

Contents

PREFACE	v
Chapter 1: ELEMENTS OF GEOMETRICAL AND WAVE OPTICS	1
1. Elements of photometry	1
2. Formation of an optical image	5
3. Numerical aperture of an optical system	14
4. The electromagnetic theory of light. Maxwell's equations	15
5. Energy density and energy flux	19
6. Polarization of electromagnetic waves	20
7. Boundary conditions at the interface between two media	23
8. Reflection and refraction of a plane wave at the interface between two dielectrics	27
9. Fresnel equations	31
10. Polarization effects in reflection and refraction	36
11. Total internal reflection	40
12. Coated optics	46
Chapter 2: PROPAGATION OF LIGHT IN THICK FIBERS	56
1. Requirements from fibers and fiber bundles	56
2. Numerical aperture of a bundle	57
3. Light-transfer efficiency of fibers for meridional rays	67
4. Transfer of oblique rays by fibers	72
5. Fresnel losses at fiber ends	77
6. Angular distribution of radiation	81
7. Depolarization	83
8. A curved cylindrical fiber	85
Chapter 3: PROPAGATION OF LIGHT IN THIN FIBERS	87
1. Fundamental equations	87
2. Wave propagation in a dielectric waveguide	93
3. Qualitative treatment of the mode characteristics in dielectric waveguides	100
4. Solution of the fundamental waveguide equation	105
5. Energy flux along the waveguide. The optical diameter	109
6. Field configuration in dielectric waveguides	115
7. A bundle of thin fibers	121

Chapter 4:	THE PRINCIPAL CHARACTERISTICS OF FIBER BUNDLES	126
	1. General background	126
	2. Leakage effects	130
	3. Resolving power	136
	4. Image contrast	147
Chapter 5:	MANUFACTURE OF FIBER ELEMENTS AND QUALITY CONTROL	
	METHODS	152
	1. Manufacture of glass fibers and bundles	152
	2. Quality control of fibers	155
	3. Ulexite fiber elements	165
Chapter 6:	APPLICATION OF FIBERS IN OPTICAL SYSTEMS	168
	1. General remarks	168
	2. Correction of distortion and field curvature	169
	3. Optical fibers in a stellar spectrograph	174
	4. Point-target autocollimator	176
	5. Dielectric cylinder refractometer	179
Chapter 7:	FIBER OPTICS IN ELECTRON-OPTICAL SYSTEMS	187
	1. Introduction	187
	2. Image transmission by fibers from a luminescent screen	188
	3. CRT with a fiber-optics screen	195
	4. Fiber elements in television	196
	5. Image converters and image intensifiers	204
	6. Information pickoff and transmission	207
	7. Scanning and control systems	215
Chapter 8:	OTHER APPLICATIONS OF FIBER ELEMENTS	226
	1. Observation of inaccessible cavities	226
	2. Application of fibers in lasers	232
	3. Scintillators	238
	4. High-speed photography	246
	5. Coupling of electric circuits	249
APPENDIX:	Some Properties of Cylindrical Functions	255
BIBLIOGRAPHY		261
SUBJECT INDEX		269