

CONTENTS

CHAPTER 1. DIRECT CURRENT CIRCUITS. TRANSIENTS	1
1-1 Functions of resistors	1
1-2 Units	2
1-3 Schematic symbols	3
1-4 Series circuits	3
1-5 Parallel circuits	5
1-6 Common grounds	5
1-7 Voltage divider	5
1-8 Voltmeter and ammeter connections	7
1-9 Ohmmeters	8
1-10 Superposition	9
1-11 Self-inductance	11
1-12 Impure coil connected to d.c. source	12
1-13 Capacitance	14
CHAPTER 2. ALTERNATING CURRENT CIRCUITS	21
2-1 Sinusoidal variations	21
2-2 Vector diagrams	23
2-3 Addition of sine waves of the same frequency	24
2-4 Addition of sine waves of different frequencies	24
2-5 Harmonic analysis	25
2-6 Average values of sine waves	25
2-7 Multiplication of sine waves of the same frequency	27
2-8 Sinusoidal voltages and currents	27
2-9 Pure resistance in a.c. circuits	27
2-10 Effective values of sinusoidal voltages and currents	28
2-11 Pure inductance in a.c. circuits	29
2-12 Impure inductors in a.c. circuits	32
2-13 Alternating current circuits with inductance and resistance in series	32
2-14 Capacitor with a.c. source	35
2-15 Alternating current circuit with capacitor and resistor in series	36
2-16 Alternating current circuits with R, L, and C in series	38
2-17 Series resonance	39
2-18 Parallel a.c. circuits	39
2-19 Alternating current circuit with R and C in parallel	39
2-20 Alternating current circuit with R and L in parallel	41

- 2-21 Alternating current circuit with impure coil and pure capacitor in parallel
- 2-22 Parallel resonance
- 2-23 Effect of source resistance on parallel resonant circuits
- 2-24 Transformers

CHAPTER 3. ELECTRON EMISSION

- 3-1 Methods of liberating electrons
- 3-2 Photoelectric emission
- 3-3 Secondary emission
- 3-4 Thermionic emission
- 3-5 Thermionic cathode materials
- 3-6 Cathode structure

CHAPTER 4. THE VACUUM DIODE AND ITS APPLICATION AS A RECTIFIER

- 4-1 Drift current in a diode
- 4-2 Control of current by an externally applied field
- 4-3 Volt-ampere characteristics
- 4-4 Static volt-ampere characteristic of a diode
- 4-5 Emission-limited current
- 4-6 Space charge
- 4-7 Child's law
- 4-8 Load resistors
- 4-9 Dynamic or load characteristic
- 4-10 The diode as a half-wave rectifier
- 4-11 Two diodes as a full-wave rectifier
- 4-12 Ripple factor
- 4-13 Smoothing filters
- 4-14 Inductor filter
- 4-15 Capacitor filter
- 4-16 Inductor-capacitor filters
- 4-17 Voltage doublers
- 4-18 Regulation
- 4-19 Ratings of diodes

CHAPTER 5. THE VACUUM TRIODE AND ITS APPLICATION AS A VOLTAGE AMPLIFIER

- 5-1 The control grid
- 5-2 Static characteristic curves of triodes
- 5-3 Plate characteristic
- 5-4 Transfer characteristic

5-5 Static tube coefficients	79
5-6 Load resistor	81
5-7 Load line	82
5-8 Direct current amplifier	83
5-9 The grid circuit of a triode	83
5-10 The triode with a resistance load as an amplifier of alternating voltages	84
5-11 Phase relations in amplifiers	85
5-12 Graphical determination of gain	86
5-13 Equivalent-plate-circuit theorem	88
5-14 Methods of obtaining bias voltages	89
5-15 Distortion in amplifiers	91
5-16 Degeneration	94
5-17 Cathode follower	95
5-18 Ratings of triodes	96
CHAPTER 6. MULTIELECTRODE TUBES	100
6-1 The screen grid	101
6-2 Screen potential	102
6-3 Static characteristic curve of a tetrode	102
6-4 Tetrode voltage amplifier	103
6-5 The pentode	105
6-6 Beam power tubes	107
6-7 Remote cutoff or variable- μ tubes	108
6-8 Power supplies for tetrodes and pentodes	110
6-9 Pentodes as constant-current generators	111
6-10 Multipurpose tubes	112
CHAPTER 7. MULTISTAGE AMPLIFIERS. AMPLIFIER COUPLING	115
7-1 Interstage coupling	115
7-2 Comparison of types of coupling	117
7-3 Radio-frequency amplifiers	119
7-4 Common supplies	120
7-5 Multistage amplifiers with common supplies	121
7-6 Limits on signal levels	122
CHAPTER 8. POWER AMPLIFIERS	125
8-1 Maximum-power-transfer theorem	125
8-2 Power transfer from a vacuum tube to a resistive load	126
8-3 Plate efficiency	127
8-4 Power output	128
8-5 Amplifier feed	129

