

<b>Chapter</b>	<b>Contents</b>	<b>Page No</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.0. Introduction	1
	1.1. What is Work Study and Ergonomics	2
	1.2. Ergonomics	4
	1.3. Effect & Significance of Work-Study on Enterprises	4
<b>2</b>	<b>METHOD STUDY</b>	<b>8</b>
	2.0. Purpose of Work-Study	8
	2.1. Basic Approach for Work-Study	9
	2.2. Method Study	11
	2.3. Charting Technique Applied in Method Study	13
	2.4. Therbligs	28
	2.5. Cycle Graph and Chro-Nocycle Graph	32
	2.6. Chronocycle Graph	33
	2.7. Micro-Motion & Memo-Motion Study	34
	2.8. Critical Examination	35
	2.9. Principle of Motion Economy	37
<b>3</b>	<b>WORK MEASUREMENTS</b>	<b>43</b>
	3.0. Work-Measurement	43
	3.1. Purpose of Work- Measurement	44
	3.2. Procedure of Work Measurement	45
	3.3. Rating	50
	3.4. Allowances	52
	3.5. Special Type of Allowance	55
	3.6. No of Cycle to be Timed	56
	3.7. The Standard Time	57
	3.8. Selection of Jobs	58
	3.9. Breaking a Job Into Elements	59
	3.10. Work Sampling	60
	3.11. Theory of Sampling	62
	3.12. Requirement of Work Sampling Process	63
	3.13. Standard Time / Piece Calculation from Work Sampling Technique	66

<b>4</b>	<b>INCENTIVE SCHEME</b>	<b>73</b>
	4.0. Incentive Scheme	73
	4.1. Wages / Incentives Plans	75
	4.2. Method Time Measurement (MTM)	80
	4.3. Work Factor System	83
	4.4. Standard Data System	86
<b>5</b>	<b>HUMAN FACTORS ENGINEERING</b>	<b>89</b>
	5.0. History of Human Factor Engineering	89
	5.1. Effect of Ergonomics in the Workplace	92
	5.2. Sitting Posture for Operator	92
	5.3. Ergonomics	95
	5.4. Man-Machine-System	98
	5.5. Classification of Man – Machine System :- Man Machine	100
	System May be Classified as Given Below	
	5.6. Goals of Man Machine System	103
	5.7. Important Aspect of Man Machine System	105
	5.8. Human Tasks with Automation and Control	106
	5.9. Control Devices	108
	5.10. Position of Work Station	109
	5.11. Sitting and Chair Design: Followings are Some Basic	111
	Highlights Regarding the Sitting Work	
	5.12. Standing Work Station	111
	5.13. Information & Communication Ergonomics	112
	5.14. Human Information Processing	113
	5.15. Sensory Input Devices	116
	5.16. Signal Conditioning Operations	124
	5.17. Information Reception and Processing	126
	5.18. Factors Affecting the Information Reception and	127
	Processing	
<b>6</b>	<b>ANTHROPOMETRY</b>	<b>134</b>
	6.0. Anthropometry	134
	6.1. Systems of Variables	135
	6.2. Anthropometric Principles in Work-Space and	137
	Equipments Design: - Following Principle Leads to	
	Anthropometry	

	6.3. Display Systems	138
	6.4. Safety Signs and Colour Code at Work-Place	144
	6.5. Factorial and Graphic Display	145
	6.6. Guiding Principles	153
	6.7. Basic Characteristics of Display System	155
<b>7</b>	<b>WORKING CONDITION</b>	<b>160</b>
	7.0. Working Condition	160
	7.1. Cleanliness	161
	7.2. Availability of Drinking Water	161
	7.3. House Keeping	162
	7.4. Lighting Facility in Work-Place	165
	7.5. Ventilation, Heating and Cooling	166
	7.6. Noise	168
	7.7. Working Space and Seating	169
	7.8. Accidental Prevention at Work-Place	170
	7.9. Fire Prevention	172
<b>8</b>	<b>PLANT LAYOUT</b>	<b>177</b>
	8.0. Introduction	177
	8.1. Objective of Plant Layout	178
	8.2. Advantage of Good Plant Layout	178
	8.3. Classification of Layout	179
	8.4. Introduction of Effective Production Control	184
	8.5. Material Handling Technique used in Manufacturing Industries	186
	8.6. Principle of Material Handling System	187
	8.7. The Purpose of Material Handling	192
	8.8. Type of Material-Handling Equipment	193
	8.9. Deciding Factor for Selection of Material-Handling Equipment	202
	8.10. Importance of Material Handling	203
	8.11. Site Selection	204
<b>9</b>	<b>QUALITY &amp; RELIABILITY</b>	<b>214</b>
	9.0. Introduction	214
	9.1. Quality Control	215

