



## BIOMEDICAL ELECTRONICS TECHNICIAN

**OD44003**

ALIGNED WITH NATIONAL SKILLS STANDARDS BOARD

## Competency-Based Education: OKLAHOMA'S RECIPE FOR SUCCESS

### ***BY THE INDUSTRY FOR THE INDUSTRY***

Oklahoma's *CareerTech* system of competency-based education uses industry professionals and certification standards to identify the knowledge and abilities needed to master an occupation. This industry input provides the foundation for development of instructional materials that help prepare the comprehensively trained, highly skilled employees demanded by our workplace partners.

### ***TOOLS FOR SUCCESS***

*CareerTech* relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction in Oklahoma's *CareerTech* system. The skills standards outline the knowledge, skills, and abilities needed to perform related jobs within an industry. Skills standards are aligned with national skills standards; therefore, a student trained to the skills standards possesses technical skills that make him/her employable in both state and national job markets.

**Curriculum materials** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources provide supplemental activities to enhance learning and provide hands-on training experiences.

**Competency Assessments** test the student over material outlined in the skills standards and taught using the curriculum materials. When used with classroom performance evaluations, written competency assessments provide a means of measuring occupational readiness.

Although each of these components satisfy a unique purpose in competency-based education, they work together to reinforce the skills and abilities students need to gain employment and succeed on the job.

### ***MEASURING SUCCESS***

Written competency assessments are used to evaluate student performance. Results reports communicate competency assessment scores to students and provide a breakdown of assessment results by duty area. The results breakdown shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

Group analysis of student results also provides feedback to instructors seeking to improve the effectiveness of career and technology training. Performance patterns in individual duties indicate opportunities to evaluate training methods and customize instruction.

### ***TRUE TO OUR PURPOSE***

"Helping Oklahomans succeed in the workplace" defines the mission of Oklahoma *CareerTech* and its competency-based system of instruction. Skills standards, curriculum, and assessments that identify and reinforce industry expectations provide accountability for programs and assure *CareerTech*'s continued role in preparing skilled workers for a global job market

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**ELECTRONICS  
BIOMEDICAL ELECTRONICS TECHNICIAN  
SKILLS STANDARDS  
Frequency and Criticality Ratings**

- Duty A: Demonstrate Proper Procedures and Practices for Safety in the Work Area
- Duty B: Demonstrate Employability Skills
- Duty C: Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment
- Duty D: Identify and Demonstrate Proper Use of Common Tools and Test Equipment
- Duty E: Identify Components, Establish Their Value or Parameters Using Common Reference Material and Color Codes, and Test for Proper Function
- Duty F: Demonstrate Proper Soldering and Desoldering Procedures
- Duty G: Identify Fasteners and Terminals and Demonstrate Proper Installation Procedures
- Duty H: Read and Interpret Schematics, Diagrams, and Blueprints
- Duty I: Interpret and Apply Industry-Specific Codes and Regulations
- Duty J: Evaluate Direct Current Circuits
- Duty K: Evaluate Alternating Current Circuits
- Duty L: Evaluate Common Semi-Conductor Devices
- Duty M: Evaluate Analog Circuit Devices
- Duty N: Evaluate Digital Logic Devices
- Duty O: Evaluate Microprocessor Systems
- Duty P: Evaluate Electro-Mechanical Devices and Controls
- Duty Q: Evaluate Communications Techniques and Equipment
- Duty R: Evaluate, Troubleshoot, and Upgrade Microcomputers, Peripherals, and Networks
- Duty T: Generate Technical Documentation
- Duty W: Demonstrate Knowledge of Basic Biomedical Electronics Technician Functions

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**Frequency:** represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

- 1 = less than once a week
- 2 = at least once a week
- 3 = once or more a day

**Criticality:** denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

- 1 = slight
  - 2 = moderate
  - 3 = extreme
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**DUTY A: Demonstrate Proper Procedures and Practices for Safety in the Work Area**

CODE	TASK	F/C
A.01	Identify and practice mechanical safety <ul style="list-style-type: none"> <li>• Tool safety</li> <li>• Hand safety</li> <li>• Eye safety</li> </ul>	2/3
A.02	Immediately report injuries/accidents following company procedures	2/3
A.03	Identify and practice electrical safety	3/3
A.04	Participate in "Right to Know" training and practice environmental safety <ul style="list-style-type: none"> <li>• Chemical awareness</li> <li>• Environmental regulations</li> <li>• Gases and pressure safety</li> </ul>	2/3
A.05	Identify and practice safety related to infectious disease, universal precautions, blood-borne pathogens, and chemical hygiene	2/3
A.06	Identify and practice thermal safety	2/2
A.07	Identify and practice radiation safety	2/2
A.09	Identify and practice laser safety	1/2
A.10	Demonstrate knowledge of lock-out/tag-out requirements and danger associated with potential energy sources	2/3
A.14	Identify and practice radar/high frequency radio safety	2/2
A.15	Identify and practice medical gas safety	2/2
A.16	Identify and practice fiber optic handling safety	2/2
A.17	Perform a leakage check on electronic equipment	1/2
A.18	Test electrical equipment to ensure proper grounding	2/2
A.19	Identify sources of hazardous noise	2/2