8-6	Maximum undistorted power	
8-7	Maximum plate efficiency of class A amplifiers	
8-8	Class B amplifiers	
8-9	Push-pull amplifiers	
8-10	Properties of push-pull amplifiers	
8-11	Class C amplifiers	
8-12	Positive grids	
8-13	Grid-current bias	
8-14	Impedance matching by transformers	
8-15	The decibel	
CHAPTER 9. SINE WAVE OSCILLATORS		
9-1	Feedback oscillators	
9-2	Frequency control	
9-3	Two-stage RC feedback oscillator	
9-4	One-stage RC feedback oscillator	
9-5	Feedback oscillators using LC resonant circuits	
9-6	Negative-resistance oscillators	
9-7	Grid bias of oscillators	
9-8	Beat-frequency oscillators	
9-9	Comparison of oscillators	
9-10	Methods of detecting the presence of oscillations	
CHAPTER 10. GAS-FILLED TUBES		
10-1	Volt-ampere curve of a hot-cathode gas-filled diode	
10-2	Precautions in the operation of gas-filled tubes	
10-3	Cathodes of gas-filled tubes	
10-4	Gas diodes as rectifiers	
10-5	Voltage regulator tubes	
10-6	Gas-filled triodes	
10-7	Firing or control characteristics of a thyatron	167
10-8	Gas triodes as controlled rectifiers	167
10-9	Gas-filled tetrodes	
10-10	Electronically regulated power supplies	
CHAPTER 11. SPECIAL PURPOSE TUBES AND DEVICES		
11-1	Electrometer tubes	
11-2	Miniature and subminiature tubes	177
11-3	Ionization-detecting tubes	177
11-4	Electron-multiplier tubes	
11-5	Phototubes	
11-6	Cathode ray tubes	

11-7 Ultra-high-frequency tubes and circuits	188
11-8 High-frequency modifications of conventional tubes	189
11-9 Transmission lines and resonant cavities as frequency-controlling elements	190
11-10 Velocity-modulation tubes	191
11-11 Magnetrons	192
 CHAPTER 12. WAVE-SHAPING AND CONTROL CIRCUITS	 196
12-1 Differentiating circuits	196
12-2 Integrating circuits	198
12-3 Production of square waves by overdriven amplifiers	200
12-4 Limiters	202
12-5 Clampers	204
12-6 Relaxation oscillators	205
12-7 Saw-tooth wave form generators	207
12-8 Trigger circuits	209
12-9 Scalers and counters	211
12-10 Flip-flop or gate circuit	212
12-11 Coincidence circuits	213
12-12 Wide-band amplifiers	214
 CHAPTER 13. ELECTRONIC VOLTMETER AND CATHODE RAY OSCILLOSCOPE IN INSTRUMENTATION	 218
13-1 Direct current vacuum-tube voltmeters	218
13-2 Alternating current vacuum-tube voltmeters	220
13-3 The cathode ray oscilloscope	223
13-4 The electronic switch	225
13-5 Display of wave forms on the CRO	226
13-6 The CRO as a voltmeter	228
13-7 The CRO as an ammeter	228
13-8 The CRO as a frequency meter and phase meter	228
13-9 Tube characteristics displayed on the CRO screen	232
13-10 Hysteresis curves displayed on the CRO screen	233
13-11 Time intervals measured by the CRO	234
13-12 Intensity modulation	234
 INDEX	 237
 ANSWERS TO PROBLEMS	 243