Fundamentals of Manufacturing

Second Edition

Philip D. Rufe, CMfgE
Editor

Society of Manufacturing Engineers
Dearborn, Michigan

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The efforts of the people responsible for the previous edition are greatly appreciated. Their efforts created the foundation from which this edition has been built. Much of the material from the previous edition has been incorporated into this edition.

Preface

This book was designed to provide a structured review of the fundamentals of manufacturing for individuals planning to take the Fundamentals of Manufacturing Certification Examination. The topics covered are the result of a 1999 survey of manufacturing managers, manufacturing technologists and engineers, and manufacturing educators. Its purpose: to identify fundamental competency areas required by manufacturing technologists and engineers in the field.

While the objective of this book is to help prepare manufacturing managers, technologists, and engineers for the certification process, it is also a primary source of information for individuals interested in learning fundamental manufacturing concepts and practices. This book is a valuable resource for many individuals with limited manufacturing experience or training.

Introduction

MANUFACTURING CERTIFICATION

Manufacturing is concerned with energy, materials, tools, equipment, and products. Excluding services and raw materials in their natural state, most of the remaining gross national product is a direct result of manufacturing.

Modern manufacturing activities have become exceedingly complex because of rapidly increasing technology and expanded environmental involvement. This, coupled with increasing social, political, and economic pressures, has caused successful firms to strive for high-quality manufacturing engineers and managers.

To aid in improving manufacturing, the Society of Manufacturing Engineers' Board of Directors initiated the Manufacturing Engineering Certification Institute (MECI) in 1971. The principal advantage of certification is that it shows the ability to meet a certain set of standards related to the many aspects of manufacturing. These standards pertain to the minimum academic requirements needed, but more importantly, they pertain to the practical experience required of a manufacturing engineer or manager.

Many persons currently employed in industry can successfully measure themselves against these standards, but they cannot provide documentation concerning their ability. The certification program is designed to provide successful candidates with documentary evidence of their abilities. The designations Certified Manufacturing Engineer (CMfgE), Certified Manufacturing Technologist (CMfgT), and/or Certified Enterprise Integrator (CEI) are bestowed upon successful candidates.

Philosophically, the purpose of Manufacturing Certification is to gain increased acceptance of Manufacturing Engineering and Management as a profession and to ultimately improve overall manufacturing effectiveness and productivity.

PURPOSE AND OVERVIEW

The purpose of this text is to provide a structured review for the manufacturing engineer or manager wishing to prepare for certification. The text will serve as a useful review for the experienced manufacturing professional or as an information source and study guideline for the person just entering the field.

The major areas of manufacturing science reviewed include mathematics, physics and engineering science, materials, product design, manufacturing processes, production systems, automated systems and control, quality, and manufacturing management. In each area the topics emphasized are those fundamental to manufacturing.

Sample problems and questions are included at the conclusion of each section for practice. Answers are included for all questions but it is recommended that all problems be attempted before reading the answer.

EXAMINATION SPECIFICS

The Fundamentals of Manufacturing Certification Examination is a three-hour open-book exam consisting of 130 multiple-choice questions. Each major area and its relative emphasis in the exam are listed as follows:

- Mathematics 2.1%
- Physics and Engineering Science 9.1%
- Materials 5.1%
- Product Design 13.4%
- Manufacturing Processes 14.1%
- Production Systems 20.9%
- Automated Systems and Control 5.3%
- Quality 13.0%
- Manufacturing Management 10.8%
- Personal/Professional Effectiveness 6.2%

Personal/Professional Effectiveness is a new area in the Fundamentals of Manufacturing Certification Exam. The text does not discuss personal/professional effectiveness because this area is more judgement based rather than knowledge based. Personal/Professional Effectiveness includes:

- Interpersonal skills.
- Negotiating and conflict management.
- Presentation skills and oral communication.
- Written communication skills.
- Innovation and creativity.
- Learning and knowledge transfer.

ADDITIONAL INFORMATION

The bibliography at the end of the book contains appropriate sources for more detailed information on the topics covered. Additional study resources for the Fundamentals of Manufacturing Certification Exam include, but are not limited to, a pencil and paper practice exam and a Windows®-based self-assessment program. The interactive self-assessment program contains 165 questions and answers (based on the same topics as the exam), which will determine your strengths and weaknesses. Built-in bibliographic references suggest study materials for topics where additional help is needed.

For more information regarding the exam or additional resources, please contact the Manufacturing Engineering Certification Institute by calling 313-271-1500, ext. 1811 or e-mail: cert@sme.org. Information can also be obtained on SME's certification website www.sme.org/certification.

Any questions or comments regarding this book are welcome and appreciated. Please direct questions and/or comments to cert@sme.org.

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