Erie County Technical School
Electronics Duty/Task List

This program is accredited by the Electronics Technician's Association.				Pennsylvania Academic Standards				NOCTI Alignment Test Code 4035		PDE Program of Study Alignment
Duty Area and Task #	Content Areas, Course Titles and Task Statements	Course Number	National Skill Standards	Math	Reading	Writing	Career Education & Work	Written Test	Performance Test	CIP #15.0303
	00 - FUNDAMENTALS									
A	**ELECTRICAL SAFETY AND GROUNDING**	**ELC101**								
A001	Describe the physiological reactions electrical shock causes on the human body	ELC101	8.1	N/A	1.1.8C	1.4.8B	13.3.11A	**X**		107
A002	List various degrees of current the human body can tolerate	ELC101	8.1	N/A	1.1.8D	1.4.8B	13.3.11A	**X**		107
A003	Explain the concept of First Aid and its particular importance to workers in the electrical and electronics fields	ELC101	8.2	N/A	1.2.8A	1.4.8B	13.3.11A			102
A004	Explain what the National Electric Code is	ELC101	8.3	N/A	N/A	1.4.8B	13.3.11A	**X**		101
A005	Describe various rules electronics technicians must abide by	ELC101	8.3	N/A	N/A	1.4.8B	13.3.11A	**X**		102
A006	List tools, hazards which are associated with technician activities in the workplace	ELC101	8.7	N/A	N/A	N/A	13.3.11A	**X**		102
A007	Explain eye and ear protection needed by technicians	ELC101	8.12	N/A	N/A	1.4.8B	13.3.11A	**X**		101
A008	Describe the types, operation and proper usage of fire extinguishers	ELC101	8.15	N/A	1.1.8G	1.4.8B	13.3.11A	**X**		103
A009	List service vehicle safety concerns such as transporting ladders, securing flying objects and driver screens inside the vehicle	ELC101	8.14	N/A	1.1.8G	1.4.8B	13.3.11A	**X**		
A010	Demonstrate safe and proper practices for hand tool use	ELC101	8.7	N/A	N/A	N/A	13.3.11A	**X**		102
A011	Define electrical grounding	ELC101	6.1	N/A	1.1.8G	1.4.8B	13.3.11A			
A012	Identify several types of intentional grounds and their symbols	ELC101	4.1	N/A	1.1.8G	N/A	13.3.11A			
A013	Explain several types of unintentional grounds	ELC101	6.1	N/A	1.1.8G	1.4.8B	13.3.11A			105
A014	Safely discharge a cathode ray tube (CRT)	ELC101	6.1	N/A	1.1.8G	1.4.8B	13.3.11A	X		106
A015	Explain how to safely dispose of environmentally hazardous electronic material	ELC101	6.1	N/A	1.1.8G	1.4.8B	13.3.11A	X		
B	**ORIENTATION**	**ELC102**								
B001	Locate all safety devices in the classroom	ELC102	8.15	N/A	N/A	N/A	13.3.11A			
BOO2	Explain the use of safety devices in the classroom	ELC102	8.15	N/A	1.1.8D	1.5.5E	13.3.11A			102
BOO3	Identify the major areas of the classroom environment	ELC102	N/A	N/A	N/A	N/A	13.3.11A			
BOO4	List the means of securing help in the event of a classroom emergency	ELC102	N/A	N/A	N/A	1.5.5E	13.3.11A			
BOO5	Demonstrate the ability to execute the classroom fire drill procedure	ELC102	N/A	N/A	N/A	1.5.5E	13.3.11A			103
	LEADERSHIP	**PFS109**								
	LEADERSHIP	**PFS110**								

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C	**ELECTRONICS SAFETY AND GROUNDING**	**ELC201**								
C001	Describe lock-out and tagging rules for potentially unsafe electrical or mechanical hazards	ELC201	8.8	N/A	1.1.8G	1.4.8B	13.3.11A	X		101
C002	Explain RF transmitter hazards and precautions	ELC201	8.9	N/A	1.1.8G	1.4.8B	13.3.11A			
C003	Explain the safe use of ac line operated equipment	ELC201	6.1	N/A	1.1.8G	1.4.8B	13.3.11A			
C004	Demonstrate the proper use of ac line operated equipment such as isolation transformers, grounds and GFCIs	ELC201	6.1	N/A	1.1.8G	1.4.11B	13.3.11A			101
C005	Demonstrate the use of Material Safety Data Sheets (MSDS) for common chemicals used in the home and classroom	ELC201	8.2	N/A	1.1.11F	1.4.11B	13.3.11A	X		104
C006	Describe fire prevention and fire-fighting techniques	ELC201	8.15	N/A	1.1.8G	1.4.8B	13.3.11A	X		103
C007	Explain appropriate actions taken around common job site hazards	ELC201	8.13	N/A	1.1.8G	1.4.8B	13.3.11A			102
C008	Explain grounding as it relates to unwanted feedback	ELC201	13.5	N/A	1.1.11F	1.4.8B	13.3.11A			
C009	Define a virtual ground	ELC201	14.6	N/A	1.1.11F	1.4.8B	13.3.11A			
	BUSINESS PRINCIPLES	**PFS209**								
	BUSINESS PRINCIPLES	**PFS211**								
D	**DIGITAL ELECTRONICS SAFETY AND GROUNDING**	**ELC301**								
D001	Explain several causes of static and associated CMOS damage	ELC301	8.6	N/A	1.1.11A	1.4.11B	13.3.11A			
D002	Describe static prevention measures such as straps, maps and grounding	ELC301	8.6	N/A	1.1.11A	1.4.11B	13.3.11A			
D003	List tools, hazards which are associated with technician activities in the field	ELC301	8.3	N/A	1.1.8D	1.4.8B	13.3.11A			
D004	List fiber optic hazards to the skin and eyes	ELC301	8.1	N/A	1.1.8D	1.4.8B	13.3.11A			
D005	List ladder handling and usage and OSHA heights safety rules	ELC301	8.13	N/A	1.1.8D	1.4.11B	13.3.11A			
D006	Demonstrate safe IC chip technician practices	ELC301	8.6	N/A	1.1.8D	N/A	13.3.11A			
D007	List the grounding methods used to eliminate electrostatic discharge (ESD)	ELC301	8.6	N/A	1.1.8D	1.4.8B	13.3.11A			
D008	Explain the proper use of ESD protection grounding equipment	ELC301	8.6	N/A	1.1.8C	1.4.8B	13.3.11A			
D009	Explain several causes of static and associated CMOS damage	ELC301	8.6	N/A	1.1.11A	1.4.8B	13.3.11A			
	TOTAL QUALITY PRINCIPLES	**PFS309**								
	TOTAL QUALITY PRINCIPLES	**PFS310**								
DD	**BEFORE THE INTERVIEW--PRESENTING YOURSELF ON PAPER**	**GAA211**								
DD01	Complete a pocket resume	GAA211								
DD02	Prepare a list of potential employers	GAA211								
DD03	Create a resume	GAA211								
DD04	Type a personal reference page	GAA211								
DD05	Write a cover letter	GAA211								
DD06	Complete a job application	GAA211								

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DD07	Maintain a career-planning portfolio	GAA211	American School Counselor Association							
DDD	**LANDING THAT JOB--THE INTERVIEW**	**GAA212**								
DDD01	Prepare for a job interview	GAA212								
DDD02	Participate in mock interviews	GAA212								
DDD03	Write a follow-up thank you letter	GAA212								
DDD04	Maintain a career-planning portfolio	GAA212								
	10 - TECHNICAL MATH									
E	**ELECTRICAL MATH I**	**ELC111**								
E001	Convert from base units using scientific notation.	ELC111	9.2	2.5.8	1.1.8B	1.4.8B	N/A	**X**		
E002	Identify and use prefixes associated with scientific notation.	ELC111	9.2	2.5.8	1.1.8B	1.4.8B	N/A	**X**		
E003	Manipulate simple algebraic equations to solve for an unknown.	ELC111	9.2	2.8.8	1.1.8B	1.4.8B	N/A	**X**		
E004	Read and interpret graphs	ELC111	9.7	2.8.8	1.1.8B	1.4.8B	N/A	**X**		
E005	Convert between fraction, decimal and percent.	ELC111	9.1	2.1.8	1.1.8B	1.4.8B	N/A	**X**		
E006	Calculate efficiency and express as a percentage.	ELC111	9.2	2.1.8	1.1.8B	1.4.8B	N/A	X		
E007	Convert simple numbers to exponent form.	ELC111	9.1	2.1.8	1.1.8B	1.4.8B	N/A	X		
F	**ELECTRICAL MATH II**	**ELC112**								
F001	Manipulate algebraic equations to solve for several unknown values.	ELC112	1.12	2.8.11	1.1.8B	1.4.8B	N/A	X		
F002	Manipulate algebraic equations containing reciprocals to solve for several unknown values.	ELC112	1.12	2.8.8	1.1.8B	1.4.8B	N/A	X		
F003	Create algebraic equations that express circuit conditions.	ELC112	1.12	2.8.8	1.1.8B	1.4.8B	N/A	X		
F004	Solve simultaneous linear equations.	ELC112	1.12	2.8.11	1.1.8B	1.4.8B	N/A	X		
F005	Calculate area and volume of rectangular and circular shapes.	ELC112	1.12	2.8.11	1.1.8B	1.4.8B	N/A	X		
F006	Calculate ratio and proportions.	ELC112	1.12	2.1.8	1.1.8B	1.4.8B	N/A	X		
G	**ELECTRICAL MATH III**	**ELC113**								
G001	Name and identify basic Trigonometric functions.	ELC113	1.13	2.10.11	1.1.8B	1.4.8B	N/A			
G002	Use basic trig functions to calculate unknown values.	ELC113	1.13	2.10.11	1.1.8B	1.4.8B	N/A			
G003	Read and interpret complex charts and graphs.	ELC113	1.13	2.6.8	1.1.8B	1.4.8B	N/A			
G004	Plot values to create a chart.	ELC113	1.13	2.6.5	1.1.8B	1.4.8B	N/A			
G005	Plot multiple functions on a single graph.	ELC113	1.13	2.6.5	1.1.8B	1.4.8B	N/A			
G006	Differentiate between phasors and vectors.	ELC113	1.13	2.5.11	1.1.8B	1.4.8B	N/A	**X**		
G007	Use Pythagorean Theorem to solve for unknown values of a right triangle.	ELC113	1.13	2.10.8	1.1.8B	1.4.8B	N/A	X		
G008	Calculate time constants.	ELC113	1.13	2.2.8	1.1.8B	1.4.8B	N/A			
G009	Create a graph based on expected values over time.	ELC113	1.13	2.2.11	1.1.8B	1.4.8B	N/A	X		
H	**ELECTRICAL MATH IV**	**ELC114**								
H001	Use ratios to solve real problems.	ELC114	1.13	2.1.11	1.1.8B	1.4.8B	N/A	**X**		

