

CONTENTS

PREFACE	v
1. A SURVEY OF ELECTROMAGNETISM	1
1.1. Early Electromagnetic Ideas	1
1.2. Quantitative Basis of Electromagnetism	2
1.3. Classical Electromagnetic Theory	7
1.4. The Nature of Electricity	7
2. CURRENT ELECTRICITY	10
2.1. Basic Electrical Quantities	10
2.2. Alternating Current	23
2.3. Circuit Calculations	34
2.4. Electrical Measurements	45
2.5. The Mechanism of Electrical Conduction	62
3. PHYSICAL BASIS OF ELECTRONICS	71
3.1. Physical Basis of Thermionic Devices	71
3.2. Charged Particles in Electric and Magnetic Fields	77
3.3. Physical Basis of Semi-conducting Devices	80
3.4. Physical Basis of Photo-electric Devices	89
3.5. Integrated Circuits	92
3.6. Limitations of Electronics	94
4. ELECTRONIC DEVICES AND CIRCUITS	96
4.1. Rectification of an Alternating Current	96
4.2. Amplification	106
4.3. Important Electronic Devices	121
4.4. Functional Electronic Circuits	131
5. WAVE THEORY AND ELECTROMAGNETIC RADIATION	141
5.1. Classical Wave Theory	141
5.2. Electromagnetic Radiation	150
5.3. Quantum Aspects of Electromagnetic Radiation	156
5.4. Interaction of Electromagnetic Radiation with Matter	161
5.5. Matter Waves	164

CONTENTS

6. GEOMETRICAL AND PHYSICAL OPTICS	168
6.1. Introduction	168
6.2. Reflection and Refraction	169
6.3. Refractive Index	172
6.4. Principles of Light Scattering	179
6.5. Dispersion	182
6.6. Thin Lenses	184
6.7. Thick Lenses and Lens Systems	188
6.8. Lens Aberrations	191
6.9. Polarized Light	194
6.10. Interference	203
6.11. Diffraction	208
6.12. Resolving Power	214
6.13. Colour	217
6.14. Photometry	219
 7. APPLIED OPTICS	223
7.1. Introduction	223
7.2. Sources of Electromagnetic Radiation	223
7.3. Detectors	234
7.4. Dispersion Systems	238
7.5. Filters and Monochromators	242
7.6. Applications of Interference	246
7.7. Sampling Systems	254
7.8. Applications of Polarized Light	258
7.9. Mirror and Lens Systems	262
7.10. Features of Spectroscopic Instrumentation	269
7.11. Synopsis of Spectroscopic Techniques	278
 8. TEMPERATURE	286
8.1. The Concept of Temperature	286
8.2. Temperature Scales	289
8.3. Negative Absolute Temperatures	294
8.4. Thermometry	297
8.5. Temperature Control	312
8.6. Baths and Accessories	315
 9. HEAT	319
9.1. The Nature of Heat	319
9.2. The Basis of Heat Transfer	321
9.3. Heat Capacity	331

CONTENTS

9.4. Calorimetry	334
9.5. Thermal Methods of Chemical Analysis	339
9.6. Low Temperatures	343
9.7. High Temperatures	345
APPENDIX A. General Electrical Symbols	349
APPENDIX B. Resistors, Capacitors and Inductances	351
INDEX	355