to include many examples worked in detail (e.g. 34 examples in Chapter 3) as well as a wide variety of homework problems (usually over 30 problems at the end of each chapter) which should be useful to the student and instructor alike. He has also tried to include non-traditional examples (space station life support system, solar-powered chemical heat pump) although, with the book's emphasis toward design calculations, possibly not as many as could have been included. The only feature of the book which students and the instructor might find frustrating is the sparse numbering of equations. For example, there are 43 pages of material between equation 4.5 (p. 194) and equation 4.6 (p. 237). Ignoring this one inconvenience, this book should prove to be successful in instructing students not only in the basic ideas of material and energy balances but also in the methods of using these balances in the flowsheet analysis of a chemical engineering process.

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Flow Measurement Engineering Handbook by R. W. Miller, McGraw Hill Book Company, 960 pages, $59.95

This book is a well written, well organized, and complete guide to the selection of flow meters for closed conduits. Open channel measurement techniques are specifically excluded. The handbook explains how relevant fluid properties are determined and contains extensive graphs and tables of these properties for a wide range of liquids and gases of chemical engineering interest. It addresses the important topic of measurement accuracy and how it may be quantified. The author provides a matrix of flowmeter types and applications to assist in the initial selection of flowmeter type, followed by in-depth descriptions of the method of operation of each flow meter type, ranging from the very traditional to the more recently developed, such as ultrasonic meters. For each type of meter the governing equations relating flow rate to the other relevant quantities are discussed in detail, and sample calculations are given to guide the engineer in the specification of the characteristics of the flowmeter required. The installation requirements and performance of each flow meter are referred to ANSI, ASME, and ISO standards where applicable. The text is comple-

mented throughout with illustrations and photographs.

The author recognizes that many engineering applications of flowmeters are in flow rate measurements of multiphase or nonNewtonian fluids or in situations where the flow is nonhomogeneous or pusatile. His treatment of these "influence quantities" in terms of their effect on the mean velocity profile is complete and thorough. It does not point out the fact, however, that such "influence quantities" can affect not only the velocity profile but also the flow pattern around certain types of obstructions (e.g. orifices) used in flow metering. This additional complication must be accounted for if the flow meter utilizes any local change in diameter of the flow path. To his credit, however, the author does discuss means of dealing with nonhomogeneous flow effects and recommends the use of nonobtrusive meters with such fluids as those having viscoelastic properties.

In my judgement this book should be a useful resource for those chemical engineers who must design or specify flow metering methods in closed conduit flow systems.

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Chemistry and Unit Operations in Water Treatment, by D. Barnes (University of New South Wales, Australia) and F. Wilson (University of Canterbury, New Zealand), Applied Science Publishers Ltd., Price $55.50.

Viewed from the practicing engineer's perspective, this book provides a good basis for understanding the physical, chemical and microbiological processes used to produce safe, potable water at municipal water treatment plants.

Along with those engineers involved with municipal water treatment, chemical engineers who design and operate water treatment facilities at large manufacturing plants in the food-processing, pharmaceutical and fermentation industries should find this book very useful.

The authors assume that practicing engineers in water treatment plants have inadequate backgrounds in chemistry and biology but are well versed in mathematics. Chemical engineers will find the applied chemistry interesting, the discussions of unit operations such as multi-media filtration, coagulation and flocculation—different, and the chapter on disinfection especially valuable. The book would be more useful outside of the author's extension classes if problems with answers had been included at the ends of chapters.

Since the book is based upon "experience gained from postgraduate and extension courses" given to practicing engineers, it has some unusual features. New developments in current practices are featured, assuming that the reader already is familiar with the operations and processes involved; some chapters are more up-to-date than others; the discussions of basic chemistry in Chapter 2 is elementary while that of analytical chemistry in Chapter 9 requires a more advanced background. The information in both of these chapters is necessary for practicing engineers in water treatment plants.

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