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H002	Use trig to solve for phase relationship values.	ELC114	1.13	2.10.8	1.1.8B	1.4.8B	N/A	X		
H003	Use square and cube roots to solve for combined phasors.	ELC114	1.13	2.10.8	1.1.8B	1.4.8B	N/A			
H004	Interpret graphs and charts of electrical applications.	ELC114	1.13	2.5.8	1.1.8B	1.4.8B	N/A			
H005	Correlate Pythagorean Theorem to various electrical applications.	ELC114	1.13	2.5.11	1.1.8B	1.4.8B	N/A			
H006	Calculate operating limits based on equipment name plate data.	ELC114	1.13	2.5.11	1.1.8B	1.4.8B	N/A			
H007	Calculate shunt values of a circuit.	ELC114	1.13	2.5.8	1.1.8B	1.4.8B	N/A			
H008	Interpret logarithmic scales.	ELC114	1.13	2.5.8	1.1.8B	1.4.8B	N/A			
I	**ELECTRONICS MATH I**	**ELC211**								
I001	Differentiate between analog and digital signals.	ELC211	1.12	2.1.8	1.1.8B	1.4.8B	N/A			
I002	Analyze temperature coefficients.	ELC211	1.12	2.1.11	1.1.8B	1.4.8B	N/A			
I003	Read and interpret graphs and charts.	ELC211	1.12	2.6.5	1.1.8B	1.4.8B	N/A			
I004	Solve multiple step equations.	ELC211	1.12	2.8.11	1.1.8B	1.4.8B	N/A	X	X	
I005	Solve problems using integration and differentiation.	ELC211	1.12	2.11.11	1.1.8B	1.4.8B	N/A			
I006	Read a graticule using different settings	ELC211	1.12	2.6.5	1.1.8B	1.4.8B	N/A			
I007	Read and interpret three axis graphs	ELC211	1.12	2.6.5	1.1.8B	1.4.8B	N/A			
J	**ELECTRONICS MATH II**	**ELC212**								
J001	Plot points on a three axis graph.	ELC212	1.12	2.6.5	1.1.8B	1.4.8B	N/A			
J002	Solve practical problems using multiple step equations.	ELC212	1.12	2.8.8	1.1.8B	1.4.8B	N/A			
J003	Interpret algebraic symbols in practical problems.	ELC212	1.12	2.8.5	1.1.8B	1.4.8B	N/A			
J004	Read tables using high/low values.	ELC212	1.12	2.6.5	1.1.8B	1.4.8B	N/A			
J005	Use logarithms and inverse logarithms to solve algebraic equations.	1.1.8B	1.4.8B	CC.2.2.HS.D.10	1.1.8B	1.4.8B	N/A			
J006	Solve complex algebraic equations.	ELC212	1.12	2.1.11	1.1.8B	1.4.8B	N/A			
J007	Correlate logarithms with decibels.	ELC212	1.12	2.2.11	1.1.8B	1.4.8B	N/A	X		
K	**ELECTRONICS MATH III**	**ELC213**								
K001	Solve complex algebraic equations.	ELC213	1.13	2.2.11	1.1.8B	1.4.8B	N/A			
K002	Read and interpret complex three axis graphs.	ELC213	1.13	2.6.5	1.1.8B	1.4.8B	N/A			
K003	Use Pythagorean theorem to solve for vectors.	ELC213	1.13	2.5.8	1.1.8B	1.4.8B	N/A			
K004	Use trigonometry to solve problems containing vectors.	ELC213	1.13	2.5.11	1.1.8B	1.4.8B	N/A			
K005	Calculate high and low operating values using algebraic equations.	ELC213	1.13	2.2.11	1.1.8B	1.4.8B	N/A			
L	**ELECTRONICS MATH IV**									
L001	Read and interpret complex three axis graphs.	ELC214	1.13	2.6.5	1.1.8B	1.4.8B	N/A			
L002	Solve complex algebraic equations.	ELC214	1.13	2.2.11	1.1.8B	1.4.8B	N/A			
L003	Use percent's in practical applications.	ELC214	1.13	2.2.11	1.1.8B	1.4.8B	N/A	X		
L004	Convert numbers from decimal numbers into binary form.	ELC214	1.13	2.2.11	1.1.8B	1.4.8B	N/A	X		
M	**DIGITAL ELECTRONICS MATH I**	**ELC311**								
M001	Convert numbers from decimal to binary form.	ELC311	9.4	2.2.11	1.1.8B	1.4.8B	N/A	X		

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M002	Add and subtract binary numbers.	ELC311	9.4	2.2.11	1.1.8B	1.4.8B	N/A			
M003	Convert binary numbers to octal and hexadecimal numbers.	ELC311	9.4	2.2.11	1.1.8B	1.4.8B	N/A	X		
M004	Create truth tables.	ELC312	14.3	2.6.11	1.1.8B	1.4.8B	N/A		X	
M005	Solve problems using Boolean algebra.	ELC311	9.5	2.2.11	1.1.8B	1.4.8B	N/A	X	X	
M006	Express English language statement into Boolean algebra formula.	ELC312	9.5	2.2.11	1.1.8B	1.4.8B	N/A		X	
M007	Map, graph, chart and write logic statements.	ELC311	14.3	2.6.11	1.1.8B	1.4.8B	N/A			
M008	Read and interpret charts and graphs.	ELC311	9.7	2.6.11	1.1.8B	1.4.8B	N/A			
N	**DIGITAL ELECTRONICS MATH II**	**ELC312**								
N001	Encoding and decoding.	ELC312	9.4	2.2.11	1.1.8B	1.4.8B	N/A			
N002	Express numbers in various digital codes.	ELC312	9.4	2.2.11	1.1.8B	1.4.8B	N/A			
N003	Use truth tables to solve practical problems.	ELC312	9.7	2.6.11	1.1.8B	1.4.8B	N/A			
N004	Solve problems using Boolean algebra.	ELC312	9.5	2.2.11	1.1.8B	1.4.8B	N/A	X	X	
N005	Add and subtract binary numbers.	ELC312	9.4	2.2.11	1.1.8B	1.4.8B	N/A			
O	**DIGITAL ELECTRONICS MATH III**	**ELC313**								
O001	Express numbers in various number systems (decimal, BCD, octal, hexadecimal).	ELC313	9.2	2.2.11	1.1.8B	1.4.8B	N/A			
O002	Use truth tables to solve practical problems.	ELC313	9.2	2.2.11	1.1.8B	1.4.8B	N/A			
O003	Solve problems using Boolean algebra.	ELC313	9.7	2.6.11	1.1.8B	1.4.8B	N/A			
O004	Practice Karanaugh mapping solutions from truth tables.	ELC313	9.5	2.2.11	1.1.8B	1.4.8B	N/A		X	
O005	Practice algebraic conversion using DeMorgan's theorems.	ELC313	9.5	2.2.11	1.1.8B	1.4.8B	N/A			
O006	Add and subtract binary numbers.	ELC313	9.4	2.2.11	1.1.8B	1.4.8B	N/A			
P	**DIGITAL ELECTRONICS MATH IV**	**ELC314**								
P001	Decimal conversion review	ELC314	9.2	2.1.11	1.1.8B	1.4.8B	N/A	X		
P002	Ratio/Fraction/Proportion review	ELC314	9.2	2.1.11	1.1.8B	1.4.8B	N/A	X		
P003	Scientific notation review	ELC314	9.2	2.1.8	1.1.8B	1.4.8B	N/A	X		
P004	Charts/Graphs Review	ELC314	9.7	2.6.8	1.1.8B	1.4.8B	N/A			
P005	Algebraic review	ELC314	9.1	2.8.11	1.1.8B	1.4.8B	N/A	X		
P006	Estimation Review	ELC314	9.2	2.2.11	1.1.8B	1.4.8B	N/A			
P007	Trigonometric review	ELC314	9.2	2.10.11	1.1.8B	1.4.8B	N/A			
P008	Log/inv log review	ELC314	9.2	2.1.11	1.1.8B	1.4.8B	N/A			
P009	Decimal/Binary conversion review	ELC314	9.4	2.1.11	1.1.8B	1.4.8B	N/A	X		
P010	Binary/Decimal conversion review	ELC314	9.4	2.1.11	1.1.8B	1.4.8B	N/A	X		
P011	Hex and Octal number review	ELC314	9.4	2.1.11	1.1.8B	1.4.8B	N/A	X		
P012	Binary addition and subtraction review	ELC314	9.5	2.1.11	1.1.8B	1.4.8B	N/A			
	20 - SOLDERING									
Q	**SOLDERING SAFETY AND THEORY**	**ELC121**								
Q001	Describe flux, flux action and the necessity of using flux	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E	X		2000
Q002	State flux types and their proper applications	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E			2000

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Q003	Describe a technician grade soldering iron	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E			2001
Q004	Define solder iron tip linkage area	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E	X		2000
Q005	Explain solder tinning	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E	X		2000
Q006	List good and bad solder joint characteristics and their causes	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E	X		2000
Q007	Describe various component mounting configurations and their applications	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E			2003
Q008	Define reflow soldering and its applications	ELC121	13.2.11E	N/A	1.1.8D	1.4.8B	13.2.11E			2000
Q009	Explain axial and radial lead configurations	ELC121	3.8	N/A	1.1.8D	1.4.8B	13.2.11E	X		2003
Q010	Describe various types of desoldering equipment and its use	ELC121	3.11	N/A	1.1.8D	1.4.8B	13.2.11E			2002
Q011	Explain desoldering principles	ELC121	3.1	N/A	1.1.8D	1.4.8B	13.2.11E			2002
Q012	Demonstrate the use of braid-wick solder removers	ELC121	3.12	N/A	1.1.8D	N/A	13.2.11E	X		2002
Q013	Prepare and equip a soldering work station	ELC121	3.9	N/A	1.1.8D	N/A	13.2.11E		X	
Q014	Demonstrate proper preparation of PC boards and components for soldering	ELC121	3.4	N/A	1.1.8D	N/A	13.2.11E		X	2003
Q015	Demonstrate various component mounting configurations	ELC121	3.8	N/A	1.1.8D	N/A	13.2.11E		X	2003
Q016	Solder a variety of components to Electronic Industry Association standards (EIA)	ELC121	3.7	N/A	1.1.8D	N/A	13.2.11E		X	2004
Q017	Assess peer and self soldering for EIA compliance	ELC121	3.7	N/A	1.1.8D	N/A	13.2.11E		X	2004
Q018	Solder while adhering to all applicable rules for safety and soldering	ELC121	3.7	N/A	1.1.8D	N/A	13.2.11E	X	X	2000
Q019	Perform technician level soldering for customer repair projects	ELC121	3.7	N/A	1.1.8D	N/A	13.2.11E			2000
Q020	Assemble various kit soldering projects	ELC121	3.7	N/A	1.1.8D	N/A	13.2.11E			2000
	30 - BASIC ELECTRICITY THEORY/LABS									
R	**ELECTRICAL CONCEPTS, QUANTITITES AND UNITS**	**ELC131**								
R001	Use standard and international base units for specifying and calculating energy, work, and other electrical quantities	ELC131	1.13	2.8.08	1.1.8D	1.4.8B	13.2.11E			201, 202
R002	Explain energy conversion and conversion efficiency	ELC131	1.1	N/A	1.1.8D	1.4.8B	13.2.11E			
R003	List and explain the characteristics of the major particles of an atom	ELC131	1.1	N/A	1.1.8D	1.4.8B	13.2.11E			
R004	Explain the nature of electric charge	ELC131	1.1	N/A	1.1.8D	1.4.8B	13.2.11E			
R005	Explain several industrial applications of static electricity	ELC131	1.1	N/A	1.1.8D	1.4.8B	13.2.11E			
R006	Demonstrate and explain the reactions associated with various static charges- lab	ELC131	1.1	N/A	1.1.8D	1.4.8B	13.2.11E			
R007	Describe and use units of charge, current, voltage, resistance, and power	ELC131	1.5	2.8.08	1.1.8D	1.4.8B	13.2.11E	X		201
R008	Describe current in solids, liquids, and gases	ELC131	1.1, 1.5	2.8.08	1.1.8D	1.4.8B	13.2.11E			

