TABLE OF CONTENTS

Personnel Publications and Reports Introduction		vi
		xi
		xv
I.	Physical Electronics	1
	Electron Emission and Cesium Plasma	1
	Thermionic Energy Converters	1
	Thermionic Work-Function of Zirconium Carbide	1
	Physical Electronics in the Solid State	2
	Characteristics of Semiconductor Junctions	2
	Temperature Dependence of Esaki Tunneling	3
II.	Plasma Dynamics	5
	Plasma Physics	5
	Heat Transport in Plasmas	5
	A Microwave Radiation Pyrometer	7
	Radiofrequency Confinement in the Presence of Magnetic Hills	11
	Electrostriction in Plasmas	15
	Magnetoambipolar Diffusion	20
	Measurement of Radiation Fluctuations from a Source in Thermal Equilibrium	23
	Plasma Electronics	27
	A Low-Pressure Gas-Arc Device	27
	Propagation in Plasma Waveguides	29
	Plasma Magnetohydrodynamics and Energy Conversion	33
	Hydromagnetic Resonators	33
	Study of a Magnetic Probe	33
	Magnetohydrodynamic Interactions in Seeded Detonation Waves	36
III.	Statistical Thermodynamics	39
	Canonical and Microcanonical Ensembles	39
IV.	Thermoelectric Processes and Materials	43
	Mercury Telluride Evaluation	43
	Transport of Contact Materials in Bismuth Telluride	44
	Thermal Conductivity Studies	45

CONTENTS

V.	Microwave Spectroscopy	53
	Ruby Linewidth	53
	Paramagnetic-Resonance Experiments on Samples with Appreciable Electric Losses	53
	Gain Bandwidth in Circuits with Negative L and C	54
VI.	Nuclear Magnetic Resonance and Hyperfine Structure	57
	Machine Calculation of Nuclear Resonance Spectra	5 7
	Spin-Lattice Relaxation of I ¹²⁷ in Various Chemical Environments	57
	Hyperfine Structure of Hg ¹⁹⁷ : An Application of the Level-Crossing Technique	57
	Photomultiplier Bridge for Magnetic-Scanning Experiments	60
	Intensity and Linewidth of an Electrodeless Discharge Lamp in a Magnetic Field	62
	Hyperfine Structure of the ³ P ₁ State of Hg ¹⁹⁹	63
	Nuclear Orientation by Optical Pumping	64
VII.	Microwave Electronics	7 9
	Two-Gap Klystron Cavities	7 9
VIII.	Molecular Beams	83
	Charged Atoms	83
	Cesium Maser	83
	Precision Measurement of the Hyperfine-Structure Constants of the Stable Bromine Isotopes	86
IX.	Modulation Theory and Systems	87
	FM Reception with Coherent Interference and Random Noise	87
х.	Statistical Communication Theory	89
	Waveform Signals with Minimum Spectral Width	89
	Measurement of Correlation Functions	93
	Design of Binary, Synchronous Pulse-Transmission Links	99
XI.	Processing and Transmission of Information	109
	A Method of Picture Coding	109
	Estimating Filters for Linear Time-Variant Channels	115
XII.	Physical Acoustics	117
	Scattering of Sound by Sound	117
	Sound Attenuation in Aluminum Rods	119

CONTENTS

XIII.	Speech Communication	121
	Speech Analysis	121
	Detectability of Small Irregularities in a Harmonic Line Spectrum	122
XIV.	Signal Detection by Human Observers	127
	Color Vision	127
XV.	Communications Biophysics	137
	Electrical Responses to Acoustic Clicks Recorded from Human Scalp	137
	Repetitive Cortical Responses to Acoustic Clicks	143
	Firing Patterns of Single Cells in the Auditory Cortex	150
XVI.	Neurophysiology	161
	Hydration of Biological Macromolecules	161
	Logically Stable Nets	161
	Many-Valued Logics and Neuronal Nets	163
	Note on Deaths and Fits of Formal Neurons	163
	Form-Function Relations in the Retina	166
	Hearing Senses in the Frog	167
	Optic-Nerve Functions in the Rat	168
	Olfactory Sense in Amphibia and Reptilia	169
	Devices for Use in Biological Measurements	170
	Electrochemiluminescence	171
XVII.	Circuit Theory	175
	High-Order Frequency Multiplication with Varactors	175
XVIII.	Network Synthesis	177
	On the Analysis and Synthesis of Single-Element-Kind Networks	177
XIX.	Satellite Time-Dilation Measurement	179
	Gravitational Red Shift Investigation	179
XX.	Sensory Aids Research	181
	Research Objectives	181
	Discriminatory Thresholds for the Sense of Touch	182
XXI.	Shop Notes	185
	Short Spiral Baffles	185