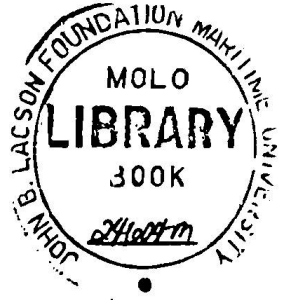


Introduction to
**Engineering
Technology:**
World Edition

2nd
Edition



3G E-LEARNING



Introduction to Engineering Technology: World Edition

2nd Edition



3G E-LEARNING

TABLE OF CONTENTS

Preface	xi
CHAPTER 1 THE INDUSTRIAL REVOLUTION	1
Introduction	2
History of the Industrial Revolution	2
Meaning of Industrial Revolution	4
Why it is beginning in England?	6
Industrial Development in England	15
Industrial Development in Belgium	16
Industrial Development in France	17
Industrial Development in Germany	19
Industrial Development in Italy	22
The Austrian Empire	22
Russia	22
The Industrial Expansion after 1870	24
Results of the Industrial Revolution: Economic Effects	31
Trade Union: Labor Organization	39
Historical Development	40
Legal Precedents	41
Modern Developments	41
Employers Organizations	42
The Engineering Industry	45
Primary Needs and Engineering Industry	46
Light Engineering Industry: Meaning and Definition	47
Engineering Industry under Plans	49
Classification of Engineering Industries	51
Structure of a Company	52
Personnel in a Company	56
Education And Training	59
Target Audiences	61
Why Training and Education?	62
Scope and Objectives of Training and Education	64

Technological and Demographic Change	66
Training Venues and Providers	68
Conclusion	70
CHAPTER 2 SYSTEM OF MEASUREMENT	75
Introduction	76
Overview of Measurement Systems	76
Early Units and Standards	77
The English and United States Customary Systems of Weights and Measures	83
The Metric System of Measurement	90
Widely Used Units in the SI System	95
Prefixes and Units Used In the Metric System	97
Metric Conversions	99
Dimensional Measurement: Production Control and Reverse Engineering	101
Types of Dimensional Measurement Tools	104
Use of Precision Measuring Instruments	107
Dimensional Control	111
Conclusion	117
CHAPTER 3 OBSERVING SAFE PRACTICES	123
Introduction	124
Overview Of Health And Safety Legislation	124
The Health and Safety at Work, etc. Act 1974	126
The Management of Health and Safety at Work Regulations 1999	127
The Workplace, (Health, Safety and Welfare) Regulations 1992	128
The Manual Handling Operations Regulations 1992	128
The Control of Asbestos at Work Regulations 2012	129
The Health and Safety (Display Screen Equipment) Regulations 1992	130
The Electricity at Work Regulations 1989	130
The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995	130
The Control of Substances Hazardous to Health Regulations 2002	131
The Provision and Use of Work Equipment Regulations 1998	132
The Construction (Design and Management) Regulations 2007	132
The Equality Act 2010	133
Health and Safety (First Aid) Regulations 1981	133
The Regulatory Reform (Fire Safety) Order 2005	134
Employers' Duties, Responsibilities and Workplace Problems	134
Accidents — Causes and Prevention	139
Principles of Accident Prevention	140
Safe Working Practices	143

Personal Safety	144
Managing Safety	147
Causation Theories	147
Causes of Accidents	151
Electrical Hazards: Legislation And Regulations	154
Electrical Hazards: General Safety Rules	155
Procedure in Case of Electric Shock	158
Artificial Respiration	166
Fire Prevention and Control	168
Fire-Fighting Equipment	171

CHAPTER 4 MOVEMENT OF LOADS 177

Introduction	178
Overview Of Loads and Safety	178
Safety Tips When Working Around Suspended Loads	181
Safety Measures While Securing Loads	182
Risk Factors Associated with Pushing and Pulling Loads	185
Manual Handling of Loads	188
Lifting Operations And Lifting Equipment	191
Definitions of Lifting Operations and Lifting Equipment	191
Risks associated with Lifting Operations	194
Ensuring Safe and Healthy Lifting Operations	199
General Safety Rules	208
Knot Selection and Care	210
Conclusion	221

