

---

# Contents

<b>1 Science and Technology: Definitions and Terminologies</b> . . . . .	1
1.1 Need to Know . . . . .	2
1.2 Perspectives on Knowledge, Information, Data . . . . .	2
1.2.1 Description of Knowledge . . . . .	2
1.2.2 Information Technology (IT) . . . . .	3
1.2.3 Knowledge Management . . . . .	4
1.2.4 Wisdom . . . . .	4
1.2.5 Knowledge in Organizations . . . . .	6
1.3 Descriptions of Science and Technology . . . . .	7
1.3.1 Science . . . . .	8
1.3.2 Science and Ignorance . . . . .	8
1.3.3 Etymology of Technology . . . . .	9
1.3.4 Distinction Between Science and Technology . . . . .	9
1.4 Education as a Means of Gaining Knowledge . . . . .	10
1.4.1 Technology Education and Educational Technology . . . . .	10
1.4.2 Broad Classification of Knowledge Level . . . . .	10
1.4.3 Effects on Society . . . . .	11
1.5 Science and Ethics . . . . .	12
1.6 Recapitulation . . . . .	12
1.6.1 Summary . . . . .	12
1.6.2 Review Questions . . . . .	13
References . . . . .	13
<b>2 Foundations of Science</b> . . . . .	15
2.1 Creator and Creation . . . . .	16
2.1.1 Who Is the Human Being? . . . . .	16
2.1.2 Life and the Responsibility . . . . .	17
2.2 Fundamental Sciences . . . . .	18
2.2.1 Definitive (Explicit) Sciences . . . . .	19
2.2.2 Probable (Implicit) Sciences . . . . .	20

2.3	Humanitarian Needs . . . . .	25
2.3.1	Humanity; Senses and Emotions . . . . .	25
2.3.2	Satisfaction of Feelings . . . . .	26
2.3.3	Three Types of Manner . . . . .	27
2.3.4	Rules of Interactions . . . . .	28
2.4	Characterization of Education . . . . .	29
2.4.1	Purpose of Education. . . . .	29
2.4.2	Role of Wisdom . . . . .	30
2.4.3	Main Streams of Education . . . . .	30
2.4.4	Need for a Trainer. . . . .	31
2.5	Scholastic (Educational) Status . . . . .	32
2.5.1	Bloom's Taxonomy and Levels of Learning . . . . .	32
2.5.2	Affective Domain (Attitudes)—Degrees of Internalization. . . . .	34
2.5.3	Cognitive Domain (Mental)—Levels of Learning . . . . .	35
2.5.4	Psychomotor Domain (Levels of Physical Skills). . . . .	37
2.6	Wisdom and Intelligence . . . . .	40
2.6.1	Eight Ways of Knowing . . . . .	40
2.6.2	Intelligence and Inherited Wealth . . . . .	41
2.7	Recapitulation . . . . .	42
2.7.1	Summary of Foundations of Science . . . . .	42
2.7.2	Review Questions . . . . .	43
	References . . . . .	44
<b>3</b>	<b>Ways of Acquiring Scientific Knowledge . . . . .</b>	<b>47</b>
3.1	Educational Phenomena . . . . .	48
3.1.1	Stages of Education. . . . .	48
3.1.2	Education for New Knowledge . . . . .	49
3.1.3	Attaining Knowledge. . . . .	50
3.1.4	Design and Research: Two Distinct Scientific Activities . . . . .	51
3.2	Characteristics of Design . . . . .	51
3.2.1	Realms in Problem-Solving . . . . .	53
3.2.2	Defining the Design Problem . . . . .	53
3.2.3	A Simplified Flow Practice for Design. . . . .	54
3.2.4	Fundamental Elements of Design Process. . . . .	55
3.2.5	Diagnosing a Disease as a Design Example . . . . .	56
3.3	Research: What? . . . . .	57
3.3.1	Purpose of Research . . . . .	57
3.3.2	What a Researcher Needs? . . . . .	59
3.3.3	Qualities of a Good Researcher. . . . .	60
3.3.4	Types of Research. . . . .	61