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R009	Explain the difference (and relationship) between power and energy	ELC131	1.13	2.8.08	1.1.8D	1.4.8B	13.2.11E			
R010	Convert quantities from base units to sub-multiple or multiple units and vice versa	ELC131	1.12	2.3.08	1.1.8D	1.4.8B	13.2.11E			203
R011	Express the relationship between energy, charge, and voltage	ELC131	1.1	2.3.08	1.1.8D	1.4.8B	13.2.11E			
R012	List and explain several ways of reducing voltage	ELC131	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			
R013	Distinguish between conductive and non-conductive materials-lab	ELC131	1.6	N/A	1.1.8D	1.4.8B	13.2.11E			
R014	Record and analyze temperature coefficients of resistors-lab	ELC131	1.6	N/A	1.1.8D	1.4.8B	13.2.11E			
S	**BASIC CIRCUIT LAWS, MEASUREMENTS AND COMPONENTS**	**ELC132**								
S001	Describe the relationship between schematic diagrams and physical circuits	ELC132	4.8	N/A	1.1.8D	1.4.8B	13.2.11E			401
S002	Use Ohm's law to calculate the current, voltage, and resistance in simple electric circuits	ELC132	1.12	2.8.08	1.1.8D	1.4.8B	13.2.11E		**X**	402
S003	Calculate circuit power when any two of three quantities of voltage, current, or resistance are known can be found	ELC132	1.13	2.8.08	1.1.8D	1.4.8B	13.2.11E	**X**		403
S004	Calculate the cost of operating an electric device for a specified length of time	ELC132	1.13	2.3.08	1.1.8D	1.4.8B	13.2.11E			
S005	Measure the current, voltage, and resistance in electric circuits	ELC132	1.12	2.3.08	1.1.8D	1.4.8B	13.2.11E	**X**	**X**	301
S006	Describe the relationship between scales and ranges on multi-scale, multi-range meters	ELC132	7.1	2.3.08	1.1.8D	1.4.8B	13.2.11E			301
S007	Draw and analyze schematic diagrams-lab	ELC132	4.8	2.3.08	1.1.8D	1.4.8B	13.2.11E		**X**	206
S008	Measure current, voltage and resistance-lab	ELC132	1.12	2.3.08	1.1.8D	N/A	13.2.11E		**X**	301
S009	Calculate current, voltage and resistance using Ohm's law-lab	ELC132	9.1	2.8.08	1.1.8D	1.4.8	13.2.11E	**X**	**X**	401
S010	Trouble-shoot an electrical circuit-lab	ELC132	1.12	2.5.08	1.1.8D	1.4.8B	13.2.11E			
S011	Identify common electric components and their schematic symbols	ELC132	2.1 - 2.6, 4.1	N/A	1.1.8D	1.4.8B	13.2.11E			206
S012	Measure and specify wire size for electric conductors	ELC132	5.1	2.1.05	1.1.8D		13.2.11E			
S013	Demonstrate an understanding of the operating principles of electric components	ELC132	2.1 - 2.10	N/A	1.1.8D	1.4.8B	13.2.11E			
S014	Interpret and specify the ratings of components	ELC132	2.1 - 2.10	N/A	1.1.8D	1.4.11B	13.2.11E			
S015	Explain the terminology used to describe circuit components and faults	ELC132	11.1, 11.2	N/A	1.1.8D	1.4.11B	13.2.11E			

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S016	Use the resistor color code to determine resistance and tolerance	ELC132	2.1	2.1.05	1.1.8D	1.4.11B	13.2.11E	X	X	405
S017	Build circuits from diagrams-lab	ELC132	6.2	2.5.08	1.1.8D	1.4.8B	13.2.11E		X	206
S018	Determine the hot and cold resistance of an incandescent component-lab	ELC132	1.6	2.2.05	1.1.8D	1.4.8B	13.2.11E			
S019	Measure and calculate internal resistance of a source-lab	ELC132	1.6	2.3.08	1.1.8D	1.4.8B	13.2.11E			
S020	List resistance values and tolerances of resistors-lab	ELC132	2.1	2.3.08	1.1.8D	1.4.8B	13.2.11E			
S021	Calculate required wire sizes for various loads-lab	ELC132	5.2	2.3.08	1.1.8D	1.4.8B	13.2.11E			
T	**MULTIPLE LOAD CIRCUITS**	**ELC133**								
T001	Identify and classify multiple-load circuits	ELC133	11.1, 11.2	2.1.05	1.1.8D	1.4.8B	13.2.11E			802
T002	List and explain the characteristics of series, parallel, and series-parallel circuits	ELC133	11.1, 11.2	N/A	1.1.8D	1.4.11B	13.2.11E			505, 605, 704
T003	Measure the current, voltage, and/or resistance in any part of a multiple-load circuit	ELC133	11.1, 11.2	2.3.08	1.1.8D	1.4.11B	13.2.11E			501
T004	Calculate power, current, voltage, and/or resistance for the total circuit or any load in a multiple-load circuit	ELC133	11.12, 11.13	2.8.08	1.1.8D	1.4.11B	13.2.11E			404
T005	State Kirchoff's laws and use them in conjunction with Ohm's law to solve circuit problems	ELC133	1.12	2.8.11	1.1.8D	1.4.11B	13.2.11E			503
T006	Convert from resistance to conductance and vice versa	ELC133	1.12, 11.9	2.8.11	1.1.8D	1.4.11B	13.2.11E			
T007	Explain the relationship between maximum power transfer and efficiency	ELC133	1.13	N/A	1.1.8D	1.4.11B	13.2.11E			805
T008	Construct, test and explain the major characteristics of a series circuit-lab	ELC133	11.1, 11.2	2.5.08	1.1.8D	1.4.11B	13.2.11E			501
T009	Construct, test and explain the major characteristics of a parallel circuit-lab	ELC133	11.1, 11.2	2.5.08	1.1.8D	1.4.11B	13.2.11E			602, 603
T010	Construct, test and explain the major characteristics of a series-parallel circuit-lab	ELC133	11.1, 11.2	2.5.08	1.1.8D	1.4.11B	13.2.11E			704
T011	Determine the polarity of voltage drops in multi-load circuits - lab	ELC133	7.3, 9.1	2.8.08	1.1.8D	1.4.11B	13.2.11E		**X**	802
T012	Compare differences in measured and calculated values due to component tolerances-lab	ELC133	2.1	2.8.08	1.1.8D	1.4.8B	13.2.11E			
T013	Measure and verify Kirchhoff's laws-lab	ELC133	11.9	2.5.11	1.1.8D	1.4.8B	13.2.11E	**X**		703
T014	Make various measurements and calculations in multiple load circuits-lab	ELC133	11.1, 11.2	2.3.08	1.1.8D	1.4.8B	13.2.11E			704
T015	Design and test circuits to meet specified criteria-lab	ELC133	1.12	2.5.08	1.1.8D	1.4.8B	13.2.11E		**X**	

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T016	Troubleshoot simple and complex circuits for single and multiple faults-lab	ELC133	11.1, 11.2	2.5.08	1.1.8D	1.4.8B	13.2.11E			
U	**MAGNETISM**	**ELC134**								
U001	Draw magnetic fields, flux and forces	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U002	Determine the direction of the magnetic flux created by a current-carrying conductor	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U003	Predict the direction of the force between current-carrying conductors	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U004	Explain why some magnetic materials make permanent magnets and others make temporary magnets	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U005	Explain and use the many terms needed to describe magnetism and magnetic circuits	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E	X		
U006	Solve magnetic circuit problems using magnetic quantities and units	ELC134	9.2	2.8.8	1.1.8D	1.4.8B	13.2.11E			
U007	Describe the basic principle of operation of a motor, generator, transformer, solenoid and relay	ELC134	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			
U008	Demonstrate the existence of magnetic forces surrounding current-carrying conductors-lab	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U009	Demonstrate magnetic field strengths and concentrations-lab	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
U010	Magnetize and demagnetize ferromagnetic materials to verify	ELC134	1.2	N/A	1.1.8D	1.4.8B	13.2.11E			
V	**AC CURRENT AND VOLTAGE**	**ELC135**								
V001	Differentiate between the various forms of alternating and direct current	ELC135	11.1, 11.2	N/A	1.1.8D	1.4.8B	13.2.11E			903
V002	Explain and use the relationship between time and frequency	ELC135	9.3	2.3.8	1.1.8D	1.4.8B	13.2.11E	**X**	**X**	901
V003	Describe four ways to express the magnitude of alternating current	ELC135	11.2	2.3.8	1.1.8D	1.4.8B	13.2.11E			1002
V004	Explain how a sine wave is generated	ELC135	11.2	2.1.011	1.1.8D	1.4.8B	13.2.11E			
V005	State the difference between, and the relationship of, mechanical and electrical degrees	ELC135	1.4, 11.2	2.2.8	1.1.8D	1.4.8B	13.2.11E			1004
V006	Illustrate how three-phase alternating current is produced	ELC135	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			
V007	Explain the characteristics and applications of delta- and wye-connected ac systems	ELC135	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
V008	Display various voltages and currents-lab	ELC135	7.11	2.8.08	1.1.8D	1.4.8B	13.2.11E			1002
V009	Connect transformers in delta and wye configurations-lab	ELC135	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
V010	Make various measurements using an oscilloscope, a signal generator and a DMM-lab	ELC135	7.2, 7.5, 7.11	2.3.11	1.1.8D	1.4.8B	13.2.11E	X	X	1003

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W	**CAPACITANCE AND INDUCTANCE**	**ELC136**								
W001	Describe the construction of capacitors and the purpose of each part	ELC136	2.2	N/A	1.1.8D	1.4.8B	13.2.11E			
W002	Explain how capacitors perform in ac and dc circuits	ELC136	2.2	N/A	1.1.8D	1.4.8B	13.2.11E	X		1501
W003	Explain why a capacitor causes current to lead voltage by 90º	ELC136	2.2	2.9.11	1.1.8D	1.4.8B	13.2.11E			1602
W004	Determine the values of reactance, voltage and current in capacitive circuits	ELC136	11.6	2.1.011	1.1.8D	1.4.8B	13.2.11E	X		1604
W005	Write the specifications needed to order capacitors	ELC136	2.2, 20.3	N/A	1.1.8D	1.4.8B	13.2.11E			
W006	Describe how to test capacitors for opens and shorts	ELC136	7.3	N/A	1.1.8D	1.4.8B	13.2.11E			
W007	Calculate the time required to charge a capacitor in a resistor-capacitor circuit	ELC136	2.2	2.8.08	1.1.8D	1.4.8B	13.2.11E			1604
W008	Construct ac and dc circuits containing capacitors-lab	ELC136	11.1, 11.2	N/A	1.1.8D	1.4.8B	13.2.11E			1603
W009	Construct an RC circuit, measure and record RC time constants-lab	ELC136	11.8	2.3.08	1.1.8D	1.4.8B	13.2.11E			1603
W010	Construct capacitive circuits and demonstrate the relationships between ƒ, C and Xc - lab	ELC136	2.2	2.1.011	1.1.8D	1.4.8B	13.2.11E			1603
W011	Construct circuits and calculate equivalent capacitance and reactance of series and parallel circuits-lab	ELC136	2.2	2.1.011	1.1.8D	1.4.8B	13.2.11E			1603
W012	Describe inductance and the causes of inductance	ELC136	1.8	N/A	1.1.8D	1.4.8B	13.2.11E			
W013	State the terminology associated with inductance and inductors	ELC136	1.8	N/A	1.1.8D	1.4.8B	13.2.11E	X		
W014	Identify common types of inductors and write complete specifications for them	ELC136	1.8	N/A	1.1.8D	1.4.8B	13.2.11E			
W015	Explain why inductance causes current to lag voltage by 90º and thus use no power	ELC136	1.8	2.9.11	1.1.8D	1.4.8B	13.2.11E			
W016	Describe the relationship between inductance, frequency and reactance	ELC136	1.8	2.8.8	1.1.8D	1.4.8B	13.2.11E			1202
W017	Solve circuit values when inductors are connected in series or in parallel	ELC136	2.3	2.8.11	1.1.8D	1.4.8B	13.2.11E			1101, 1102
W018	Describe what causes an inductor to have resistance and how this controls the quality of the inductor	ELC136	1.8	2.8.11	1.1.8D	1.4.8B	13.2.11E			
W019	Demonstrate characteristics of inductors in ac and dc circuits-lab	ELC136	2.3	N/A	1.1.8D	1.4.8B	13.2.11E			1203
W020	Demonstrate inductive kick- lab	ELC136	2.3	N/A	1.1.8D	1.4.8B	13.2.11E			1203
W021	Demonstrate the effect of ƒ on XL -lab	ELC136	2.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			1203

