TABLE O	F CONTENTS
---------	------------

Personnel	vii
Publications and Reports	xv
Introduction	xxi

GENERAL PHYSICS

I.	Molecular Beams	1
	High-Resolution Measurements with a Two-Cavity Maser — Analysis of Unresolved Spectra	1
п.	Microwave Spectroscopy	5
	Work Completed	5
	A Study of Superconducting Domain Structures Using Optical Polarization Techniques	5
	The Low-Temperature Use of Electrolytic Capacitors and Bifilar Pulse Transformers	5
	Incoherent Phonon Propagation in x-cut Quartz	6
	Incoherent Phonon Propagation in a Born-Kármán Lattice	7
	Fermi Surfaces of Gallium Single Crystals by the Size Effect	14
III.	Radio Astronomy	17
	Observations of Microwave Emission from Atmospheric Oxygen	17
	Remote Sounding of the Upper Atmosphere by Microwave Meas- urements	19
	Varactor Parameters	26
	Spectral-Line Radiometer System at Haystack	30
	Studies of Radar Echoes from the Sun	34
IV.	Optical and Infrared Spectroscopy	37
	Temperature Dependence of the Far Infrared Reflectivity of Magnesium Stannide	37
v.	Geophysics	43
	Absorption of λ = 4880 Å Laser Beam by Argon Ions	43
	Optical Doppler Radar I	45
	Investigation of a Reflex Discharge	47

CONTENTS

VI.	Noise in Electron Devices	51
	Signal-to-Noise Ratio of Photomultiplier Spectrum Measurement and Counting Experiment	51
	Quantum Analysis of Noise in the Laser Oscillator	58
	Spectral Analysis of Laser Oscillator by Means of Higher Auto- correlation Functions	64
VII.	Physical Electronics and Surface Physics	67
	Simple Classical Model for the Scattering of Gas Atoms from Solid Surfaces	67
VIII.	Physical Acoustics	73
	Instability in Parallel Hydrodynamic and Magnetohydrodynamic Flows	73
	PLASMA DYNAMICS	
IX.	Plasma Physics	77
	Electron Density Measurements with a Laser Interferometer	77
	Ion Cyclotron Resonance in a Radiofrequency Discharge — High Q Mode	83
x.	Gaseous Electronics	85
	Oscillations of an Inhomogeneous Plasma	85
	Radiofrequency Dipole Resonance Probe	95
XI.	Plasma Electronics	99
	Active Solid-State Plasmas	99
	Stimulated Emission of Phonons by Electrons Drifting along the Magnetic Field	99
	Longitudinal Interaction of Electrons with Phonons in a Mag- netic Field	104
	Instabilities of Waves across the Magnetic Field	107
	Instabilities in Transverse Waves along B	107
	Instabilities in Quasi-static Waves across B	113
	Quasi-linear Interaction of a Filamentary Electron Beam with a Plasma-Filled Waveguide	118
	Dispersion Diagrams for Hot-Electron Plasmas	126
	Nonadiabatic Diffusion in Toroidal Geometry	131
	Measurement of Optical Gain of the Hollow-Cathode Discharge	133
	Interaction of Particles with Circularly Polarized Waves in Plasmas	134
	Nonadiabatic Magnetic Traps	139
	Study of Laser Radiation Thomson-Scattered by an Electron Beam	143
	Incoherent Scattering of Light from a Plasma. II.	145

CONTENTS

Plasma Magnetohydrodynamics and Energy Conversion	149
Steam-Water Condensing Ejector Test Facility	149
Magnetohydrodynamic Channel-Flow Velocity Profiles and Entry Length	152
Thermionic Emission from a Tungsten Monocrystal in Oxygen	156
Characteristics of a Pure Alkali-Metal Vapor Plasma	167
Brayton Cycle Magnetohydrodynamic Power Generation	175
	 Steam-Water Condensing Ejector Test Facility Magnetohydrodynamic Channel-Flow Velocity Profiles and Entry Length Thermionic Emission from a Tungsten Monocrystal in Oxygen Characteristics of a Pure Alkali-Metal Vapor Plasma

COMMUNICATION SCIENCES AND ENGINEERING

XIII.	Statistical Communication Theory	177
	Work Completed	177
	Bioelectric Control of Prostheses	177
	Functional Analysis of Systems Characterized by Nonlinear Differential Equations	177
	Optimum Laguerre Expansion of Symmetric N th -Order ´ Functions	177
	Some Problems in the Study of Nonlinear Systems with Feedback Loops	178
	Measurement of Volterra Kernels of a Nonlinear System of Finite Order	178
	Several Adaptive Binary Detection Problems	178
	Digital Simulation of Analog Modulation Techniques over the Rayleigh Channel	178
	Space-Time Signal Processing	178
	Analog Communication through Separable Multipath Channels Characterized by Time-Varying Path Delays	178
	Predistortion in No-Memory Filtering and in Quantization	179
	A Statistical Study of VLF Atmospheric Noise	179
	Determination of Optimum Nonlinear Systems for Gaussian Inputs by Crosscorrelation	179
	Useful Approximations to Optimum Quantization	185
	Time Jitter in Tunnel Diode Threshold-Crossing Detectors	191
	Nonlinear Minimum-Mean Square Filtering with Application to Analog Communication	199

XIV.	Processing and Transmission of Information	205
	Optical Communication Systems	205

*

CONTENTS

XV.	Cognitive Information Processing	207
	Cognitive Processes	207
	Variations of Perceived Distance with Apparent Motion	207
	Picture Processing	211
	Efficient Facsimile Transmission by Superposition of Pseudorandomly Scanned Pictures	211
	Optimum Binary Code	214
	Sensory Aids	216
	Mobility Aid Simulator	216
	Optical Character Recognition for Reading Machine Applications	219
	Perceptual Model	227
	Experiments in Reading Nonvisual Text	237
XVI.	Communications Biophysics	247
	Tissue Dynamics of Brain Tissue In Vitro	247
XVII.	Computation Research	263
	Generalized Polynomial Root-Finding Program for a Time- Shared Computer	263
Autho	r Index	267