

TABLE OF CONTENTS

Dedication

iii

Chapter 1 Manufacturing Engineering Organization Concepts	1
A Fable: The Company That Could and the Company That Couldn't	1
The Industrial Matrix	2
The Manufacturing Matrix	2
Manufacturing Engineering Relationships with Other Functions	4
Manufacturing Engineering within the Manufacturing Function	4
Advanced Manufacturing Engineering (AME)	5
Methods, Planning, and Work Measurement	9
Maintenance	14
Process Control	16
Summary	19
Review Questions	20

Chapter 2 Manufacturing Engineering Management Techniques	21
The Business Plan Cycle and the Manufacturing Engineering Role	21
Objectives and Goals	22
Projects—the Mechanism for Achieving Goals	24
Basics of Project Management	27
The Golden Rule of Project Scheduling “Do It Sooner Rather Than Later”	41
“Those That Shoot Before Aiming Rarely Hit the Target”	42
Setting up the Objectives and Goals System	50
Work Planning	54
Financial Controls	58
Summary	67
Review Questions	68

Chapter 3 Factory Capacity and Loading Techniques	69
Technical Capacity	69
Physical Capacity	69
Techniques for Developing Workstation Capacities	70
Theory of Constraints	75
Evaluating for Practical Capacity	76
Effect of Level Loading on Capacity Analysis	79
Bottleneck Identification and Elimination	81
Use of Computers for Capacity and Loading Simulations	83
Summary	87
Review Questions	88

Chapter 4 Capital Equipment Programs	91
Facilities Programs	91
Financial Justification Techniques	106
Manufacturing Engineering Budgets	108
Capital Equipment Project Management	111
Summary	112
Review Questions	112
Chapter 5 Machine Tool and Equipment Selection and Implementation	113
Making the Preliminary Layout	113
The Layout Checklist and How to Tie Into Project Management	117
Working with Vendors	119
Selecting the Equipment	121
Implementation Schedule During Manufacturing of Equipment	124
Implementing Equipment on the Factory Floor	129
Capital Equipment Project Control Charts	133
Commercial Software for Networking and Gantt Charts	136
Summary	138
Review Questions	138
Chapter 6 Producibility Engineering	141
Concurrent Engineering Concepts	141
The Producibility Design Review Process	146
Setting Design Tolerances	151
Statistical Approaches to Tolerance Setting	152
Geometric Dimensioning and Tolerancing	157
Attributes of Good Design Used in the Concurrent Engineering Process	164
Summary	166
Review Questions	167
Chapter 7 Methods, Planning, and Work Measurements	169
The Scientific Method Applied to Manufacturing Engineering	169
Methods Engineering	170
Scientific Time Standard Analysis	181
Planning of Operations	201
Concepts of Work Measurement	202
Summary	206
Review Questions	206
Chapter 8 Job Evaluations, Pay Plans, and Acceptance	209
Fundamentals of Job Evaluation	210
Creation of Job Descriptions	213
Defining Key Jobs	217

Using the Job Rating System to Determine Point Value for a Job and Assigning a Compensation Rate	219
Developing a Pay Rate Matrix	221
Thoughts on Alternate Ways of Compensating Employees, and Fairness Involved	222
The Employee Handbook for Selling the Fairness Doctrines of Job Ratings and Pay Levels	226
Summary	232
Review Questions	233
<hr/> Chapter 9 Employee Appraisals and Evaluation	235
Purpose of Appraisals and Evaluations	235
The Main Components of Any Appraisal	236
The Design of the Appraisal Form	238
Using the Appraisal as a Management Tool	244
The Appraisal Cycle	245
Summary	247
Review Questions	248
<hr/> Chapter 10 Process Control Engineering and Quality Control in Job Shops	249
Seven Steps of the Manufacturing System	249
The Quality Organization with Respect to Process Control Engineering	256
Human Motivation and Quality	257
The Process Control System	258
Quality Plans	259
Measurements	261
Data Collection, Recording, and Classification	263
Corrective Action (Short Term)	266
Reports	268
Corrective Action (Long Term)	269
Quality Costs	270
Quality Audits	274
Inspection Systems and Planning	275
Relations with Other Manufacturing Engineering Units	277
An Introduction to Statistics and Probability Theory for Statistical Process Control	279
Use of Control Charts	284
Design for Experiments Relationship to Statistical Process Control (SPC)	293
Total Quality Management and the Six Sigma Approach	296
Summary	298
Review Questions	299
<hr/> Chapter 11 Maintenance Engineering	303
Tasks Assigned to Maintenance Engineering	303
The Three Types of Maintenance Management Theory and When to Use Each Maintenance Engineering	308
Organization for Effective Management of the Maintenance Engineering Unit	317
Methods of Management	318