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W022	Demonstrate voltage distribution in series and parallel inductive circuits-lab	ELC136	2.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			1301, 1302
W023	Troubleshoot inductive circuits-lab	ELC136	2.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
X	**TRANSORMERS AND R,C, AND L CIRCUITS**	**ELC137**								
X001	Draw the correct symbol for each type of transformer	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X002	Explain and apply transformer terminology	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			1401
X003	Explain how a transformer can change voltage levels, match impedances and provide electrical isolation	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X004	Select a transformer with ratings that are appropriate for the job to be done	ELC137	2.4, 20.3	2.5.08	1.1.8D	1.4.8B	13.2.11E			
X005	Describe how to connect three-phase transformer windings in either a delta or a wye configuration	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X006	Describe how to connect transformer windings in series and/or parallel to obtain the desired voltage and current capabilities	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E		X	
X007	Calculate transformer losses	ELC137	2.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			
X008	Determine the characteristics of a transformer under load- lab	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X009	Phase transformer windings for series and parallel connections-lab	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X010	Connect and troubleshoot transformers and loads to match impedances for maximum power transfer-lab	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E	X		
X011	Connect single-phase transformers for transforming three-phase voltages	ELC137	2.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X012	Describe the relationship between resistance, reactance and impedance	ELC137	1.9	2.7.8	1.1.8D	1.4.8B	13.2.11E			
X013	Use phasors to represent electrical quantities	ELC137	1.9	2.7.8	1.1.8D	1.4.8B	13.2.11E			
X014	Add voltages, currents or oppositions that are 90º out of phase	ELC137	1.9	2.1.011	1.1.8D	1.4.8B	13.2.11E			
X015	Calculate impedance and phase angle for RC, RL, and RCL circuits when the components are connected in either series or parallel	ELC137	11.3	2.1.011	1.1.8D	1.4.8B	13.2.11E			1801
X016	Calculate the resonant frequency, quality and bandwidth of LC circuits	ELC137	11.3	2.1.011	1.1.8D	1.4.8B	13.2.11E			1901
X017	Describe the purpose and operation of basic filter circuits	ELC137	6.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X018	Identify and classify simple filter circuits	ELC137	6.4	N/A	1.1.8D	1.4.8B	13.2.11E			
X019	Make and interpret measurements in R, C and L combination circuits-lab	ELC137	7.8	2.5.08	1.1.8D	1.4.8B	13.2.11E			1904

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X020	Measure and determine the characteristics of resonant circuits-lab	ELC137	6.4	2.3.08	1.1.8D	1.4.8B	13.2.11E			
X021	Measure and determine the characteristics of various filters-lab	ELC137	6.4	2.3.08	1.1.8D	1.4.8B	13.2.11E			
X022	Measure phase shift in an ac circuit-lab	ELC137	11.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
y	**MOTORS AND INSTRUMENTS**	**ELC138**								
Y001	Classify motors by type of power source, intended use and special characteristics	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3001
Y002	Describe motor ratings and use them in selecting an appropriate motor for a specific application	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3001
Y003	Identify the parts of various squirrel-cage induction motors	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3007
Y004	Describe various applications of ac and dc motors	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3004
Y005	List various means of creating the rotating magnetic field needed to start most induction motors	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			
Y006	List the special characteristics of several types of single-phase motor	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			
Y007	List the special characteristics of several types of dc motors	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3001
Y008	Identify the windings and demonstrate direction reversal in split-phase motors-lab	ELC138	1.4	N/A	1.1.8D	1.4.8B	13.2.11E			3005
Y009	Measure locked-rotor and no-load currents on several types of single-phase motors and compare locked-rotor torques-lab	ELC138	1.4	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y010	Explain how a digital multimeter measures current, voltage and resistance	ELC138	7.1, 7.2, 7.3	N/A	1.1.8D	1.4.8B	13.2.11E			
Y011	Explain how capacitance and inductance are measured with a digital meter	ELC138	7.3	N/A	1.1.8D	1.4.8B	13.2.11E			
Y012	Describe how an analog meter movement can be converted to a VOM	ELC138	7.1, 7.2, 7.3	N/A	1.1.8D	1.4.8B	13.2.11E			
Y013	Measure power in three-phase circuits with either balanced or unbalanced loads-lab	ELC138	7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y014	Use a bridge to measure capacitance, inductance and resistance	ELC138	7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y015	Calculate the amount of meter loading when measuring current and voltage	ELC138	7.6	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y016	Explain why some ohmmeters are reverse reading and nonlinear	ELC138	7.1	N/A	1.1.8D	1.4.8B	13.2.11E	X		

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Y017	Identify various types of analog meter movements	ELC138	7.1, 7.2	N/A	1.1.8D	1.4.8B	13.2.11E			
Y018	Extend the range of a panel meter with external multipliers-lab	ELC138	7.1, 7.2, 7.3	N/A	1.1.8D	1.4.8B	13.2.11E			
Y019	Demonstrate the necessity of using specific meters to minimize meter loading-lab	ELC138	7.6	N/A	1.1.8D	1.4.8B	13.2.11E	X		
Y020	Use a Wheatstone Bridge to measure a wide range of resistances-lab	ELC138	7.1, 7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y021	Use an ac bridge to measure the capacitance of various capacitors-lab	ELC138	7.1, 7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y022	Measure the impedance of a speaker using the equivalent-resistance method at several frequencies-lab	ELC138	7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Y023	Measure three-phase power using the single-wattmeter and the two-wattmeter method-lab	ELC138	7.3	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z	**RESIDENTIAL ELECTRICITY**	**ELC139**								
Z001	Describe how electricity is distributed throughout a house	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z002	Explain the importance of electrical codes	ELC 139	8.3,4	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z003	Diagram multipoint control of a lighting circuit	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z004	Describe the purpose and the operation of a GFCI	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E	X		
Z005	Describe the purpose and the operation of an AFCI	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E	X		
Z006	Differentiate between the functions of neutral and ground conductors	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z007	Diagram 240 volt circuits and their protection features	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z008	Explain how feeder circuits and sub-panels are wired	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z009	Define residential wiring terminology	ELC 139	4.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
Z010	Wire and troubleshoot a single location operated load - lab	ELC 139	5.1,2,47,8,	N/A	1.1.8D	1.4.8B	13.2.11E			
Z011	Wire and troubleshoot a two location operated load - lab	ELC 139	5.1,2,47,8,9	N/A	1.1.8D	1.4.8B	13.2.11E			
Z012	Wire and troubleshoot a three location operated load - lab	ELC 139	5.1,2,47,8,	N/A	1.1.8D	1.4.8B	13.2.11E			
AA	**COMPLEX CIRCUIT ANALYSIS**	**ELC233**								
AA01	Use simultaneous equations to solve equations with more than one unknown variable	ELC233	9.1	2.8.11	1.1.8D	1.4.8B	13.2.11E			806
AA02	Write loop equations using Kirchhoff's voltage law	ELC233	11.9	2.5.11	1.1.8D	1.4.8B	13.2.11E			703
AA03	Determine the values of electrical quantities of either single-source or multiple-source complex circuits using a variety of techniques	ELC233	9.1	2.3.08	1.1.8D	1.4.8B	13.2.11E			802
AA04	Use the superposition theorem to solve multiple-source complex circuits	ELC233	11.1, 11.2	2.8.11	1.1.8D	1.4.8B	13.2.11E			806

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AA05	Explain the advantages of viewing a circuit as a two-terminal network	ELC233	11.1, 11.2	N/A	1.1.8D	1.4.8B	13.2.11E			
AA06	Apply Thevenin's theorem and Norton's theorem to reduce complex circuits	ELC233	11.1, 11.2	2.8.11	1.1.8D	1.4.8B	13.2.11E			804, 806
AA07	Measure and analyze a bridge circuit-lab	ELC233	11.1, 11.2	2.5.08	1.1.8D	1.4.8B	13.2.11E			
AA08	Construct, measure and analyze a constant current source-lab	ELC233	11.1, 11.2	2.5.08	1.1.8D	1.4.8B	13.2.11E			
AA09	Convert complex circuits into equivalent circuits-lab	ELC233	11.1, 11.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
AA10	Apply superposition theorem to multiple load circuits-lab	ELC233	11.1, 11.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			806
AA11	Develop a Thevenin equivalent circuit for an unknown voltage source-lab	ELC233	11.1, 11.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			804
AA12	Troubleshoot a bridge circuit-lab	ELC233	11.1, 11.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
BB	**AC POWER**	**ELC235**								
BB01	Describe phase relationships in ac circuits	ELC235	1.9	2.9.11	1.1.8D	1.4.8B	13.2.11E	X		
BB02	Use phasor diagrams to represent circuit currents and voltages	ELC235	1.9	2.9.11	1.1.8D	1.4.8B	13.2.11E			
BB03	Apply right-triangle relationships to electric circuits to determine phase angles	ELC235	1.9	2.1.011	1.1.8D	1.4.8B	13.2.11E			
BB04	Use trigonometric functions to determine resistive and reactive currents and voltages	ELC235	1.9	2.1.011	1.1.8D	1.4.8B	13.2.11E			
BB05	Explain the relationship between true power and apparent power	ELC235	1.9, 1.13	2.9.11	1.1.8D	1.4.8B	13.2.11E	X		
BB06	Explain the importance of the power factor of an electric distribution system	ELC235	1.9, 1.13	N/A	1.1.8D	1.4.8B	13.2.11E			
BB07	Measure true and apparent power in several types of loads-lab	ELC235	1.9	2.3.11	1.1.8D	1.4.8B	13.2.11E			
	40 - ELECTRONICS THEORY/LABS									
CC	**ELECTRONICS INTRODUCTION AND SEMICONDUCTOR THEORY**	**ELC241**								
CC01	Identify some major events in the history of electronics	ELC241	N/A	N/A	1.1.11D	1.4.11B	13.2.11E			
CC02	Classify circuit operation as digital or analog	ELC241	14	N/A	1.1.8D	1.4.8B	13.2.11E			
CC03	List major analog circuit functions	ELC241	1.11	N/A	1.1.8D	1.4.8B	13.2.11E			
CC04	Develop a system viewpoint for troubleshooting	ELC241	11	N/A	1.1.11D	1.4.11B	13.2.11E			
CC05	Analyze circuits with both dc and ac sources	ELC241	11.1-11.2	N/A	1.1.11D	1.4.11B	13.2.11E		X	
CC06	Discuss current trends in electronics	ELC241	N/A	N/A	1.1.11D	1.4.11B	13.2.11E			
CC07	Analyze wave forms for a circuit with both ac and dc components-lab	ELC241	7.5	2.6.08	1.1.11D	1.4.11B	13.2.11E		X	

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CC08	Review basic ac concepts of Z, filter action and resonance-lab	ELC241	6.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			
CC09	Identify common electronic materials as conductors or semiconductors	ELC241	2.7	N/A	1.1.8D	1.4.8B	13.2.11E			
CC10	Predict the effect of temperature on conductors	ELC241	2.3	2.3.08	1.1.8D	1.4.8B	13.2.11E	X		
CC11	Predict the effect of temperature on semiconductors	ELC241	2.7	2.3.08	1.1.8D	1.4.8B	13.2.11E	X		
CC12	Show the directions of electron and hole currents in semiconductors	ELC241	2.7	N/A	1.1.8D	1.4.8B	13.2.11E			
CC13	Identify the majority and minority carriers in N-type semiconductors	ELC241	2.6	N/A	1.1.8D	1.4.8B	13.2.11E			
CC14	Identify the majority and minority carriers in P-type semiconductors	ELC241	2.6	N/A	1.1.8D	1.4.8B	13.2.11E			
CC15	Demonstrate and compare the effect of heat on conductors and semiconductors-lab	ELC241	11.1, 11.2	N/A	1.1.8D	1.4.8B	13.2.11E			
DD	**JUNCTION DIODES AND DC POWER SUPPLIES**	**ELC242**								
DD01	Predict the conductivity of junction diodes under the conditions of forward and reverse bias	ELC242	2.8	2.3.08	1.1.8D	1.4.8B	13.2.11E			2101
DD02	Interpret volt-amp curves for diodes	ELC242	2.8	2.3.08	1.1.8D	1.4.8B	13.2.11E			2102
DD03	Identify the cathode and anode leads of some diodes by visual inspection	ELC242	2.9	N/A	1.1.8D	1.4.8B	13.2.11E	X	X	
DD04	Identify the cathode and anode leads of diodes by ohmmeter testing	ELC242	2.8	N/A	1.1.8D	1.4.8B	13.2.11E			2101
DD05	Identify diode schematic symbols	ELC242	2.9	N/A	1.1.8D	1.4.8B	13.2.11E	X	X	
DD06	List several diode types and applications	ELC242	2.9	N/A	1.1.8D	1.4.8B	13.2.11E			
DD07	Analyze a constructed circuit to become familiar with solid state diodes, their characteristics and applications-lab	ELC242	2.9	N/A	1.1.8D	1.4.8B	13.2.11E		X	2103
DD08	Construct and analyze diode matrix circuits-lab	ELC242	2.6	N/A	1.1.8D	1.4.8B	13.2.11E			2103
DD09	Construct and analyze a diode wave shaping circuit-lab	ELC242	2.6	2.3.08	1.1.8D	1.4.8B	13.2.11E		X	2202
DD10	Identify the common rectifier circuits and explain how they work	ELC242	6.3	N/A	1.1.8D	1.4.8B	13.2.11E			2102
DD11	Recognize various filter configurations and list their characteristics	ELC242	6.4	N/A	1.1.8D	1.4.8B	13.2.11E			2203
DD12	Measure and calculate power-supply ripple percentage and voltage regulation	ELC242	6.5	2.8.08	1.1.8D	1.4.8B	13.2.11E	X	X	2201
DD13	Predict and measure dc output voltage for filtered and unfiltered power supplies	ELC242	6.5	2.3.08	1.1.8D	1.4.8B	13.2.11E			2205
DD14	Troubleshoot common power-supply problems	ELC242	6	2.5.08	1.1.8D	1.4.8B	13.2.11E			

