

# Table of Contents

<i>Preface</i> .....	<i>iii</i>
<i>Introduction</i> .....	<i>xvii</i>
<b>Chapter 1: Overview of Production and Operations Management .....</b>	<b>1</b>
1.1 Introduction .....	2
1.2 Concept of Production and Operations Management .....	2
1.2.1 Evolution of Production and Operations Management .....	3
1.2.2 Elements of Production and Operations Management .....	4
1.2.3 Objectives of Production and Operations Management .....	4
1.2.4 Scope of Production and Operations Management .....	5
1.2.5 Advantages of POM .....	6
1.3 Role and Responsibilities of a Productions and Operations Manager .....	7
1.4 Recent Trends in Production and Operations Management .....	8
1.5 Summary .....	11
1.6 Key Terms .....	11
1.7 Exercise.....	11
Multiple Choice Questions .....	11
Short Answer Type Questions .....	14
Long Answer Type Questions .....	14
<b>Chapter 2: Operations Strategy .....</b>	<b>15</b>
2.1 Introduction .....	16
2.2 Concept of Strategy .....	16
2.2.1 Features and Importance of Strategy .....	17
2.2.2 Levels of Strategy.....	18
2.2.3 Role of Strategists .....	19
2.3 Concept of Strategic Management .....	20
2.3.1 Definition of Strategic Management .....	21
2.3.2 Need of Strategic Management .....	21
2.3.3 Components of Strategic Management .....	22
2.3.4 Process of Strategic Management.....	22
2.3.5 Role of Strategic Management in an Organization .....	24

2.4	Concept of Operations Strategy .....	26
2.4.1	Competitive Priorities .....	26
2.4.2	Relationship among Organization, Operations, and Marketing Strategies .....	28
2.4.3	Factors Influencing Operations Strategy .....	29
2.4.4	Types of Operations Strategies.....	30
2.5	Modification of an Operations Strategy .....	36
2.6	Summary .....	37
2.7	Key Terms .....	37
2.8	Exercise.....	37
	Multiple Choice Questions .....	37
	Short Answer Type Questions .....	40
	Long Answer Type Questions .....	40
<b>Chapter 3:</b>	<b>Forecasting.....</b>	<b>41</b>
3.1	Introduction .....	42
3.2	Concept of Forecasting .....	42
3.2.1	Period of Forecasting.....	42
3.2.2	Forecasting in Different Departments .....	43
3.2.3	Steps in Forecasting .....	44
3.3	Techniques of Forecasting .....	45
3.3.1	Survey Method .....	45
3.3.2	Statistical Methods .....	47
3.4	Limitations of Forecasting.....	64
3.5	Criteria for Efficient Forecasting .....	65
3.6	Summary .....	67
3.7	Key Terms .....	67
3.8	Exercise.....	67
	Multiple Choice Questions .....	67
	Short Answer Type Questions .....	70
	Long Answer Type Questions .....	70
<b>Chapter 4:</b>	<b>Product Analysis.....</b>	<b>71</b>
4.1	Introduction.....	72
4.2	Concept of Product and its Characteristics.....	72
4.2.1	Levels of Product .....	72
4.2.2	Product Classification .....	73
4.2.3	Product Differentiation and its Basis .....	75
4.2.4	Product Line Analysis.....	76
4.2.5	Product Mix Analysis.....	77
4.3	Product Selection.....	79
4.4	Product Design .....	80
4.4.1	Factors to be Considered for Product Design.....	80
4.4.2	Design for Manufacture and Assembly (DFMA).....	87