	9.2. Fifteen Quality Improvement Tools	218
	9.3. Customer Orientation	221
	9.4. Customer Orientation and Global Corporate Strategy	224
	9.5. External & Internal Customer	226
	9.6. Life Cycle Approach to Quality Costs – Prevention	227
	9.7. Quality Philosophies	229
	9.8. Quality Control Tools	232
	9.9. Process Capability Concepts	239
	9.10. Process Capability Indices (PCIs)	243
	9.11. Process Capability Index Cpk	244
	9.12. Process Capability Index CPM	245
	9.13. Introduction	246
	9.14. Bath Tub Curve	248
	9.15. Design for Reliability	249
	9.16. Availability & Maintainability	250
	9.17. Redundancy	251
	9.18. Types of System Reliability Models	252
<b>10</b>	<b>INVENTORY MANAGEMENT</b>	261
	10.0. Introduction	261
	10.1. Inventory Costs	262
	10.2. Principles of Inventory Management	264
	10.3. Inventory Model	267
	10.4. Inventory Control System	269
	10.5. Material Requirement Planning (MRP)	272
	10.6. An Outline of the MRP Process	273
<b>11</b>	<b>PERT/CPM</b>	280
	11.0. Introduction	280
	11.1. Difference between PERT and CPM	284
	11.2. PERT for Project Planning and Scheduling	285
	11.3. Project Scheduling by Critical Path Method (CPM)	289
	11.4. Scheduling	292
	11.5. Principle of Scheduling	295
	11.6. Factors Affecting Scheduling	296
	11.7. The General Scheduling Problem	300

	11.8. Job Shop Scheduling	302
	11.9. Sequencing Jobs for One Workstation	305
	11.10. Scheduling Jobs for Multiple Workstations	306
	11.11. Line Balancing	307
<b>12</b>	<b>PRODUCTION PLANNING AND CONTROL</b>	<b>313</b>
	12.0. Introduction	313
	12.1. Classification of Production System	315
	12.2. Factor Affecting Production Planning and Control	320
	12.3. Manufacturing Systems	321
	12.4. Flexible Manufacturing System Layout	324
	12.5. Flexibility Concept	329
	12.6. Lean Manufacturing or Lean Production	330
	12.7. Lean Manufacturing Tools and Techniques	332
	12.8. Total Productive Maintenance	337
	12.9. The 5 S's of Lean	339
	12.10. The Five Steps of Lean Implementation	341
	12.11. Principle of Lean Manufacturing	341
	12.12. Agile Manufacturing System	345
<b>13</b>	<b>PRODUCT DESIGN AND DEVELOPMENT</b>	<b>353</b>
	13.0. Product Design and Development	353
	13.1. Common Stage & Common Features of Good Product Design	353
	13.2. Product Function	354
	13.3. New Product Design Process	355
	13.4. Process Design and Analysis	357
	13.5. Product Design Concept Development	358
	13.6. Economics of a New Design	362
	13.7. Product Cost Analyses	363
	13.8. The Product Life Cycle	367
	13.9. Profit and Competitiveness	369
	13.10. Break-Even Analysis	371
<b>14</b>	<b>CAPACITY PLANNING &amp; FORECASTING</b>	<b>379</b>
	14.0. Introduction	379
	14.1. Measurement of Capacity Planning	379

14.2.	Process of Capacity Planning	380
14.3.	Approach for Capacity Decisions	382
14.4.	Capacity Planning Technique	384
14.5.	Aggregate Planning	385
14.6.	Demand Forecasting	386
14.7.	Demand Patterns	389
14.8.	Principle of Forecasting	396
14.9.	Nature of Fore-Casts	397
14.10.	Forecasting Methods	398
14.11.	Casual Forecasting	406
14.12.	Objectives of Demand Forecasting	409
14.13.	Selection of Forecasting Technique	410
<b>15</b>	<b>OPERATIONS RESEARCH</b>	<b>425</b>
15.0.	Introduction	425
15.1.	Contribution of Operation Research in Manufacturing Production	428
15.2.	Definition of Operation Research	429
15.3.	Important Aspect of Operation Research	431
15.4.	Important Steps in Operation Research	432
15.5.	Applications of Operations Research	433
15.6.	Introduction to Linear Programming	435
15.7.	Transportation Problem	440
15.8.	Vogel's Approximation Method (VAM)	442