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DD15	Select replacement parts for power supplies	ELC242	6.4	N/A	1.1.8D	1.4.8B	13.2.11E			
DD16	Construct various power supply circuits and measure their performance characteristics-lab	ELC242	6	2.5.11	1.1.8D	1.4.8B	13.2.11E		X	
DD17	Construct and analyze a combination power supply-lab	ELC242	6.7	2.511	1.1.8D	1.4.8B	13.2.11E	X	X	
DD18	Construct and analyze a combination bridge doubler -lab	ELC242	6.7	2.511	1.1.8D	1.4.8B	13.2.11E			
EE	**TRANSISTORS**	**ELC243**								
EE01	Identify the schematic symbols for several types of transistors	ELC243	2.5	N/A	1.1.8D	1.4.8B	13.2.11E	X		2401
EE02	Define the meaning of amplification and power gain	ELC243	2.5	N/A	1.1.8D	1.4.8B	13.2.11E	X		2402
EE03	Predict the correct bias polarity for several types of transistors	ELC243	2.5	N/A	1.1.8D	1.4.8B	13.2.11E			
EE04	Calculate current gain from data and from characteristic curves	ELC243	12.2, 12.3	2.8.08	1.1.8D	1.4.8B	13.2.11E			
EE05	Calculate collector dissipation from data and from characteristic curves	ELC243	12.2, 12.3	2.8.08	1.1.8D	1.4.8B	13.2.11E			
EE06	Explain how to test bipolar transistors with an ohmmeter	ELC243	2.6	N/A	1.1.8D	1.4.8B	13.2.11E			
EE07	Construct and analyze several circuits containing bipolar, field-effect, and unijunction transistors-lab	ELC243	2.6	2.5.08	1.1.8D	1.4.8B	13.2.11E			
EE08	Gather and record data on various semiconductor devices-lab	ELC243	2.6	2.5.08	1.1.8D	1.4.8B	13.2.11E			2403, 2404, 2405
FF	**SMALL AND LARGE SIGNAL AMPLIFIERS**	**ELC244**								
FF01	Identify the standard methods of signal coupling and list their characteristics	ELC244	12.2	N/A	1.1.8D	1.4.8B	13.2.11E			
FF02	Calculate the input impedance of common-emitter amplifiers	ELC244	12.2	2.8.08	1.1.8D	1.4.8B	13.2.11E			
FF03	Find voltage gain in cascade amplifiers	ELC244	12.2	2.8.8	1.1.8D	1.4.8B	13.2.11E			
FF04	Draw a signal load line for a common-emitter amplifier	ELC244	12.2	2.6.8	1.1.8D	1.4.8B	13.2.11E			
FF05	Solve FET amplifier circuits	ELC244	2.5	2.8.8	1.1.8D	1.4.8B	13.2.11E			
FF06	Identify negative feedback and list its effects	ELC244	12.8	N/A	1.1.8D	1.4.8B	13.2.11E			
FF07	Determine the frequency response a common-emitter amplifier	ELC244	12.7	2.3.08	1.1.8D	1.4.8B	13.2.11E			
FF08	Construct circuits to demonstrate several coupling methods, loading, a common source FET amplifier and a negative-feedback amplifier-lab	ELC244	2.5	N/A	1.1.8D	1.4.8B	13.2.11E			
FF09	Calculate amplifier efficiency	ELC244	12.5	2.8.11	1.1.8D	1.4.8B1.4.8E	13.2.11E			
FF10	Identify the class of amplifier operation	ELC244	12.3	N/A	1.1.8D	1.4.8B	13.2.11E	X		
FF11	Recognize crossover distortion in push-pull amplifiers	ELC244	12.6	N/A	1.1.8D	1.4.8B	13.2.11E			
FF12	Explain the operation of complementary symmetry amplifiers	ELC244	12.5	N/A	1.1.8D	1.4.8B	13.2.11E			
FF13	Describe tank circuit action in class C amplifiers	ELC244	12.3	N/A	1.1.8D	1.4.8B	13.2.11E			
FF14	Construct, measure and analyze various large-signal amplifier circuits-lab	ELC244	12.3	2.8.11	1.1.8D	1.4.8B	13.2.11E			2402

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GG	**OPERATIONAL AMPLIFIERS**	**ELC245**								
GG01	Predict the phase relationships in differential amplifiers	ELC245	12.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
GG02	Determine the CMRR for differential amplifiers	ELC245	12.7	2.8.8	1.1.8D	1.4.8B	13.2.11E			
GG03	Calculate the power bandwidth for operational amplifiers	ELC245	12.7	2.8.11	1.1.8D	1.4.8B	13.2.11E			
GG04	Find voltage gain for operational amplifiers	ELC245	12.7	2.8.11	1.1.8D	1.4.8B	13.2.11E	X	X	
GG05	Determine the small-signal bandwidth for operational amplifiers	ELC245	12.1	2.8.8	1.1.8D	1.4.8B	13.2.11E			
GG06	Identify various applications for operational amplifiers	ELC245	12.3	N/A	1.1.8D	1.4.8B	13.2.11E	X		
GG07	Construct various differential and operational amplifier circuits, measure and analyze performance data-lab	ELC245	12.7	2.6.8	1.1.8D	1.4.8B	13.2.11E		X	2403, 2404, 2405
HH	**OSCILLATORS AND RADIO RECEIVERS**	**ELC246**								
HH01	Identify oscillator circuits	ELC246	10.1	N/A	1.1.8D	1.4.8B	13.2.11E	X		
HH02	Apply the concepts of gain and feedback to oscillators	ELC246	13.1	N/A	1.1.8D	1.4.8B	13.2.11E			
HH03	Predict the frequency of operation for oscillators	ELC246	13.1	2.3.11	1.1.8D	1.4.8B	13.2.11E			
HH04	List causes of undesired oscillations	ELC246	13.2	N/A	1.1.8D	1.4.8B	13.2.11E			
HH05	Identify techniques used to prevent undesired oscillation	ELC246	13.2	N/A	1.1.8D	1.4.8B	13.2.11E			
HH06	Troubleshoot oscillators	ELC246	13.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
HH07	Construct and analyze several common oscillator circuit-lab	ELC246	13.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
HH08	Define modulation and demodulation	ELC246	10.6	N/A	1.1.8D	1.4.8B	13.2.11E			
HH09	List the characteristics of AM, FM and SSB	ELC246	10.4	N/A	1.1.8D	1.4.8B	13.2.11E			
HH10	Explain the operation of basic radio receivers	ELC246	10.8	N/A	1.1.8D	1.4.8B	13.2.11E			2901, 2902
HH11	Predict the bandwidth of AM signals	ELC246	10.4	2.4.8	1.1.8D	1.4.8B	13.2.11E			
HH12	Calculate the oscillator frequency for superheterodyne receivers	ELC246	10.1	2.8.1	1.1.8D	1.4.8B	13.2.11E			
HH13	Calculate the image frequency for superheterodyne receivers	ELC246	10.1	2.8.11	1.1.8D	1.4.8B	13.2.11E			
HH14	Troubleshoot radio receivers	ELC246	13.2	2.511	1.1.8D	1.4.8B	13.2.11E			
HH15	Construct and analyze electronic communication circuits-lab	ELC246	13.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
II	**INTEGRATED CIRCUITS AND ELECTRONIC CONTROL DEVICES**	**ELC247**								
II01	Compare integrated circuit (IC) technology to discrete technology	ELC247	14.1	N/A	1.1.8D	1.4.8B	13.2.11E			
II02	Explain the photolithographic process used to make ICs	ELC247	N/A	N/A	1.1.8D	1.4.8B	13.2.11E			
II03	Make calculations for 555 timer circuits	ELC247	14.1	2.8.08	1.1.8D	1.4.8B	13.2.11E			
II04	Recognize some common linear ICs and their symbols	ELC247	2.1	2.8.08	1.1.8D	1.4.8B	13.2.11E	X		
II05	Explain digital signal processing	ELC247	14.11	N/A	1.1.8D	1.4.8B	13.2.11E			
II06	Troubleshoot circuits with ICS	ELC247	13.2	2.5.08	1.1.8D	1.4.8B	13.2.11E			
II07	Construct and compare two linear IC circuits-lab	ELC247	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			

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II08	Calculate efficiency in control circuits	ELC247	14.9	2.8.11	1.1.8D	1.4.8B	13.2.11E			
II09	Identify the schematic symbols for thyristors	ELC247	2.7	N/A	1.1.8D	1.4.8B	13.2.11E			
II10	Explain the operation of thyristors	ELC247	2.7	N/A	1.1.8D	1.4.8B	13.2.11E			
II11	Define conduction angle in thyristor circuits	ELC247	2.7	2.11.8	1.1.8D	1.4.8B	13.2.11E			
II12	Explain commutation in thyristor circuits	ELC247	2.7	N/A	1.1.8D	1.4.8B	13.2.11E			
II13	Troubleshoot control circuits	ELC247	13.2	2.5.08	1.1.8D	1.4.8B	13.2.11E			
II14	Construct and compare several thyristor circuits and their applications as control devices-lab	ELC247	13.2	N/A	1.1.8D	1.4.8B	13.2.11E			
JJ	**REGULATED POWER SUPPLIES**	**ELC248**								
JJ01	Perform basic calculations for power supply regulator circuits	ELC248	6.5	2.8.08	1.1.8D	1.4.8B	13.2.11E	X	X	
JJ02	Explain the use of feedback in voltage regulator circuits	ELC248	6.5	N/A	1.1.8D	1.4.8B	13.2.11E			
JJ03	Identify the types of current regulation	ELC248	6.5	N/A	1.1.8D	1.4.8B	13.2.11E			
JJ04	Identify crowbar circuits	ELC248	13.2	N/A	1.1.8D	1.4.8B	13.2.11E			
JJ05	Identify switch-mode regulators and their characteristics	ELC248	6.5	N/A	1.1.8D	1.4.8B	13.2.11E			
JJ06	Troubleshoot regulated power supplies	ELC248	6.5	2.5.08	1.1.8D	1.4.8B	13.2.11E			
JJ07	Construct and measure the performance of several regulated power supply circuits-lab	ELC248	6.5	2.511	1.1.8D	1.4.8B	13.2.11E		X	
KK	**DIGITAL SIGNAL PROCESSING**	**ELC249**								
KK01	Define DSP and list its advantages over analog	ELC249	14.4	13.2	1.1.8D	1.4.8B	13.2.11E			
KK02	Sketch a DSP block diagram	ELC249	14.4	13.2	1.1.8D	1.4.8B	13.2.11E			
KK03	List DSP limitations	ELC249	14.7	13.2	1.1.8D	1.4.8B	13.2.11E			
KK04	Represent DSP signals in time and frequency	ELC249	14.7	13.2	1.1.8D	1.4.8B	13.2.11E			
KK05	Explain the design and operation of DSP filters	ELC249	14.7	13.2	1.1.8D	1.4.8B	13.2.11E			
LL	**INTRODUCTION TO SMALL SIGNAL AMPLIFIERS**	**ELC343**								
LL01	Calculate decibel gain and loss	ELC343	12.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			2402
LL02	Draw a load line for a basic common-emitter amplifier	ELC343	12.9	N/A	1.1.8D	1.4.8B	13.2.11E			
LL03	Define clipping in a linear amplifier	ELC343	2.6	N/A	1.1.8D	1.4.8B	13.2.11E	X		
LL04	Find the operating point for a basic common-emitter amplifier	ELC343	12.6	2.8.8	1.1.8D	1.4.8B	13.2.11E			
LL05	Determine common-emitter amplifier voltage gain	ELC343	12.6	2.8.8	1.1.8D	1.4.8B	13.2.11E			
LL06	Identify common-base and common-collector amplifiers	ELC343	12.6	N/A	1.1.8D	1.4.8B	13.2.11E			
LL07	Explain the importance of impedance matching	ELC343	13.3	N/A	1.1.8D	1.4.8B	13.2.11E			
LL08	Construct various configurations of an amplifier circuit, measure and analyze data-lab	ELC343	12.6	2.8.08	1.1.8D	1.4.8B	13.2.11E			
MM	**TROUBLESHOOTING OPERATIONAL AMPLIFIERS**	**ELC345**								
MM01	Identify symptoms in malfunctioning equipment and systems	ELC345	12.2	N/A	1.1.8D	1.4.8B	13.2.11E	X		
MM02	Perform preliminary checks and eliminate obvious problems	ELC345	12.2	N/A	1.1.8D	1.4.8B	13.2.11E	X		

