

# Contents

Preface.....	xi
Acknowledgments.....	xiii
<b>1. Introduction.....</b>	<b>1</b>
<b>2. Information and Communication Technology.....</b>	<b>5</b>
2.1 Basic Definitions and Principles of Information and Communication Technology.....	5
2.2 ICT Applications.....	6
2.2.1 ICT and Education—e-Education.....	6
2.2.2 ICT and Government—e-Government.....	10
2.2.3 ICT and Health—e-Health.....	12
2.2.4 ICT and the Environment—e-Environment.....	15
2.2.5 ICT and Commerce—e-Commerce.....	27
2.2.6 ICT and Agriculture—e-Agriculture.....	30
2.2.7 Emerging Applications of ICT.....	35
2.2.7.1 Landline Connectivity.....	35
2.2.7.2 Wireless Connectivity.....	38
2.2.7.3 Smart Phones and Tablets.....	40
2.2.7.4 Future Technology.....	41
2.2.8 ICT Case Study.....	41
References.....	45
<b>3. Space Technology.....</b>	<b>49</b>
3.1 Introduction.....	49
3.2 Outer Space.....	51
3.2.1 Outer Space Laws.....	51
3.2.2 Outer Space Exploration.....	55
3.2.3 Outer Space Challenges Ahead.....	58
3.2.3.1 International Agreement on a Code of Conduct for Outer Space Activities.....	59
3.2.3.2 Sustainability of Outer Space.....	60
3.2.3.3 Space Traffic Management.....	61
3.2.3.4 Space Security.....	62
3.3 Space within Reach.....	66
3.3.1 Space Shuttle Program.....	66
3.3.2 Buran—The Soviet Shuttle.....	73
3.3.3 The Mir Space Station.....	73
3.3.4 The International Space Station.....	74

3.3.5	Space Activities in Other Countries.....	78
3.3.5.1	Chinese Space Activities .....	78
3.3.5.2	European Space Activities .....	80
3.3.5.3	Japan's Space Activities.....	81
	References .....	93
<b>4.</b>	<b>Satellites .....</b>	<b>97</b>
4.1	Introduction .....	97
4.1.1	The Benefits of Satellites .....	98
4.1.2	Satellite Orbits .....	99
4.1.3	Satellite Structure.....	100
4.1.4	Mission Analysis.....	104
4.1.5	Satellite Tool Kit .....	106
4.2	Application Satellites .....	107
4.2.1	Earth Resource Satellites.....	107
4.2.1.1	QuickBird .....	109
4.2.1.2	Ikonos.....	110
4.2.1.3	Landsat .....	111
4.2.1.4	Envisat.....	114
4.2.1.5	ERS.....	117
4.2.1.6	Indian Remote Sensing Satellite.....	117
4.2.1.7	Radarsat .....	117
4.2.1.8	National Oceanic and Atmospheric Administration (NOAA) .....	119
4.2.1.9	Spin-2.....	119
4.2.1.10	SPOT.....	120
4.2.1.11	Russian Satellites.....	122
4.2.1.12	Issues and Remarks .....	122
4.2.2	Meteorological Satellites .....	125
4.2.3	Global Positioning Satellites.....	132
4.3	Scientific Satellites.....	136
4.3.1	Research Satellites.....	136
4.3.2	CubeSats.....	141
4.4	Communication Satellites .....	144
4.4.1	Fixed Satellite Service (FSS).....	162
4.4.1.1	Very Small Aperture Terminal System (VSAT).....	162
4.4.1.2	Broadband Access .....	164
4.4.1.3	Satellite Multicasting .....	165
4.4.1.4	Earth Station Design.....	169
4.4.2	Mobile Satellite Service (MSS).....	184
4.4.3	Broadcasting Satellite Service (BSS) .....	186
4.4.3.1	Orbital Spacings, EIRP, and Frequency Bands.....	186
	References .....	203

<b>5. Future Space Technologies</b> .....	207
5.1 Introduction .....	207
5.2 Space Technologies .....	208
5.3 Nonrocket Space Launch .....	210
5.4 Single Stage-to-Orbit.....	210
5.5 Solar Power Satellites.....	216
References .....	219
<b>6. Information and Communication Technology and Space Technology</b> .....	221
References .....	224
<b>Appendix A: Scientists and Mathematicians Referred to in This Book</b> .....	225
<b>Index</b> .....	235