

Preface		v
Chapter 1	Electromagnetic Theory	1
1.0	Introduction	
1.1	The Complex-Function Formalism	
1.2	Considerations of Energy and Power in Electromagnetic Fields	
1.3	Wave Propagation in Isotropic Media	
1.4	Wave Propagation in Crystals—The Index Ellipsoid	
Chapter 2	The Propagation of Rays and Spherical Waves	18
2.0	Introduction	
2.1	The Lens Waveguide	
2.2	The Propagation of Rays between Mirrors	
2.3	Rays in Lenslike Media	
2.4	Propagation of Spherical Waves	
Chapter 3	Propagation of Gaussian Beams	30
3.0	Introduction	
3.1	The Wave Equation	
3.2	The Gaussian Beam in a Homogeneous Medium	

3.3	The Transformation of the Gaussian Beam	
3.4	Propagation of a Gaussian Beam in a Medium with a Quadratic Index Profile	
3.5	Propagation in Media with a Gain Profile	
3.6	High-Order Beam Modes	
3.7	Dielectric Waveguides	
Chapter 4	Optical Resonators	50
4.0	Introduction	
4.1	The Fabry–Perot Etalon	
4.2	Fabry–Perot Etalons as Optical Spectrum Analyzers	
4.3	Optical Resonators with Spherical Mirrors	
4.4	Mode Stability Criteria	
4.5	The Resonance Frequencies	
4.6	Losses in Optical Resonators	
Chapter 5	Interaction of Radiation and Atomic Systems	73
5.0	Introduction	
5.1	Spontaneous Transitions between Atomic Levels—Homogeneous and Inhomogeneous Broadening	
5.2	Induced Transitions	
5.3	Absorption and Amplification	
5.4	The Electron Oscillator Model of an Atomic Transition	
5.5	Atomic Susceptibility	
5.6	Gain Saturation in Homogeneous Laser Media	
5.7	Gain Saturation in Inhomogeneous Laser Media	
Chapter 6	Theory of Laser Oscillation	98
6.0	Introduction	
6.1	The Fabry–Perot Laser	
6.2	The Oscillation Frequency	
6.3	Three- and Four-Level Lasers	
6.4	Power in Laser Oscillators	
6.5	Optimum Output Coupling in Laser Oscillators	
6.6	Multimode Laser Oscillation and Mode Locking	
6.7	Giant Pulse (<i>Q</i> -switched) Lasers	

6.8	Hole-Burning and the Lamb Dip in Doppler Broadened Gas Lasers	
6.9	Relaxation Oscillation in Lasers	
Chapter 7	Some Specific Laser Systems	141
7.0	Introduction	
7.1	Pumping and Laser Efficiency	
7.2	The Ruby Laser	
7.3	The Nd^{3+} : YAG Laser	
7.4	The Neodymium-Glass Laser	
7.5	The He-Ne Laser	
7.6	The Carbon Dioxide Laser	
7.7	The Ar^+ Laser	
7.8	Semiconductor Junction Lasers	
7.9	Organic-Dye Lasers	
Chapter 8	Second-Harmonic Generation and Parametric Oscillation	177
8.0	Introduction	
8.1	On the Physical Origin of Nonlinear Polarization	
8.2	The Formalism of Wave Propagation in Nonlinear Media	
8.3	Optical Second-Harmonic Generation	
8.4	Second-Harmonic Generation Inside the Laser Resonator	
8.5	Photon Model of Second-Harmonic Generation	
8.6	Parametric Amplification and Oscillation	
8.7	Phase-Matching in Parametric Amplification	
8.8	Parametric Oscillation	
8.9	Frequency Tuning in Parametric Oscillation	
8.10	Power Output and Pump Saturation in Optical Parametric Oscillators	
8.11	Frequency Up-Conversion	
Chapter 9	The Modulation of Optical Radiation	222
9.0	Introduction	
9.1	The Electrooptic Effect	
9.2	Electrooptic Retardation	
9.3	Electrooptic Amplitude Modulation	
9.4	Phase Modulation of Light	
9.5	Transverse Electrooptic Modulators	

9.6	High-Frequency Modulation Considerations	
9.7	Electrooptic Beam Deflection	
Chapter 10	Noise in Optical Detection and Generation	247
10.0	Introduction	
10.1	Why is Noise Bad?	
10.2	Noise—Basic Definitions and Theorems	
10.3	The Spectral Density Function of a Train of Randomly Occurring Events	
10.4	Shot Noise	
10.5	Johnson Noise	
10.6	Spontaneous Emission Noise in Laser Oscillators	
Chapter 11	The Detection of Optical Radiation	269
11.0	Introduction	
11.1	Optically Induced Transition Rates	
11.2	The Photomultiplier	
11.3	Noise Mechanisms in Photomultipliers	
11.4	Heterodyne Detection with Photomultipliers	
11.5	Photoconductive Detectors	
11.6	The <i>p-n</i> Junction	
11.7	Semiconductor Photodiodes	
11.8	The Avalanche Photodiode	
Chapter 12	Interaction of Light and Sound	305
12.0	Introduction	
12.1	Scattering of Light by Sound	
12.2	Particle Picture of Bragg Diffraction of Light by Sound	
12.3	Bragg Diffraction of Light by Acoustic Waves — Analysis	
12.4	Deflection of Light by Sound	
Chapter 13	Two Laser Applications	322
13.1	Design Considerations Involving an Optical Communication System	
13.2	Holography	
Appendix	The Electrooptic Effect in Cubic $\bar{4}3m$ Crystals	334
Index		339