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MM03	Localize circuit defects by using signal injection and signal tracing	ELC345	12.2	N/A	1.1.8D	1.4.8B	13.2.11E			
MM04	Find component-level defects by using voltage analysis	ELC345	12.2	2.8.8	1.1.8D	1.4.8B	13.2.11E			
MM05	Troubleshoot intermittent systems	ELC345	13.1	2.511	1.1.8D	1.4.8B	13.2.11E			
MM06	Troubleshoot operational-amplifier (op-amp) circuits	ELC345	13.1	2.511	1.1.8D	1.4.8B	13.2.11E			
MM07	Troubleshoot and repair various amplifier circuits-lab	ELC345	13.1	2.511	1.1.8D	1.4.8B	13.2.11E			
	50 - DIGITAL ELECTRONICS THEORY/LABS									
NN	**DIGITAL ELECTRONICS INTRODUCTION AND DIGITAL NUMBERING SYSTEMS**	**ELC351**								
NN01	Identify several characteristics of digital circuits as opposed to linear (analog) circuits	ELC351	14.1	N/A	1.1.8D	1.4.8B	13.2.11E			
NN02	Classify devices as using digital, analog, or a combination of technologies	ELC351	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
NN03	Differentiate between digital and analog signals and identify the HIGH and LOW portions of the digital waveform	ELC351	14.2	2.6.8	1.1.8D	1.4.8B	13.2.11E			
NN04	List three types of multivibrators and describe the general purpose of each type of circuit	ELC351	14.5	N/A	1.1.8D	1.4.8B	13.2.11E	X		
NN05	Analyze simple logic-level indicator circuits	ELC351	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
NN06	Cite several reasons for using digital circuits	ELC351	14	N/A	1.1.8D	1.4.8B	13.2.11E			
NN07	Describe the history of integrated circuits and list several limitations of digital circuits	ELC351	14.4	N/A	1.1.8D	1.4.8B	13.2.11E			
NN08	Wire and test a free-running clock circuit-lab	ELC351	14.8	N/A	1.1.8D	1.4.8B	13.2.11E			
NN09	Demonstrate understanding of the idea of place value in the decimal, binary, octal, and hexadecimal number systems	ELC351	14.1	2.1.08	1.1.8D	1.4.8B	13.2.11E	X		2602
NN10	Convert binary numbers to decimal and decimal numbers to binary	ELC351	14.1	2.1.11	1.1.8D	1.4.8B	13.2.11E	X		2601
NN11	Convert hexadecimal numbers to binary, binary to hexadecimal, hexadecimal to decimal and decimal numbers to hexadecimal	ELC351	14.1	2.1.11	1.1.8D	1.4.8B	13.2.11E	X		2602
NN12	Convert octal numbers to binary, binary to octal, octal to decimal and decimal numbers to octal	ELC351	14.1	2.1.11	1.1.8D	1.4.8B	13.2.11E	X		2602
NN13	Wire a 74147 encoder IC to convert decimal numbers to binary numbers-lab	ELC351	14.11	2.1.11	1.1.8D	1.4.8B	13.2.11E			
NN14	Wire a 7442 decoder IC to convert binary numbers to decimal numbers-lab	ELC351	14.2	2.11.1	1.1.8D	1.4.8B	13.2.11E			
NN15	Wire a CMOS 74HC393 binary counter to interpret an 8-bit binary display in both hexadecimal and octal-lab	ELC351	14.2	2.1.11	1.1.8D	1.4.8B	13.2.11E			

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OO	**LOGIC GATES AND LOGIC GATE USES**	**ELC352**								
OO01	Recite the name, draw the symbol and truth table, explain the function and Boolean expression for the eight basic logic gates	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E	X		
OO02	Draw a logic diagram of any of the eight basic logic functions using only NAND gates	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E			
OO03	Convert one type of basic gate to any other logic function using inverters	ELC352	14.3	N/A	1.1.8D	1.4.8B	13.2.11E	X		
OO04	Draw logic diagrams illustrating how two-input gates could be used to create gates with more inputs	ELC352	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
OO05	Memorize the inverted input forms of the NAND and NOR gates	ELC352	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
OO06	Identify pin number and manufacturer's markings on both TTL and CMOS dual-in-line package ICs	ELC352	14.11	N/A	1.1.8D	1.4.8B	13.2.11E	X	X	
OO07	Troubleshoot simple logic gate circuits	ELC352	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
OO08	Recognize new logic gate symbols used in dependency notation (IEEE standard 91-1984)	ELC352	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
OO09	Wire and operate a two-input AND gate-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO10	Wire and operate a three-input AND gate using a 7408 IC-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO11	Wire and operate a two-input OR gate-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO12	Wire and operate a five-input OR gate using a 7432 IC-lab	ELC352	14.2	2.7.1.1	1.1.8D	1.4.8B	13.2.11E			
OO13	Wire and operate an inverter-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO14	Wire and test 6 inverters in a 7404 IC-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO15	Wire and operate a two-input NAND gate-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO16	Wire and operate a two-input NOR gate-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO17	Construct a NAND gate using an AND gate and an inverter-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO18	Design a gating circuit that will perform the NOR function using a 7432 IC and a 7404 IC-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO19	Wire and operate an XOR gate-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO20	Wire and operate an XNOR gate using a 7486 IC and a 7404 IC-lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO21	Wire and operate a two-input AND gate using a two-input NAND gate as a universal gate- lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO22	Wire and operate a two-input OR gate using a two-input NAND gate as a universal gate- lab	ELC352	14.2	2.7.11	1.1.8D	1.4.8B	13.2.11E			

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OO23	Wire and operate a two-input NOR gate using a two-input NAND gate as a universal gate -lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO24	Wire and operate a two-input XOR gate using a two-input NAND gate as a universal gate -lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO25	Design, draw and wire a three-input AND circuit using two-input AND gates-lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO26	Design, draw and wire a four-input OR circuit using two-input OR gates-lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO27	Design, draw and wire a five-input NAND circuit using 1 two-input OR gate, 1 two-input NAND gate, and 1 four-input NAND gate-lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO28	Design, draw and wire several logic functions using a 7404 IC, a 7408 IC, a 7432 IC-lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E		X	
OO29	Wire and test the operation of a timer circuit using CMOS ICs, test the logic levels in the control gating circuitry of a timer circuit using a CMOS logic probe-lab	ELC352	14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
OO30	Introduce a fault into a timer circuit and detect the problem using a logic probe-lab	ELC352	14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
OO31	Draw logic diagrams from minterm and maxterm Boolean expressions	ELC352	14.1	2.4.11	1.1.8D	1.4.8B	13.2.11E	X	X	
OO32	Design a logic diagram from a truth table by first developing a minterm Boolean expression and then drawing the AND-OR logic diagram	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	
OO33	Reduce a minterm Boolean expression to its simplest form using two-, three-, four-, and five-variable Karnaugh maps	ELC352	14.1	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	
OO34	Simplify AND-OR logic circuits using NAND gates	ELC352	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	
OO35	Solve logic problems using data selectors	ELC352	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
OO36	Convert minterm-to-maxterm and maxterm-to-minterm Boolean expressions using DeMorgan's theorems	ELC352	14.1	2.1.11	1.1.8D	1.4.8B	13.2.11E			
OO37	Use a "keyboard version" of Boolean expressions	ELC352	14.3	2.1.11	1.1.8D	1.4.8B	13.2.11E			
OO38	Draw a logic symbol diagram from a Boolean expression-lab	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	
OO39	Wire and operate a logic circuit using 7408 and 7432 ICs-lab	ELC352	14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
OO40	Write a minterm Boolean expression-lab	ELC352	14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
OO41	Simplify Boolean expressions using a Karnaugh map-lab	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	

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OO42	Draw a logic symbol diagram from a simplified Boolean expression-lab	ELC352	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E		X	
OO43	Wire and operate simplified logic circuits-lab	ELC352	14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
OO44	Wire and operate a 1-of-16 data selector-lab	ELC352	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
OO45	Observe the logic level of a "floating" TTL input-lab	ELC352	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
OO46	Draw the simplest NAND logic circuit for a given 4-variable truth table, wire and operate the NAND logic circuit, wire a 74150 data selector to solve the same logic problem -lab	ELC352	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
OO47	Design, draw, construct and test a logic circuit having 5 variables, construct the circuit using CMOS NAND gates-lab	ELC352	14.2	2.5.11	1.1.8D	1.4.8B	13.2.11E		X	
PP	**IC SPECIFICATIONS AND INTERFACING**	**ELC353**								
PP01	Determine logic levels using TTL and CMOS voltage profile diagrams	ELC353	2.1	2.6.8	1.1.8D	1.4.8B	13.2.11E			
PP02	Discuss selected TTL and CMOS IC specifications such as input and output voltages, noise margin, drive capability, fan-in, fan-out, propagation delay, and power consumption	ELC353	2.1	2.3.11	1.1.8D	1.4.8B	13.2.11E			
PP03	List several safety precautions for handling and designing with CMOS ICs	ELC353	2.1	N/ A	1.1.8D	1.4.8B	13.2.11E			
PP04	Recognize several simple switch interface and debounce circuits using both TTL and CMOS ICs	ELC353	2.1	N/ A	1.1.8D	1.4.8B	13.2.11E			
PP05	Analyze interfacing circuits for LEDs and incandescent lamps using both TTL and CMOS ICs	ELC353	2.1	N/ A	1.1.8D	1.4.8B	13.2.11E			
PP06	Draw TTL-CMOS and CMOS-TTL interface circuits	ELC353	2.1	N/ A	1.1.8D	1.4.8B	13.2.11E			
PP07	Describe the Operation of interface circuits for buzzers, relays, motors, and solenoids using both TTL and CMOS ICs	ELC353	2.1	2.4.11	1.1.8D	1.4.8B				
PP08	Analyze interfacing circuits featuring an optoisolator	ELC353	18.7, 18.8	N/A	1.1.8D	1.4.8B	13.2.11E			
PP09	List the primary characteristics and feature of a stepper motor	ELC353	13.1	N/A	1.1.8D	1.4.8B	13.2.11E			
PP10	Describe the operation of stepper motor driver circuits	ELC353	13.1	2.4.11	1.1.8D	1.4.8B	13.2.11E			
PP11	Troubleshoot a simple logic circuit	ELC353	13.1	2.5.08	1.1.8D	1.4.8B	13.2.11E	X		
PP12	Wire and test active-LOW and active-HIGH pushbutton switches-lab	ELC353	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
PP13	Observe the use of pull-up and pull-down resistors-lab	ELC353	12.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
PP14	Wire and test the effect of switch bounce on a TTL counter circuit-lab	ELC353	12.7	N/ A	1.1.8D	1.4.8B	13.2.11E			