3.4	Research Process . . . . .	62
3.4.1	Fundamental Aspects . . . . .	62
3.4.2	Background Search . . . . .	67
3.4.3	The Observational Method . . . . .	73
3.4.4	Review and Revise the Problem . . . . .	74
3.5	Recapitulation . . . . .	74
3.5.1	Summary of Ways of Acquiring Scientific Knowledge . . . . .	74
3.5.2	Review Questions . . . . .	75
	References . . . . .	78
<b>4</b>	<b>Vital Essentials of Technical Exertions . . . . .</b>	<b>79</b>
4.1	Paying Attention to Time . . . . .	80
4.1.1	Mind the Time . . . . .	80
4.1.2	Work and Tawakkul (Trust in God) . . . . .	82
4.1.3	Fundamentals of Time Management . . . . .	82
4.1.4	Basic Tasks and Needs . . . . .	84
4.1.5	Methods to Use Your Business Hours Effectively . . . . .	86
4.2	Project Teams . . . . .	87
4.2.1	Necessity of Working as a Team . . . . .	87
4.2.2	Team Setting . . . . .	89
4.3	Team Meetings . . . . .	92
4.3.1	Meeting Minutes . . . . .	94
4.4	Project Management . . . . .	96
4.4.1	Decision Analysis . . . . .	96
4.4.2	Activity Network . . . . .	97
4.4.3	Timing Diagrams (Gantt Charts) . . . . .	99
4.4.4	Program Evaluation . . . . .	101
4.4.5	The Design/Research Notebook . . . . .	102
4.5	Recapitulation . . . . .	102
4.5.1	Summary of Vital Essentials of Technical Exertions . . . . .	102
4.5.2	Review Questions . . . . .	103
	References . . . . .	104
<b>5</b>	<b>Description and Historical Perspectives of Technology . . . . .</b>	<b>105</b>
5.1	What Is Technology? . . . . .	106
5.1.1	Science Versus Technology . . . . .	106
5.1.2	Goal of Science and Goal of Technology . . . . .	107
5.2	Working Definitions of Technology . . . . .	108
5.2.1	Important Terms for Technology . . . . .	108
5.2.2	Seven Principles of Technology Development . . . . .	108
5.2.3	Three Prevalent Misconceptions . . . . .	109

5.3	History of Technology Considerations . . . . .	110
5.3.1	Tools and Technological Innovations . . . . .	110
5.3.2	General Considerations on Impact of Technological Developments . . . . .	111
5.3.3	Social Involvement in Technological Awareness . . . . .	111
5.4	Brief History of Technology . . . . .	112
5.4.1	Chronological Outlook . . . . .	112
5.4.2	The Prehistoric Era . . . . .	113
5.4.3	Old Ages . . . . .	118
5.4.4	Middle Ages . . . . .	122
5.4.5	Industrial Age . . . . .	128
5.4.6	Information Age (IA) . . . . .	131
5.5	Recapitulation . . . . .	132
5.5.1	Summary of Description and Historical Perspectives of Technology . . . . .	132
5.5.2	Review Questions . . . . .	133
	References . . . . .	134
<b>6</b>	<b>Contribution of Muslim Scholars to Science and Technology . . . . .</b>	<b>137</b>
6.1	Role of Islam as a Universal Religion . . . . .	138
6.1.1	Science in the Context of Islamic Civilization . . . . .	139
6.1.2	Domains of Thought and Culture in the High Caliphate . . . . .	139
6.2	Medieval Islamic Science . . . . .	140
6.2.1	Brief History of the Early Islamic Era . . . . .	140
6.2.2	House of Wisdom . . . . .	141
6.2.3	Original Contributions from the House of Wisdom . . . . .	143
6.2.4	A Brief History of Muslim Spain . . . . .	144
6.3	Muslim Contributions to Science and Technology . . . . .	147
6.3.1	Notable Fields of Inquiry . . . . .	148
6.3.2	Notable Scientists . . . . .	148
6.3.3	Mathematics . . . . .	159
6.3.4	Astronomy . . . . .	160
6.3.5	Chemistry and Medicine . . . . .	162
6.3.6	Agricultural and Industrial Developments . . . . .	165
6.3.7	Conclusive Remarks . . . . .	166
6.4	Prevalent Muslim Sages . . . . .	166
6.4.1	Ibn Al-Haytham (Alhazen) and Optics . . . . .	166
6.4.2	Ibn Sina (Avicenna) . . . . .	168
6.4.3	Abū Rayḥān Al-Bīrūnī . . . . .	169
6.4.4	Al-Jazari . . . . .	170
6.5	Scientific Life in Seljuk's and Ottomans . . . . .	173
6.5.1	Anatolian Seljuk's . . . . .	173
6.5.2	Ottomans . . . . .	176