Summary	325
Review Questions	325
Chapter 12 Computer Numerical Control of Machine Tools	327
Description of a CNC Machine	327
CNC Parts Programming	328
Computer-Assisted CNC Programming	332
Family-of-Parts Programming	332
Uses of CNC Machine Tools	333
Advantages and Disadvantages of CNC Machines	336
Managing the Use of CNC Machines	337
Robotics	339
Summary	340
Review Questions	340
Chapter 13 Fundamentals of Computer-Integrated Manufacturing	343
Integration of Functions with CIM	343
Productivity Via CIM	345
Control of Job Shop Operations with CIM	348
A Systematic Approach to Implementing CIM in Job Shops	352
Artificial Intelligence (AI) in a CIM World	356
Summary	364
Review Questions	364
Chapter 14 Computer-Aided Process Planning and Data Collection	367
Historical Development of Computer-Aided Manufacturing	367
Early Computer-Aided Process Planning Systems	368
The CAM CAPP System	369
The Integrated CIM CAPP System	372
Management Considerations, CAPP Systems	375
Data Collection Systems	376
Summary	380
Review Questions	380
Chapter 15 The Group Technology Basis for Plant Layout	381
The Principle of Sameness	381
Group Technology Plant Layout Concept	382
The Economics of Group Technology Cellular Layout	384
Techniques for Selecting Families of Parts	388
Summary	393
Review Questions	395
Chapter 16 Manufacturing Engineering Aspects of Manufacturing Resources Planning	397
Definition and Description of Materials Requirement Planning (MRP), and Manufacturing Resources Planning (MRP II)	397

Manufacturing Resources Planning in a CIM Environment	397
Manufacturing Engineering Responsibilities for Implementing Manufacturing Resources Planning	400
Techniques for Enhancing Implementation of MRP II	403
Summary	409
Review Questions	410

Chapter 17 Just In Time and Its Corollary Lean Manufacturing: A Pragmatic Application of Manufacturing Engineering Philosophy	411
--------------------------------------------------------------------------------------------------------------------------------------	------------

Just in Time From the Viewpoint of Materials Management	411
Just in Case Versus Just in Time	413
The True Overall Goal of Just in Time	414
The CIM Approach Toward Realization of JIT Goals	415
Description of the Lean Manufacturing Process, an Extension of the JIT Philosophy	419
The Mistake Proofing Technique	420
Summary	422
Review Questions	423

Chapter 18 Environmental Control and Safety	425
----------------------------------------------------	------------

The Need for an Environmental Control and Safety Concern	425
The Case for Establishing Formal Environmental and Safety Programs	426
Knowledge Requirements for Factory Environmental Control and Safety Programs	427
The Environmental Control and Safety Program	429
Awareness Activities Program	430
Planned Action Activities Program	434
Indoctrination of New Employees	438
Summary	440
Review Questions	440

Chapter 19 The Integrated Productivity Improvement Program	441
-------------------------------------------------------------------	------------

Need for an Interactive Solution	441
Types of Productivity	443
Productivity Measurement Equations	446
Implementing the Integrated Productivity Improvement Program	450
Summary	455
Review Questions	455

Chapter 20 Using ISO 9000 as a Means of Becoming a "World Class" Company	457
---------------------------------------------------------------------------------	------------

What Does ISO 9000 Certification Mean with Respect to Competition?	457
The Role of Manufacturing Engineering in the ISO 9000 System	458
A Description of the ISO 9000-2000 Standard	458
Becoming 9001 (2000) Certified	461
Should Your Company Really Certify or Just Apply the Principles of ISO 9001 (2000)?	464
The Benefits of Becoming ISO 9001 (2000) Certified	465
Costs of Implementation	465
The Upgrade Process Leading to Certification	466

The Gap Analysis Tool to Achieve Acceptable Standards of Performance	467
The Hierarchy of Quality Planning for ISO 9001 (2000) Certification	470
Internal Auditing, a Technique That has Reached Maturity Through ISO 9000 Applications	471
Summary	474
Review Questions	474
<hr/>	
Appendix A: Employee Handbook	477
<hr/>	
Appendix B: Sales Incentive Program	496
<hr/>	
Appendix C: Investigation Points (Product Company)	498
<hr/>	
Glossary	509
<hr/>	
Selected Related Readings	519
<hr/>	
Index	523