4.4.3	Service Design .....	87
4.4.4	Different Techniques Used for Product Design.....	90
4.5	Concept of Product Development .....	90
4.5.1	Advantages of Product Development .....	91
4.5.2	Process of Developing the Existing Product .....	91
4.5.3	New Product Development Process.....	92
4.6	Summary .....	97
4.7	Key Terms .....	97
4.8	Exercise.....	98
	Multiple Choice Questions .....	98
	Short Answer Type Questions .....	100
	Long Answer Type Questions .....	100
<b>Chapter 5:</b>	<b>Capacity Management .....</b>	<b>101</b>
5.1	Introduction .....	102
5.2	Concept of Capacity .....	102
5.2.1	Short Run Average Costs .....	102
5.2.2	Long Run Average Cost .....	103
5.2.3	Long Run Marginal Cost .....	104
5.2.4	Economies of Scale .....	104
5.2.5	Diseconomies of Scale .....	105
5.3	Concept of Capacity Management.....	106
5.3.1	Determining Capacity Requirements.....	107
5.3.2	Relationship among Design Capacity, System Capacity, and Actual Output .....	107
5.4	Estimation of Equipment Requirements.....	108
5.5	Concept of Capacity Planning .....	110
5.6	Methods for Measuring Capacity .....	111
5.6.1	Linear Programming .....	111
5.6.2	Decision Tree Analysis .....	117
5.7	Summary .....	119
5.8	Key Terms .....	119
5.9	Exercise.....	119
	Multiple Choice Questions .....	119
	Short Answer Type Questions .....	122
	Long Answer Type Questions .....	122
<b>Chapter 6:</b>	<b>Quality Management: Strategic Issues.....</b>	<b>123</b>
6.1	Introduction.....	124
6.2	Quality Management.....	124
6.2.1	Dimensions of Quality.....	124
6.2.2	Evolution of Quality Management.....	126
6.2.3	Fourteen Points of Dr. Edward Deming for Quality .....	126
6.2.4	Importance of Better Quality .....	127

6.3	Total Quality Management .....	128
6.3.1	Importance of TQM .....	129
6.3.2	Barriers to the Implementation of TQM.....	129
6.4	Cost of Quality.....	130
6.4.1	Cost of Prevention .....	130
6.4.2	Cost of Inspection .....	131
6.4.3	Cost of Failure .....	131
6.5	International Organization for Standardization .....	131
6.5.1	Steps in ISO 9000 Registration .....	133
6.5.2	Advantages and Limitations of ISO 9000 Series .....	134
6.6	Summary .....	135
6.7	Key Words.....	136
6.8	Exercise.....	136
	Multiple Choice Questions .....	136
	Short Answer Type Questions .....	138
	Long Answer Type Questions .....	138
<b>Chapter 7: Facility Location and Layout .....</b>		<b>139</b>
7.1	Introduction .....	140
7.2	Concept of Facility Location.....	140
7.2.1	Factors Affecting a Facility Location .....	141
7.2.2	Alfred Weber's Theory of Industrial Location .....	142
7.2.3	Sargent Florence's Theory of Industrial Location .....	143
7.2.4	Influence of Government on Industry Location .....	143
7.3	Current Trends in Industry Location .....	143
7.4	Concept of Plant Layout.....	144
7.4.1	Objectives of an Effective Plant Layout.....	144
7.4.2	Types of Layouts .....	145
7.4.3	Factors Affecting a Plant Layout .....	147
7.4.4	Principles for Selecting a Layout .....	147
7.4.5	Prerequisites for Developing a Plant Layout .....	148
7.4.6	Process of Designing a Layout.....	148
7.4.7	Designing of a Plant Layout through Computers.....	148
7.4.8	Revision of an Existing Layout.....	149
7.5	Summary .....	151
7.6	Key Terms.....	151
7.7	Exercise.....	151
	Multiple Choice Questions .....	151
	Short Answer Type Questions .....	154
	Long Answer Type Questions .....	154