6.6	Recapitulation . . . . .	181
6.6.1	Summary of Contributions of Muslim Scholars to Science and Technology. . . . .	181
6.6.2	Review Questions . . . . .	182
	References . . . . .	183
<b>7</b>	<b>Brief History of Western Modernization . . . . .</b>	<b>185</b>
7.1	After Fall of Roman Empire . . . . .	186
7.1.1	Feudalism, Manorialism and Crusades . . . . .	186
7.1.2	Late Middle Ages . . . . .	187
7.1.3	The Renaissance . . . . .	187
7.2	European Expansion . . . . .	188
7.2.1	Agricultural Advancements. . . . .	188
7.2.2	Overseas Expeditions and Slave Trade. . . . .	189
7.2.3	Reforms. . . . .	190
7.3	From Feudalism to Absolutism . . . . .	191
7.3.1	Main Reasons for the Change. . . . .	191
7.3.2	Scientific Revolution . . . . .	192
7.3.3	Political Revolution. . . . .	193
7.3.4	Cultural Revolution (Enlightenment) . . . . .	194
7.3.5	Industrial Revolution . . . . .	194
7.4	Recapitulation . . . . .	201
7.4.1	Summary . . . . .	201
7.4.2	Review Questions . . . . .	202
	References . . . . .	203
<b>8</b>	<b>Technology and Its Aftermath . . . . .</b>	<b>205</b>
8.1	Technological Aspects . . . . .	206
8.1.1	Distinguishing Between Science and Technology . . . . .	206
8.1.2	Technological Systems. . . . .	208
8.1.3	Analysis of Historical Developments . . . . .	208
8.2	Industrial Developments . . . . .	209
8.2.1	Stages of Industrial Developments. . . . .	209
8.2.2	Industry 4.0 . . . . .	210
8.2.3	Advantages of Industry 4.0. . . . .	211
8.2.4	Challenges of Industry 4.0 . . . . .	212
8.3	Technology and Community . . . . .	213
8.3.1	Technology and Health . . . . .	213
8.3.2	Transfer of Technology . . . . .	215
8.3.3	New Job Perspectives . . . . .	215
8.3.4	Reaction to Technology: From Luddites to Cyber-Attack . . . . .	216
8.4	Education and Technology . . . . .	218
8.4.1	Necessity of Educational Authority . . . . .	218
8.4.2	Educational Technology. . . . .	220

---

8.5	Evaluating Technology . . . . .	221
8.5.1	Aesthetics and Ethics . . . . .	221
8.5.2	Technology and Environment . . . . .	221
8.5.3	Technology and Elderly . . . . .	222
8.5.4	Disadvantages of Technology . . . . .	223
8.6	Recapitulation . . . . .	223
8.6.1	Summary . . . . .	223
8.6.2	Review Questions . . . . .	224
	References . . . . .	225
	<b>Bibliography</b> . . . . .	<b>227</b>
	<b>Index</b> . . . . .	<b>229</b>



<http://www.springer.com/978-3-319-52889-2>

Science and Technology from Global and Historical  
Perspectives

Karagözoğlu, B.

2017, XIII, 232 p. 59 illus., 49 illus. in color., Hardcover

ISBN: 978-3-319-52889-2