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PP15	Construct switch de-bouncing circuitry to a counter circuit-lab	ELC353	12.7	N/ A	1.1.8D	1.4.8B	13.2.11E			
PP16	Wire and test several TTL to LED interface circuits-lab	ELC353	12.7	2.3.11	1.1.8D	1.4.8B	13.2.11E			
PP17	Wire and test a CMOS to LED interface using driver transistors-lab	ELC353	12.7	2.3.11	1.1.8D	1.4.8B	13.2.11E			
PP18	Design, draw and wire a TTL to HC-CMOS interface circuit-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP19	Design, draw and wire an HC-CMOS to standard TTL interface circuit-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP20	Wire and test a CMOS logic circuit interfaced with a relay, motor, and buzzer-lab	ELC353	14.2, 14.3	2.3.11	1.1.8D	1.4.8B	13.2.11E			
PP21	Wire and operate a TTL logic circuit, interfaced to a buzzer and dc motor, use an optoisolator to separate the logic circuit from the higher voltage and noisy dc motor circuit-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP22	Wire and test a bi-polar stepper motor, observe and record the drive control sequences-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP23	Test a stepper motor in the full and half-step mode, the CW and CCW rotation mode and attempt to operate as a continuous rotation motor-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP24	Test the logic high and low voltage calibration of a logic probe-lab	ELC353	14.9	2.5.11	1.1.8D	1.4.8B	13.2.11E			
PP25	Design a circuit to control the direction of rotation and half or full-step of a stepper motor-lab	ELC353	14.2, 14.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ	**ENCODING, DECODING, DISPLAYS AND FLIP FLOPS**	**ELC354**								
QQ01	Identify the characteristics and applications of several commonly used codes	ELC354	9.4,14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ02	Convert decimal numbers to BCD code and BCD to decimal numbers	ELC354	9.4,14.1	2.1.08	1.1.8D	1.4.8B	13.2.11E			
QQ03	Compare decimal numbers with excess-3 code, Gray code, and 8421 BCD code	ELC354	9.4,14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ04	Convert ASCII code to letters and numbers, and characters to ASCII code	ELC354	9.4,14.1	2.1.08	1.1.8D	1.4.8B	13.2.11E			
QQ05	Demonstrate the coding of a seven-segment display	ELC354	9.4,14.1	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ06	Describe the construction and important characteristics of LCD, LED and VF seven-segment displays	ELC354	2.9,14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			

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QQ07	Demonstrate the operation of several TTL and CMOS BCD-to-seven segment decoder/driver ICs used for driving LED, LCD and VF seven-segment displays	ELC354	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ08	Troubleshoot a faulty decoder/driver seven-segment display circuit	ELC354	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ09	Test a single LED indicator lamp-lab	ELC354	14.7	2.5.8	1.1.8D	1.4.8B	13.2.11E			
QQ10	Test each segment of a seven-segment LED display-lab	ELC354	14.7	2.5.8	1.1.8D	1.4.8B	13.2.11E			
QQ11	Wire and test an encoder/decoder system that converts from decimal to BCD to seven-segment code using TTL ICs-lab	ELC354	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ12	Wire and test an LCD driver circuit using a CMOS decoder and 555 timer IC-lab	ELC354	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ13	Observe in-phase and out-of-phase drive signals present on the inputs to a liquid-crystal display-lab	ELC354	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ14	Test the operation of a VF display-lab	ELC354	14.7	N/ A	1.1.8D	1.4.8B	13.2.11E			
QQ15	Wire and test a pulse-counting circuit using a CMOS IC to directly drive a VF display-lab	ELC354	14.4, 14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ16	Observe the operation of a digital circuit operating on two power supplies (+5V and +12V dc)-lab	ELC354	14.2	N/ A	1.1.8D	1.4.8B	13.2.11E			
QQ17	Troubleshoot a decoder/LED display circuit-lab	ELC354	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ18	Draw the block diagram and explain the function of each input and output on several types of flip-flops	ELC354	4.1,4.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ19	Use truth tables to determine the mode of operation and outputs of a flip-flop	ELC354	14.3,14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ20	Interpret flip-flop waveform diagrams to determine the mode of operation, outputs, and the type of triggering	ELC354	14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ21	Discuss the organization and use of a 4-bit latch and predict the operation of the IC	ELC354	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ22	Classify flip-flops as synchronous or asynchronous and compare the triggering of the synchronous units	ELC354	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
QQ23	Describe the operation of Schmitt trigger devices and cite their applications	ELC354	14.2	2..4.11	1.1.8D	1.4.8B	13.2.11E			
QQ24	Differentiate between traditional and newer IEEE/ANSI flip-flop symbols	ELC354	14.5	N/ A	1.1.8D	1.4.8B	13.2.11E			
QQ25	Wire and operate an R-S flip-flop	ELC354	14.5	2.5.08	1.1.8D	1.4.8B	13.2.11E			
QQ26	Wire and operate a clocked R-S flip-flop	ELC354	14.5	2.5.08	1.1.8D	1.4.8B	13.2.11E			
QQ27	Operate and test D flip- flops using a 7474IC	ELC354	14.5	2.3.11	1.1.8D	1.4.8B	13.2.11E			
QQ28	Operate and test J-K flip-flops using the 7476 TTL IC	ELC354	14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			

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QQ29	Wire and test an encoder-decoder system using TTL ICs that latch data at the inputs to the decoder on each keystroke, observe the action of the latch enable circuitry	ELC354	14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ30	Use a Schmidt trigger IC for wave-shaping, compare this wave-shaping with a TTL IC wave-shaper	ELC354	14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
QQ31	Build a latched encoder-decoder system using CMOS ICs and an LCD, show the encoder IC priority feature	ELC354	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR	**COUNTERS AND SHIFT REGISTERS**	**ELC355**								
RR01	Draw a circuit diagram of a ripple counter using J-K flip-flops	ELC355	14.5	2.8.08	1.1.8D	1.4.8B	13.2.11E			
RR02	Analyze the circuit action of any mod-3 to mod-8 synchronous counter	ELC355	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR03	Draw a block diagram of a frequency divider circuit and explain its operation	ELC355	4.2	2.8.08	1.1.8D	1.4.8B	13.2.11E			
RR04	Interpret data sheets for several TTL and CMOS ICs	ELC355	14.3	2.6.08	1.1.8D	1.4.8B	13.2.11E			
RR05	Predict the operation of a 4-bit magnitude comparator IC from its truth table	ELC355	14.3	2.7.11	1.1.8D	1.4.8B	13.2.11E			
RR06	Analyze the operation of an electronic number game	ELC355	14.11	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR07	Determine the output for a variety of counters based on the inputs	ELC355	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR08	Explain the operation of a counting system driven by an optical sensor	ELC355	2.9, 14.4	2.4..11	1.1.8D	1.4.8B	13.2.11E			
RR09	List and explain the uses of several pieces of test equipment used in troubleshooting logic circuits	ELC355	14.9	N/A	1.1.8D	1.4.8B	13.2.11E			
RR10	Troubleshoot a faulty ripple counter circuit-lab	ELC355	14.9	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR11	Wire, test, and draw a logic diagram for a 4-bit ripple up-counter and down-counter using J-K flip-flops-lab	ELC355	14.4, 14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR12	Design, wire and test a modulo-10 ripple counter with a digital readout-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR13	Draw and construct a 4-bit counter using a 7493 IC, add a 7447 decoder and an LED display-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR14	Draw and construct a modulo-10 counter with binary and digital readouts-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR15	Wire and operate a decade up counter using a 74192 IC-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR16	Wire and operate a decade down counter using a 74192 IC-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR17	Wire and operate a 0-99 TTL up counter-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			

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RR18	Wire and operate a 99-0 TTL down counter-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR19	Use a 74192 TTL IC as a divide-by-10 counter-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR20	Wire and operate a 4-bit counter a frequency divider-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR21	Draw, construct and operate a 4-bit CMOS counter using a 74HC393 IC-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR22	Draw, construct and operate a 4-bit CMOS decade counter using a 74HC393 IC-lab	ELC355	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR23	Wire and operate an optical encoder-lab	ELC355	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR24	Wire and operate a counter system driven by an optical encoder-lab	ELC355	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR25	Construct and operate a binary hi-low number game-lab	ELC355	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR26	Construct and operate a 0-99 counter using CMOS ICs and a LCD-lab	ELC355	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR27	Draw a circuit diagram of a serial-load shift register using D flip-flops	ELC355	14.5	2.8.08	1.1.8D	1.4.8B	13.2.11E			
RR28	Define shift right, shift left, serial load, parallel load, describe the procedures for performing these operations on various shift registers	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR29	Interpret data sheets for various TTL and CMOS shift register ICs	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR30	Predict the operation of several TTL and CMOS ICs based on a series of inputs	ELC355	14.5	2.7.11	1.1.8D	1.4.8B	13.2.11E			
RR31	Analyze the operation of a digital roulette game	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR32	Troubleshoot a faulty shift register circuit	ELC355	14.5	2.5.11	1.1.8D	1.4.8B	13.2.11E			
RR33	Wire and operate a 4-bit aerial load shift register using 7474 TTL ICs-lab	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR34	Wire and operate a 4-bit parallel load recirculating shift-right register using J-K flip-flops -lab	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR35	Construct and operate the 74194 TTL IC as a ; serial load shift-right register, serial load shift-left register, parallel load shift register, and 8-bit shift register-lab	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
RR36	Construct and operate an 8-bit serial-in parallel-out shift register using the 74H164 CMOS IC-lab	ELC355	14.5	2.4..11	1.1.8D	1.4.8B	13.2.11E			
RR37	Construct and operate an 8-bit electronic roulette wheel-lab	ELC355	14.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS	**ARITHMETIC CIRCUITS**	**ELC356**								
SS01	Draw the block diagrams for the half- adder, full-adder, half-subtractor and full- subtractor	ELC356	4.1	2.8.08	1.1.8D	1.4.8B	13.2.11E			

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SS02	Solve binary addition and subtraction problems by hand and from truth tables	ELC356	9.2	2.8.11	1.1.8D	1.4.8B	13.2.11E			
SS03	Solve binary subtraction problems using the 1s complement and end-around carry methods	ELC356	9.4	2.8.11	1.1.8D	1.4.8B	13.2.11E			
SS04	Design and draw block-style logic diagrams for several parallel adder and subtractor circuits using half-adders, full- adders and gates	ELC356	4.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
SS05	Solve binary multiplication problems	ELC356	9.4	2.2.11	1.1.8D	1.4.8B	13.2.11E			
SS06	Convert decimal numbers to 2s complement notation and 2s complement notation to decimal numbers	ELC356	9.2	2.2.11	1.1.8D	1.4.8B	13.2.11E			
SS07	Add and subtract signed numbers using 2s complement addition and subtraction	ELC356	9.2	2.2.11	1.1.8D	1.4.8B	13.2.11E			
SS08	Troubleshoot a faulty full-adder circuit	ELC356	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
SS09	Draw, construct and operate a half-adder circuit-lab	ELC356	14.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			
SS10	Draw, construct and operate a full-adder using XOR and NAND gates-lab	ELC356	14.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			
SS11	Wire and operate a 3-bit parallel adder using AND,NAND, and XOR gates-lab	ELC356	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS12	Wire and operate a 4-bit parallel binary adder using a 7483 TTL IC-lab	ELC356	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS13	Convert a 7483 TTL IC adder to a 4-bit parallel binary subtractor using inverters-lab	ELC356	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS14	Draw, construct and operate a 2s complement adder/subtractor system using 7483 and 7486 ICs-lab	ELC356	14.4	2.8.08	1.1.8D	1.4.8B	13.2.11E			
SS15	Troubleshoot a full-adder circuit-lab	ELC356	14.4	2.5.11	1.1.8D	1.4.8B	13.2.11E			
SS16	Determine which gate within an IC is faulty-lab	ELC356	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS17	Test the normal operation of a 2s complement adder/subtractor system-lab	ELC356	14.1	2.4.11	1.1.8D	1.4.8B	13.2.11E			
SS18	Troubleshoot a faulty 2s complement adder/subtractor system-lab	ELC356	14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
TT	**MEMORIES**	**ELC357**								
TT01	List and characterize common memory and storage devices used in microcomputer systems	ELC357	14.11	N/A	1.1.8D	1.4.8B	13.2.11E			
TT02	Sketch the general organization of a computer; CPU, control bus, RAM, ROM, NVRAM, and bulk storage memory devices	ELC357	14.11	2.8.08	1.1.8D	1.4.8B	13.2.11E			
TT03	Match specific characteristics with semiconductor memory cell types	ELC357	2.6	N/ A	1.1.8D	1.4.8B	13.2.11E			