<b>Chapter 8: Productivity</b> .....	<b>155</b>
8.1 Introduction .....	156
8.2 Concept of Productivity .....	156
8.2.1 Factors Affecting Productivity .....	157
8.2.2 Ways to Improve Productivity .....	157
8.3 Concept of Job Analysis .....	158
8.3.1 Methods for Accumulating Job Analysis Data.....	159
8.3.2 Process of Job Analysis.....	162
8.4 Concept of Job Description .....	164
8.4.1 Guidelines for Job Description .....	165
8.4.2 Limitations of Job Description.....	165
8.5 Concept of Job Specification .....	166
8.5.1 Guidelines for Job Specification .....	166
8.5.2 Purpose of Job Specification .....	167
8.6 Concept of Job Design .....	167
8.6.1 Techniques of Job Design.....	167
8.6.2 Purpose of Job Design .....	171
8.7 Concept of Job Evaluation.....	172
8.7.1 Process of Job Evaluation .....	172
8.7.2 Limitations of Job Evaluation.....	174
8.7.3 Job Evaluation and Compensation.....	174
8.7.4 Pre-Requisites for Effective Job Evaluation .....	175
8.8 Work Study.....	175
8.8.1 Objectives of Work Study.....	175
8.8.2 Process of Work Study.....	176
8.8.3 Benefits of Work Study .....	176
8.9 Method Study .....	176
8.9.1 Objectives of Method Study .....	177
8.9.2 Advantages of Method Study .....	177
8.9.3 Process of Method Study .....	177
8.10 Motion Study .....	179
8.10.1 Principles of Motion Study .....	179
8.10.2 Micro-motion Study .....	180
8.10.3 Memo-motion Study .....	181
8.11 Work Measurement.....	181
8.11.1 Benefits of Work Measurement.....	182
8.11.2 Process of Work Measurement .....	182
8.11.3 Techniques of Work Measurement .....	182
8.13 Solved Illustrations .....	187
8.14 Summary .....	191
8.15 Key Terms .....	191
8.16 Exercise .....	191

Multiple Choice Questions ..... 191  
 Short Answer Type Questions ..... 194  
 Long Answer Type Questions ..... 194

**Chapter 9: Aggregate Planning ..... 195**

9.1 Introduction ..... 196  
 9.2 Concept of Aggregate Planning ..... 196  
     9.2.1 Master Production Schedule ..... 197  
     9.2.2 Functions of Master Production Schedule ..... 197  
     9.2.3 Requisites for Aggregate Planning ..... 198  
     9.2.4 Costs of Aggregate Planning ..... 198  
     9.2.5 Aggregate Planning Process ..... 198  
     9.2.6 Strategies of Aggregate Planning ..... 199  
 9.3 Concept of Linear Programming ..... 200  
     9.3.1 Assumptions of Linear Programming ..... 200  
     9.3.2 Advantages and Limitations of Linear Programming ..... 201  
     9.3.3 Formulation of Linear Programming Problems ..... 202  
     9.3.4 Methods to Solve Linear Programming Problems ..... 204  
     9.3.5 Sensitivity Analysis ..... 214  
     9.3.6 Important Applications of Linear Programming ..... 218  
     9.3.7 Refinements and Variations in the Linear Programming Model ..... 219  
 9.4 Transportation Model ..... 219  
     9.4.1 Mathematical Formulation of Transportation Problems ..... 220  
     9.4.2 Procedure for Solving Transportation Problems ..... 222  
 9.5 Summary ..... 225  
 9.6 Key Terms ..... 225  
 9.7 Exercise ..... 225  
     Short Answer Type Questions ..... 228  
     Long Answer Type Questions ..... 228

**Chapter 10: Material Requirement Planning ..... 229**

10.1 Introduction ..... 230  
 10.2 Introduction to Material Requirement Planning ..... 230  
     10.2.1 Concept of Dependent Demand ..... 231  
     10.2.2 Evolution of MRP ..... 231  
     10.2.3 Factors Affecting MRP ..... 231  
     10.2.4 MRP Guidelines ..... 232  
     10.2.5 Advantages and Disadvantages of MRP ..... 232  
 10.3 Inputs of MRP ..... 233  
     10.3.1 Master Production Schedule ..... 233  
 10.4 Lot Sizing ..... 235  
 10.5 MRP Updating ..... 236  
 10.6 Capacity Requirements Planning ..... 236