CHAPTER 5 WORKHOLDING AND TOOLHOLDING 225

Introduction	226
The Need For Workholding: Location And Restraint	227
Basic Concepts of Workholding	228
Safety Precautions of Shaping Machine	241
Advantages of Workholding	243
Workholding Applications	244
Principle of the Workholder	245
History of Vises	246
Design and Operation Considerations	247
Planning the Workholding – Products and Accessories	248
Selection – Workholding for Simple Machines Such as Knee-Type Mills	249
Selection –Workholding for Complex Machines Such as Horizontal and Vertical Machining Centers	249
Considerations in Selecting the Best Available Vise Clamping and Setup Solution	250
Workstop Systems	254

Helpful Accessories make the Clamping Job Easier	254
Custom Fixturing – When and How Used	255
Future for Workholding	256
Toolholding Applications	256
Toolholders for Manually Controlled Machine Tools	258
Toolholders for CNC Applications	267
Conclusion	276

CHAPTER 6 PERCEPTIONS OF ENGINEERING DRAWING 281

Introduction	282
Basic Engineering Drawing - Drawing Instruments	283
Importance of Engineering Drawing	284
Objective, Significance and Utility of Engineering Drawing	286
Instruments Used in Engineering Drawing	288
Geometrical Drawing	297
Geometric Nomenclature	298
Using Classical Geometric Construction Techniques	300
Orthographic Projection	303
History of Orthographic Projection	305
Fundamentals of Orthographic Views	306
Isometric Drawing	311
Examples in Isometric Projections	312

CHAPTER 7 JOINING 323

Introduction	324
The Range of Joints	324
Riveted Joints	325
Riveted Joints Types	329
Failure of Riveted Joint	332
Advantages of Riveted Joint	335
Compression Joints	336
Mechanical	336
Thermal	336
Soft Soldered Joints	339
Hard Soldered Joints	341
Silver Soldering	343
Brazing	343
Fusion Welded Joints	343
Adhesive Bonded Joints	346
Thermoplastic Adhesives	350
Thermosetting Adhesives	351

Screwed Fastenings	351
Material Selection	353
Screw Thread System	353
Choice of Head	355
Washers	356
Locking Devices	356
Pins, Cotters And Keys	357
Dowels	357
Taper pins	358
Cotter pins	358
Cotter	358
Split pin	358
Circlips	358
Keys	359
Conclusion	360
INDEX	365

INDEX

A

Accountant 59
Accounting and Finance 52
Accuracy 283, 288, 294, 298
adhesive bonding 324, 346, 348, 350, 363
American Federation of Labor (AFL) 41
Anchor system 212

B

Bare surface 228
bonding material 346
brazing 337, 341, 343, 360
butt joint 328, 330, 331, 334, 363

C

Capital equipment 45
Central Planning Organization 45
chain lap joint 331
Charge-coupled device (CCD) 107
Chief Executive Officer (CEO) 57
Chief Financial Officer (CFO) 57
Chief Operating Officer (COO) 57
Circuit breaker 160
Circular scale 109
Cold shrunk joint 338
Commission for Conciliation, Mediation and Arbitration (CCMA) 44

Compression joints 336, 360
Computer numerical control (CNC) 246
Control of Substances Hazardous to Health 131
Coordinate Measuring Machines (CMMs) 131
CPR (cardiopulmonary resuscitation) 168

D

Data acquisition process 106
Dead load 178
Degrees of freedom 236
Design and Management 125, 132
Diameter 105, 108, 109, 111, 112, 114
Dimension 82, 105, 106, 108, 114
Dimensional measurement 101, 117
Display Screen Equipment 125, 130, 132
Display screen equipment (DSE) 130
Domino effect theory 148
double row double strap butt joint 332
double row lap joint 331
Drawing 283
Drawing surface 298

E

Economic equality 40
Electrical Safety 155
Electrical Safety Authority (ESA) 155
Electric current 76, 96
Employment 16, 19, 33, 35, 42, 49

Engineering drawing 283, 287, 321
 Engineering industry 45, 46, 70

F

Fire-extinguishing 170
 Fire Safety 125, 134
 First Aid 125, 133
 flexible joints 324, 360
 Frictional restraint 226, 276
 Fusion welding 343

G

General Conference on Weights and Measures 93
 General Safety Rules 208, 209
 GEOMETRICAL DRAWING 297
 Geometric construction 298, 300
 Geometric design (GD) 297