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TT04	Associate specific storage devices with their fundamental technologies (magnetic, optical, mechanical, etc.)	ELC357	14.11	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT05	Draw memory organization in table form, draw memory logic symbols	ELC357	14.6, 15.4	2.4.08	1.1.8D	1.4.8B	13.2.11E			
TT06	Explain the programming of memory	ELC357	15.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT07	Define the read/write processes in a memory and describe their operations	ELC357	15.4-15.6	2.4.11	1.1.8D	1.4.8B	13.2.11E			
TT08	Identify several specifications associated with semiconductor memories	ELC357	15.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT09	Identify several memory packages	ELC357	15.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT10	List and describe several bulk storage methods	ELC357	15.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT11	List several promising emergency memory technologies	ELC357	15.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
TT12	Wire and read the memory contents of a 7489 TTL read/write RAM-lab	ELC357	15.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
TT13	Program a 7489 RAM using the GRAY code-lab	ELC357	15.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
TT14	Operate a 7489 RAM as a binary-to-gray code converter after the memory is programmed-lab	ELC357	15.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
TT15	Wire and operate a random-counter using a ROM to store the counting sequence-lab	ELC357	14.4	2..4.11	1.1.8D	1.4.8B	13.2.11E			
UU	**DIGITAL AND COMPUTER SYSTEMS**	**ELC358**								
UU01	Identify six elements found in digital systems	ELC358	14.2	N/ A	1.1.8D	1.4.8B	13.2.11E			
UU02	Describe the internal organization of a typical calculator	ELC358	14.4	N/ A	1.1.8D	1.4.8B	13.2.11E			
UU03	Diagram the organization of a computer and microcomputer and describe the execution of a program	ELC358	14.11	2.8.08	1.1.8D	1.4.8B	13.2.11E			
UU04	Analyze the operation of a simple microcomputer address decoding system	ELC358	14.11	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU05	State several aspects of serial and parallel data transmission	ELC358	14.6	N/ A	1.1.8D	1.4.8B	13.2.11E			
UU06	Demonstrate knowledge of error detection and correction techniques	ELC358	14.3	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU07	Describe the operation of an adder/subtractor system	ELC358	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU08	Analyze the operation of a digital clock system	ELC358	14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU09	Analyze the operation of a digital frequency counter system	ELC358	14.1	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU10	Analyze the operation of an LCD timer system	ELC358	18.3	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU11	Analyze the operation of several digital game circuits	ELC358	14.11	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU12	Demonstrate a working knowledge of PLCs	ELC358	15.5	N/ A	1.1.8D	1.4.8B	13.2.11E			

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UU13	Convert relay schematics to relay logic diagrams, logic gate diagrams and Boolean expressions	ELC358	15.2	2.5.11	1.1.8D	1.4.8B	13.2.11E			
UU14	Summarize the difference between microprocessors and microcontrollers	ELC358	14.11	N/A	1.1.8D	1.4.8B	13.2.11E			
UU15	Explain the operation of a microcontroller driving an LED display circuit	ELC358	18.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU16	Wire and operate a memory address decoding circuit-lab	ELC358	14.6	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU17	Use three-state buffers to send information over a common data bus-lab	ELC358	14.6	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU18	Wire and operate a serial data transmission system using a 74150 IC and a 74514 IC-lab	ELC358	14.6	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU19	Wire and operate an adder/subtractor system-lab	ELC358	14.6	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU20	Wire and operate a digital stopwatch system using various TTL subsystems-lab	ELC358	14.6, 14.10	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU21	Wire and operate a digital frequency counter system using TTL ICs-lab	ELC358	14.6, 14.10	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU22	Wire and operate multiplexed 7-segment LED displays-lab	ELC358	14.6, 14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU23	Wire and operate a CMOS timer circuit with an LCD display and alarm-lab	ELC358	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU24	Calibrate a time-base circuit in a digital timer circuit-lab	ELC358	14.1	2.3.11	1.1.8D	1.4.8B	13.2.11E			
UU25	Wire and operate digital games using TTL ICs-lab	ELC358	14.11	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU26	Troubleshoot a frequency counter circuit-lab	ELC358	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU27	Diagram the organization of a computer and a program	ELC358	4.1, 15.1	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU28	Describe an address decoding system	ELC358	4.1, 15.1	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU29	Compare several aspects of serial and parallel data transmission	ELC358	16.3	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU30	Describe error detection and correction techniques	ELC358	16.5	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU31	Describe several applications of microcontrollers	ELC358	15.3	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU32	Summarize BASIC Stamp module characteristics	ELC358	15.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU33	Explain the functions of DSP, A/D, and D/A blocks	ELC358	15.3	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU34	Wire and test a memory address decoding circuit	ELC358	15.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
UU35	Wire and test a serial data transmission system	ELC358	15.9	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV	**CONNECTING ANALOG AND DIGITAL DEVICES**	**ELC359**								
VV01	Explain A/D and D/A conversions and how converters work	ELC359	14.2	2.3.11	1.1.8D	1.4.8B	13.2.11E			
VV02	Design an op amp circuit with a prescribed gain	ELC359	12.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
VV03	Analyze the operation of D/A converters	ELC359	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			

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VV04	Explain the operation of a counter-ramp A/D converter with a voltage comparator	ELC359	14.4	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV05	Identify several types of A/D converters	ELC359	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV06	List A/D converter specifications	ELC359	14.2	N/A	1.1.8D	1.4.8B	13.2.11E			
VV07	Describe the operation of the ADC0804 A/D converter IC	ELC359	14.2	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV08	Analyze several digital light meter systems	ELC359	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV09	Describe a DMM voltmeter system based on a 3 ½ digit LCD single chip A/D converter	ELC359	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV10	Construct and set the gain of an opamp used as a DC amplifier-lab	ELC359	12.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV11	Wire and operate a D/A converter-lab	ELC359	14.7	2.4.11	1.1.8D	1.4.8B	13.2.11E			
VV12	Construct an A/D converter and use as a voltmeter-lab	ELC359	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
VV13	Wire and operate an 8-bit A/D converter using a ADC0804 CMOS IC, calculate the conversion rate of the converter-lab	ELC359	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
VV14	Wire and operate a digital light meter circuit with binary and decimal readouts using the ADC0804 A/D converter IC-lab	ELC359	14.7	2.5.11	1.1.8D	1.4.8B	13.2.11E			
	60 - FIELD EXPERIENCE									
WW	**INTRO TO NANOTECHNOLOGY**	**ELC361**								
WW01	Troubleshoot equipment and devices	ELC361	20.8	Standard	1.4.11B	1.4.8B	13.2.11E			
WW02	Explain invoice and billing concepts for service businesses	ELC361	20.1	2.2.8	1.4.11B	1.4.8B	13.2.11E			
WW03	Locate and cross-reference parts and products in catalogs	ELC361	20.3	2.6.5	1.4.11B	1.4.8B	13.2.11E			
WW04	Demonstrate ways to procure service literature	ELC361	20.2	N/A	1.4.11B	1.4.8B	13.2.11E			
WW05	Keep proper records	ELC361	20.4	N/A	1.4.11B	1.4.8B	13.2.11E			
WW06	Record technician productivity	ELC361	20.5	2.6.8	1.4.11B	1.4.8B	13.2.11E			
WW07	Practice field technician work procedures which may differ from in-shop routines	ELC361	20.8	N/A	1.4.11B	1.4.8B	13.2.11E			
WW08	Manage a work station and repair sequence to achieve maximum results	ELC361	20.9	N/A	1.4.11B	1.4.8B	13.2.11E			
WW09	Define the term 'nanotechnology'	ELC361								
WW10	Describe nanomeasurement terms and equate them to common measurements	ELC361								
WW11	List and describe several careers in the nanotechnology field	ELC361						X		
XX	**NATIONAL SKILLS CERTIFICATE PRACTICAL FACTORS**	**ELC362**								
XX01	Train new employee in oscilloscope usage	ELC362	7.11	N/A	1.4.11B	1.4.8B	13.2.11E			
XX02	Demonstrate safe/proper use of a VOM	ELC362	7.3	N/A	1.4.11B	1.4.8B	13.2.11E			

Erie County Technical School
Electronics Duty/Task List

This program is accredited by the Electronics Technician's Association.				Pennsylvania Academic Standards				NOCTI Alignment Test Code 4035		PDE Program of Study Alignment
Duty Area and Task #	Content Areas, Course Titles and Task Statements	Course Number	National Skill Standards	Math	Reading	Writing	Career Education & Work	Written Test	Performance Test	CIP #15.0303
XX03	Repair a faulty PC board	ELC362	3.8	N/A	1.4.11B	1.4.8B	13.2.11E			
XX04	Prep and install various cable connectors	ELC362	5.13	N/A	1.4.11B	1.4.8B	13.2.11E			
XX05	Fabricate a PC board circuit	ELC362	3.8	N/A	1.4.11B	1.4.8B	13.2.11E			
XX06	Train new employee in series/parallel fundamentals	ELC362	11.1,2	2.6.5	1.4.11B	1.4.8B	13.2.11E			
XX07	Repair an ignition system	ELC362	17.1	N/A	1.4.11B	1.4.8B	13.2.11E			
XX08	Assemble, test, troubleshoot a soldered circuit	ELC362	3.8	N/A	1.4.11B	1.4.8B	13.2.11E			
XX09	Locate a bad audio component, order replacement, replace and test	ELC362	17.1	2.6.5	1.4.11B	1.4.8B	13.2.11E			
XX10	Troubleshoot primary gauges	ELC362	17.1	N/A	1.4.11B	1.4.8B	13.2.11E			
XX11	Construct a 120VAC/12VDC power supply	ELC362	6.2	N/A	1.4.11B	1.4.8B	13.2.11E			
XX12	Desolder and resolder a 14 pin DIP without damage	ELC362	3.8, 10	N/A	1.4.11B	1.4.8B	13.2.11E			
XX13	Identify, cross reference and order electronic parts	ELC362	20.3	2.6.5	1.4.11B	1.4.8B	13.2.11E			
XX14	Calculate and plot battery life in a low power device	ELC362	6.3	2.2.8	1.4.11B	1.4.8B	13.2.11E			
XX15	Construct a 4 bit parallel word register	ELC362	14.7	N/A	1.4.11B	1.4.8B	13.2.11E			
XX16	Induce a current in a wire loop and predict polarities	ELC362	1.2,3	N/A	1.4.11B	1.4.8B	13.2.11E			
XX17	Wire a fixed gain op amp and modify circuit to achieve a different gain	ELC362	12.7	2.5.11	1.4.11B	1.4.8B	13.2.11E		X	
XX18	Evaluate six types of batteries used in electronics	ELC362	6.3	N/A	1.4.11B	1.4.8B	13.2.11E			
XX19	Diagnose amp issues with square wave injection	ELC362	7.1,5,11	N/A	1.4.11B	1.4.8B	13.2.11E			
XX20	Deconstruct and explain CAT5e and CAT3 cables	ELC362	5.1,4,12	N/A	1.4.11B	1.4.8B	13.2.11E			
XX21	Identify individual channels on a spectrum analyzer	ELC362	7.12	N/A	1.4.11B	1.4.8B	13.2.11E			
YY	**NATIONAL SKILLS CERTIFICATE PREPARATION**	**ELC363**								
YY01	Access ETA website and complete the practice exam - log errors and remediate as necessary	ELC363			1.4.11B	1.4.8B	13.2.11E			
YY02	Complete course review exam battery	ELC363			1.4.11B	1.4.8B	13.2.11E			
YY03	Create a portfolio highlighting electronic careers/ requirements and current student skills/experiences	ELC363			1.4.11B	1.4.8B	13.2.11E			