10.7	Enterprise Resource Planning.....	237
10.8	Summary .....	239
10.9	Key Terms .....	239
10.10	Exercise.....	239
	Multiple Choice Questions .....	239
	Short Answer Type Questions .....	242
	Long Answer Type Questions .....	242
<b>Chapter 11:</b>	<b>Materials Management.....</b>	<b>243</b>
11.1	Introduction.....	244
11.2	Materials Management.....	244
	11.2.1 Objectives of Materials Management.....	244
	11.2.2 Importance of Materials Management.....	245
	11.2.3 Scope of Materials Management.....	245
	11.2.4 Hierarchical Structure of Materials Management.....	246
11.3	Materials Planning and Control .....	246
	11.3.1 Concept of Materials Planning.....	246
	11.3.2 Concept of Materials Budgeting.....	248
	11.3.3 Concept of Materials Control.....	248
11.4	Purchase Management.....	249
	11.4.1 Objectives of Purchasing .....	249
	11.4.2 Functions of a Purchase Department .....	249
	11.4.3 Purchase Organization .....	250
	11.4.4 Purchasing Cycle .....	250
	11.4.5 Value Analysis .....	252
11.5	Stores Management .....	252
	11.5.1 Objectives of Stores Management.....	253
	11.5.2 Functions of Stores Department.....	253
	11.5.3 Stores Location and Layout.....	253
	11.5.4 Types of Stores Layout .....	253
	11.5.5 Measurement of Stores Efficiency .....	254
	11.5.6 Stock Verification .....	254
	11.5.7 Classification and Codification.....	255
11.6	Materials Handling .....	255
	11.6.1 Objectives of Materials Handling.....	255
	11.6.2 Materials Handling Survey.....	256
	11.6.3 Classification of Materials Handling Equipment.....	258
	11.6.4 Selection of Materials Handling Equipment .....	259
11.7	Supply Chain Management.....	259
	11.7.1 Logistics .....	260
	11.7.2 Warehousing.....	261
11.8	Summary .....	263
11.9	Key Terms.....	263

11.10 Exercise..... 263  
     Multiple Choice Questions ..... 263  
     Short Answer Type Questions..... 266  
     Long Answer Type Questions ..... 266

**Chapter 12: Inventory Management..... 267**

12.1 Introduction ..... 268  
 12.2 Concept of Inventory Management..... 268  
     12.2.1 Objectives of Inventory Management ..... 269  
     12.2.2 Different Types of Inventory ..... 269  
     12.2.3 Inventory Costs..... 269  
     12.2.4 Benefits of Inventory..... 270  
     12.2.5 Process of Inventory Management ..... 271  
 12.3 Reorder Point ..... 272  
 12.4 Safety Stock..... 273  
 12.5 Techniques of Inventory Management..... 273  
     12.5.1 Stock Levels ..... 273  
     12.5.2 VED Analysis ..... 275  
     12.5.3 FSD Analysis ..... 276  
     12.5.4 Just in Time (JIT) Inventory Management..... 276  
     12.5.5 Always Better Control (ABC) Analysis ..... 276  
     12.5.6 Economic Order Quantity (EOQ) Model..... 278  
 12.6 Solved Illustrations..... 280  
 12.7 Summary ..... 286  
 12.8 Key Terms ..... 286  
 12.9 Exercise..... 286  
     Multiple choice questions..... 286  
     Short Answer Type Questions..... 288  
     Long Answer Type Questions ..... 288

