

CONTENTS

	Page
Unit 1	1
COMMERCIAL BUILDING PLANS AND SPECIFICATIONS	1
Commercial Building Specifications (Overview)	1
Specification	1
Supplementary General Conditions	3
Commercial Building Plans	4
Codes and Organizations	4
NEC Use of Metric (SI) Measurements	13
Review	14
Unit 2	16
THE ELECTRIC SERVICE	16
Askarel-insulated and Oil-insulated Transformers	16
Dry-type transformers	16
Transformer Overcurrent Protection	17
Transformer Connections	17
The Service Entrance	22
Metering	22
Service-entrance Equipment	25
Service Disconnecting Means	26
Grounding	26
Ground-fault Protection	35
Review	39
Unit 3	43
READING ELECTRICAL DRAWINGS (PRINTS) – DRUGSTORE	43
Prints	43
Application Questions	43
Unit 4	45
BRANCH CIRCUITS AND FEEDERS	45
Branch-circuit Calculation	45
Branch Circuits	48
Determine Wire Size and Type	51
Minimum Conductor Size Check	52
Correction Factors for Ambient Temperature	52
Derating Factors (Ampacity Adjustment) for More Than Three Current-carrying Conductors in One Raceway	52
Example of High Ambient Temperature and More Than Three Conductors in a Conduit	56
Feeders	56
Overcurrent Protection and Circuit Rating	56
Voltage Drop	57
Energy Savings Considerations	58
Review	60
Unit 5	62
LOW-VOLTAGE REMOTE-CONTROL LIGHTING	62
Low-voltage Remote-control Lighting	62
Wiring Methods	66
Review	67
Unit 6	69
READING ELECTRICAL DRAWINGS – BAKERY	69
Prints	69
Application Questions	70

Unit	7	SWITCHES AND RECEPTACLES	72
		Receptacles	72
		Ground-fault Circuit Interrupters (NEC Section 210-8)	73
		Electric Baseboard Heaters	75
		Switches	76
		Review	80
Unit	8	BRANCH-CIRCUIT INSTALLATION	82
		Branch-circuit Installation	82
		Rigid Metal Conduit (NEC Article 346)	82
		Electrical Metallic Tubing (NEC Article 348)	84
		Intermediate Metal Conduit	85
		Installation	85
		Flexible Connections (NEC Articles 350 and 351)	86
		Rigid Nonmetallic Conduit	87
		Conduit Sizing	88
		Special Considerations	93
		Box Styles and Sizing	93
		Raceway Support	98
		Aluminum Conductors	98
		Proper Installation Procedures	101
		Review	101
Unit	9	APPLIANCE CIRCUITS	104
		Appliances (NEC Article 100)	104
		The Exhaust Fan	104
		The Cake Mixers and the Dough Divider	105
		The Doughnut Machine	108
		The Bake Oven	109
		Review	111
Unit	10	READING ELECTRICAL DRAWINGS – INSURANCE OFFICE	112
		Prints	112
		Loading Schedule	112
		Application Questions	113
Unit	11	THE COOLING SYSTEM	115
		Refrigeration	115
		Evaporator	116
		Compressor	116
		Condenser	117
		Expansion Valve	117
		Hermetic Compressors	118
		Cooling System Control	120
		Cooling System Installation	120
		Disconnect Switch	120
		Compressor Motor Branch-circuit Protection	123
		Evaporator Fan Motor and Condenser Fan Motor Running Overload Protection	124
		Review	125
Unit	12	SPECIAL SYSTEMS	126
		Surface Metal Raceways (NEC Article 352)	126
		Multioutlet Assemblies	126
		Communication Systems	129
		Floor Outlets	130
		Review	133

Unit	13	READING ELECTRICAL DRAWINGS — BEAUTY SALON	134
		Electric Water Heater	134
		Application Questions	136
Unit	14	LAMPS FOR LIGHTING	138
		Lighting Terminology	138
		Incandescent Lamps	139
		Fluorescent Lamps	141
		Mercury Lamps	146
		Metallic Halide Lamp	147
		Sodium Vapor Lamp	147
		Xenon Lamp	147
		Review	148
Unit	15	LUMINAIRES	149
		Definitions	149
		Installation	149
		Surface-mounted Luminaires	158
		Recessed-mounted Luminaires	160
		Location of Fixtures in Clothes Closets	162
		Review	164
Unit	16	SPECIAL CIRCUITS (OWNER’S CIRCUITS)	166
		Loading Schedule	166
		Lighting Circuits	166
		Sump Pump Control	168
		Boiler Control	168
		Review	172
Unit	17	EMERGENCY POWER SYSTEMS	174
		Sources of Power (NEC Article 700, Part C)	174
		Special Service Arrangements	174
		Emergency Generator Source [Section 700-12 (b)]	174
		Review	182
Unit	18	OVERCURRENT PROTECTION: FUSES AND CIRCUIT BREAKERS	184
		Fuses and Circuit Breakers	185
		Types of Fuses	187
		Heating Damage	189
		Magnetic Forces	190
		Cartridge Fuses (NEC Article 240. Part F)	191
		Testing Fuses	197
		Delta, Three-phase, Grounded “B” Phase System	200
		Time-current Characteristic Curves and Peak Let-through Charts	200
		Circuit Breakers (NEC Article 240 Part G)	205
		Series-rated Breakers	209
		Current-limiting Breakers	212
		Cost Considerations	212
		Review	214
Unit	19	SHORT-CIRCUIT CALCULATIONS AND COORDINATION OF OVERCURRENT PROTECTIVE	
		Short-circuit Calculations	217
		Short-circuit Current Variables	218
		Coordination of Overcurrent Protective Devices	223
		Single Phasing	226
		Review	228
Unit	20	PANELBOARD SELECTION AND INSTALLATION	233

	Panelboards	233
	The Feeder	236
	Neutral Sizing (NEC Section 220-22)	238
	Review	241
Appendix		242
	Electrical Specifications	242
	Heating and Air-conditioning Specificatins	245
	Plumbing Specifications	246
	Useful Formulas	247
	Equations Based on Ohm's Law	247
Index		248