H

Handwork 227
 hard soldered joint 342
 Hazardous manual handling 189
 Health and Safety 125, 126, 127, 130, 133, 134, 140, 143, 145, 153, 155
 Health and Safety Executive (HSE) 130
 High speed machining (HSM) 271
 hot shrunk joint 337
 Human Resource 52, 56

I

Immigrant 67
 Industrialization 22, 23, 24, 28, 29, 32, 37, 45
 Industrial Revolution 2, 3, 4, 5, 6, 8, 9, 13, 14, 16, 23, 24, 28, 31, 32, 33, 35, 36, 37, 38, 70, 74
 International System of Units (SI) 77, 90, 96, 117

L

Labor Court 44
 Labor Force Survey (LFS) 189
 Language 67
 Lap joint 330
 Laser based instrumentation 116

Laser beam 111, 113, 114, 116
 Legislation 123, 125, 126, 133, 134, 140, 154, 155, 175
 Lifting equipment 177, 184, 191, 192, 193, 194, 195, 198, 199, 200, 201, 203, 204, 205, 206, 207, 208, 221, 223
 Luminosity 76

M

Machine 230, 231, 232, 233, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 253, 254, 255, 256, 257, 258, 260, 261, 263, 264, 265, 266, 267, 268, 269, 273, 274, 275, 276, 277, 280
 Machinery 4, 5, 12, 13, 14, 16, 17, 21, 28, 29, 34, 45, 46, 47, 49, 50, 51, 66
 Management of Health and Safety at Work Regulations 1999 (MHSWR) 140
 Manual Handling Operations Regulations 1992 (MHOR) 189
 Manufacturing 228, 230, 233, 234, 235, 241, 243, 244, 270, 280
 Mass production 3, 31
 Mass Production 231
 Material Safety Data Sheet 275
 Measurement system 76
 Mechanization 178, 189
 Metal shop 230
 Metric system 83, 88, 89, 90, 91, 92, 93, 97, 99, 117, 120
 Michelson interferometer 116
 Micrometer 96, 108, 109, 113, 116
 Milling 228, 229, 230, 231, 232, 233, 245, 258, 264, 265, 266, 267, 269, 276, 277
 Mobile elevating work platform (MEWP) 194
 Musculoskeletal disorders (MSDs) 189

N

National Labor Union (NLU) 41
 Non-square stock 229

O

Object geometry 106
 Occupational Health 61, 64



Office furniture 137
 Office manager 59
 Optical element 116
 Organizational structure 52, 53, 58
 Orthographic Projection 304, 305

P

Performance quality 212
 permanent joints 324, 326, 344, 346, 360
 Personal protective equipment (PPE) 145
 Photodiode 114, 115, 116
 Physical science 89
 Poor ventilation 199
 Population 3, 19, 20, 23, 24, 38, 68, 69
 Printing nozzle 229

R

Research and Development (R&D) 52
 Rigidity 237, 245, 258, 264, 272, 273
 Rivet 325, 326
 riveted joint 325, 329, 332, 335, 364

S

Safe working load (SWL) 196
 Screwed fastenings 351, 352, 354, 356
 screw thread systems 353
 silver soldering 341, 360
 single row double strap butt joint 332
 single row lap joint 331
 single row single strap butt joint 332
 Social justice 40
 Society 2, 4, 5, 17, 23, 46
 soft soldered joint 341

Soldering 339, 343, 360, 364
 Statutory council 44
 Steam engine 3, 11, 12, 22, 26, 27, 38
 Straight line 298, 299, 300
 strap 331, 332
 Strength 184, 198, 212
 Stress 180, 189, 212
 Strict interpretation 298
 Surface strain 116
 System of measurement 90, 117, 120

T

Technical drawing 285, 298
 temporary joints 324, 351, 357, 360
 thermoplastic adhesives 351
 Thermoplastic adhesives 350
 Tombstone 231, 232, 248, 252, 253
 Tool holder 256, 257, 277
 Turning 228, 248, 258, 263, 266, 269, 270, 276, 280

U

Unit of length 79, 80, 82

V

Ventilation 128, 135, 137, 141, 142, 167
 Visual display units (VDUs) 67, 137

W

Woodworker's shop 227
 Work equipment 191
 Workforce 42, 67
 Workholding 226, 227, 228, 230, 231, 232, 233, 243,
 244, 248, 249, 250, 256, 276
 Workholding technology 244

Z

zig-zag lap joint 331