**Chapter 13: Production Planning and Control ..... 289**

13.1 Introduction ..... 290  
 13.2 Concept of Production Planning..... 290  
 13.3 Production Planning- A Part of Corporate Planning..... 290  
 13.4 Meaning of Production Control ..... 291  
 13.5 Integration between Production Planning and Production Control..... 292  
 13.6 Concept of Production Planning and Control ..... 292  
     13.4.1 Scope of Production Planning and Control..... 293  
     13.4.2 Significance of Production Planning and Control..... 294  
     13.4.3 Limitations of Production Planning and Control ..... 295  
     13.4.4 Process of Production Planning and Control..... 295



13.5	Concept of Line of Balance.....	298
13.5.1	Steps Involved in LOB Technique .....	298
13.5.2	Benefits of LOB Technique in Production .....	300
13.6	Summary .....	303
13.7	Key Terms .....	303
13.8	Exercise.....	303
	Multiple Choice Questions .....	303
	Short Answer Type Questions .....	305
	Long Answer Type Questions .....	306
<b>Chapter 14:</b>	<b>Production Scheduling.....</b>	<b>307</b>
14.1	Introduction .....	308
14.2	Overview of Production Scheduling .....	308
14.3	Concept of Loading .....	309
14.3.1	Types of Loading.....	309
14.3.2	Charts Used in Loading.....	310
14.3.3	Assignment Problems in Loading .....	312
14.4	Sequencing.....	324
14.4.1	Rules of Priority.....	325
14.4.2	Sequencing ‘n’ Jobs on One Machine .....	326
14.4.3	Sequencing ‘n’ Jobs on Two Machines .....	329
14.4.4	Sequencing ‘n’ Jobs on Three Machines .....	330
14.5	Project Scheduling .....	333
14.5.1	Developing a Project Network.....	333
14.5.2	Estimation of Time.....	336
14.5.3	Project Network Analysis.....	338
14.6	Summary .....	345
14.7	Key Terms .....	345
14.8	Exercise.....	346
	Multiple Choice Questions .....	346
	Short Answer Type Questions .....	348
	Long Answer Type Questions .....	348
<b>Chapter 15:</b>	<b>Quality Control .....</b>	<b>349</b>
15.1	Introduction .....	350
15.2	Concept of Quality Control.....	350
15.2.1	Functions of Quality Control.....	351
15.2.2	Significance of Quality Control .....	351
15.2.3	Process of Quality Control .....	352
15.2.4	Scope of Quality Control.....	353
15.3	Statistical Quality Control .....	353
15.4	Tools of Descriptive Statistics .....	354

15.5	Tools of Statistical Process Control.....	356
15.5.1	Control Charts for Variables.....	356
15.5.2	Control Charts for Attributes .....	360
15.6	Tools for Acceptance Sampling.....	362
15.6.1	Types of Sampling Plans .....	362
15.6.2	Operating Characteristic Curve .....	363
15.7	Six Sigma.....	363
15.7.1	Benefits of Six Sigma.....	364
15.7.2	Principles of Six Sigma.....	364
15.7.3	DMAIC Framework-A Six Sigma Methodology .....	364
15.8	Process Capability.....	365
15.9	Quality Circles.....	367
15.9.1	Objectives of Quality Circles.....	367
15.9.2	Structure of Quality Circles.....	367
15.10	Summary.....	369
15.11	Key Terms.....	369
15.12	Exercise .....	370
	Multiple Choice Questions .....	370
	Short Answer Type Questions.....	372
	Long Answer Type Questions .....	372
<b>Chapter 16:</b>	<b>Maintenance Management .....</b>	<b>373</b>
16.1	Introduction.....	374
16.2	Concept of Maintenance Management.....	374
16.2.1	Objectives of Maintenance Management.....	374
16.2.2	Types of Maintenance .....	375
16.3	Replacement of Equipment.....	377
16.3.1	Factors Responsible for Replacement .....	377
16.3.2	Replacement Analysis.....	378
16.3.3	Systematic Equipment Replacement Program.....	380
16.3.4	Advantages of Systematic Equipment Replacement Program .....	381
16.4	Concept of Reliability.....	381
16.4.1	Reliability Engineering.....	381
16.4.2	Maintenance and Reliability .....	382
16.5	Maintenance Management System .....	383
16.5.1	Benefits of Maintenance Management System.....	383
16.5.2	Procedures for Maintenance Management System Design .....	383
16.6	Total Productive Maintenance .....	384
16.6.1	Evolution of Total Productive Maintenance .....	384
16.6.2	Objectives of Total Productive Maintenance .....	384
16.6.3	Impact of Total Productive Maintenance .....	385
16.6.4	Overall Equipment Efficiency .....	386
16.6.5	Pillars of Total Productive Maintenance .....	386

16.7	Summary .....	389
16.8	Key Terms .....	389
16.9	Exercise .....	389
	Multiple Choice Questions .....	389
	Short Answer Type Questions .....	392
	Long Answer Type Questions .....	392
<b>Chapter 17:</b>	<b>Just-in-Time System .....</b>	<b>393</b>
17.1	Introduction .....	394
17.2	Concept of Just-in-Time .....	394
	17.2.1 Objectives of JIT .....	395
	17.2.2 Characteristics of JIT .....	395
	17.2.3 Little JIT and Big JIT .....	396
17.3	Elements of JIT .....	396
17.4	Ideal Production System and JIT Production .....	397
17.5	Benefits of JIT .....	398
	17.5.1 Improved Organizational Efficiency .....	399
	17.5.2 On-Time Delivery of Materials .....	399
	17.5.3 Reduced Machine Breakdowns .....	400
	17.5.4 Improved Quality .....	400
	17.5.5 Reduced Costs .....	400
	17.5.6 High Employee Morale .....	400
17.6	Tools and Techniques of JIT .....	401
	17.6.1 Kanban .....	401
	17.6.2 SMED .....	402
17.7	Implementation of JIT .....	403
17.8	JIT in Service Sector .....	404
17.9	Synchronous Production and JIT .....	405
17.10	DBR Mechanism .....	405
17.11	Summary .....	407
17.12	Key Terms .....	407
17.13	Exercise .....	408
	Multiple Choice Questions .....	408
	Short Answer Type Questions .....	410
	Long Answer Type Questions .....	410
<b>Chapter 18:</b>	<b>Change Management .....</b>	<b>411</b>
18.1	Introduction .....	412
18.2	Concept of Change .....	412
18.3	Factors Responsible for Change in Production Environment .....	413
18.4	Interventions for Change Management in Production Environment .....	415
18.5	Challenges in Change Management .....	415
18.6	Operational Change Management .....	416

18.7 Business Process Re-engineering in Change Management..... 417

    18.7.1 Principles of Re-engineering..... 418

    18.7.2 Implementation of BPR Project ..... 418

    18.7.3 Rapid Completion of BPR Project ..... 419

18.8 Summary ..... 421

18.9 Key Terms ..... 421

18.10 Exercise ..... 421

    Multiple Choice Questions ..... 421

    Short Answer Type Questions ..... 424

    Long Answer Type Questions ..... 424

**Case Studies ..... 429**

Case Study-1: Product Design in ABC Motors ..... 429

Case Study-2: Inventory Management by PPL Ltd. .... 430

Case Study-3: Strategic Analysis of Tata Group ..... 432

Case Study-4: Assignment Problem at Sky Travels Pvt. Ltd..... 434

Case Study-5: Materials Management at CCG Biotech ..... 436

Case Study-6: Operations Strategy of Airline Industry ..... 437

Case Study-7: Service Delivery Strategy of PepsiCo ..... 438

Case Study-8: Role of ERP in Inventory Management System-A Case of Boeing ..... 439

Case Study-9: Supply Chain Management at Walmart ..... 440

Case Study-10: Just in Time at McDonalds ..... 441

**Additional Questions..... 442**

**Glossary..... 449**

**Index ..... 453**

**Online Resource Available with the Book ..... 456**