**DUTY B: Demonstrate Employability Skills**

CODE	TASK	F/C
B.01	Maintain a courteous and responsible attitude toward all customers	3/3
B.02	Demonstrate appropriate interpersonal skills	3/3
B.03	Maintain self-esteem in self and others <ul style="list-style-type: none"> <li>• Analyze personal space and needs</li> <li>• Interpret emotional reactions</li> <li>• Determine values scale and attitudes</li> <li>• Cope with changes</li> <li>• Interpret sensory clues</li> </ul>	2/2
B.04	Recognize the importance of teamwork and participate as a team member <ul style="list-style-type: none"> <li>• Participate in team (group) meetings <ul style="list-style-type: none"> <li>• Focus on topic and purpose of the meeting</li> <li>• Offer facts and ideas</li> <li>• Help others contribute facts and ideas</li> </ul> </li> <li>• Pass on good ideas</li> <li>• Look for ways to help others</li> </ul>	2/3

	<ul style="list-style-type: none"> <li>• Give recognition for things well done</li> <li>• Let others know what you need to get the job done</li> </ul>	
B.05	Maintain professional respect for supervisor and co-workers	3/3
B.06	Use professionalism <ul style="list-style-type: none"> <li>• Follow facility dress code</li> <li>• Exhibit positive attitude</li> <li>• Exhibit initiative</li> <li>• Exhibit loyalty</li> <li>• Exhibit respect to others</li> <li>• Exhibit flexibility</li> <li>• Exhibit commitment</li> <li>• Practice hygiene</li> </ul>	3/3
B.07	Use critical thinking skills in workplace situations <ul style="list-style-type: none"> <li>• Distinguish appropriateness of equipment and tests</li> <li>• Decision making</li> <li>• Creativity</li> <li>• Use quality performance processes</li> <li>• Use tools to analyze information             <ul style="list-style-type: none"> <li>• Use basic statistical concepts and analysis</li> <li>• Create charts</li> <li>• Create histograms</li> <li>• Create flow charts</li> </ul> </li> <li>• Use quality tools</li> <li>• Evaluate stressful situations</li> <li>• Evaluate how to manage ethical conflicts</li> </ul>	2/2
B.08	Maintain satisfactory attendance <ul style="list-style-type: none"> <li>• Punctuality</li> <li>• Tardiness</li> <li>• Early departure</li> <li>• Absence</li> <li>• Calling in</li> </ul>	3/3
B.09	Use stress management techniques	2/2
B.10	Function within the organizational structure <ul style="list-style-type: none"> <li>• Chain of command</li> <li>• Amount of empowerment</li> </ul>	2/2
B.11	Distinguish the departments within the organization	2/2
B.12	Distinguish the roles of the organizational members	2/2
B.13	Use self-management and time management techniques <ul style="list-style-type: none"> <li>• Independence</li> <li>• Self-evaluation</li> <li>• Leadership skills</li> <li>• Supervision</li> <li>• Delegation</li> <li>• Organization</li> <li>• Prioritization</li> <li>• Initiative</li> </ul>	3/2
B.14	Use deductive and inductive reasoning skills	3/3
B.15	Use proper telephone etiquette <ul style="list-style-type: none"> <li>• Project positive telephone image</li> <li>• Manage incoming telephone calls             <ul style="list-style-type: none"> <li>• Receive incoming calls</li> </ul> </li> </ul>	3/2

	<ul style="list-style-type: none"> <li>• Screen incoming calls</li> <li>• Transfer incoming calls when indicated</li> <li>• Manage multiple incoming calls</li> <li>• Use telephone log or computerized system</li> <li>• Manage telephone calls <ul style="list-style-type: none"> <li>• Inquiries</li> </ul> </li> <li>• Manage telephone calls involving special problems <ul style="list-style-type: none"> <li>• Unidentified callers</li> <li>• Angry callers</li> <li>• Calls from family and friends</li> </ul> </li> <li>• Manage telephone calls involving medical emergencies</li> <li>• Record and deliver telephone calls <ul style="list-style-type: none"> <li>• Local</li> <li>• Long distance</li> <li>• Conference</li> </ul> </li> <li>• Use special features if available</li> <li>• Identify factors that relate to a global business environment <ul style="list-style-type: none"> <li>• Time zones</li> <li>• International dialing codes</li> </ul> </li> <li>• Use telephone directories <ul style="list-style-type: none"> <li>• Evaluate types and organization of each type</li> <li>• Use telephone assistance and information</li> <li>• Maintain company directory</li> </ul> </li> </ul>	
B.16	Employ listening skills <ul style="list-style-type: none"> <li>• Show interest</li> <li>• Ask questions and clarify what has been heard</li> <li>• Let person know what you understand</li> </ul>	3/2
B.17	Compose written communication legibly using correct grammar, spelling, and format <ul style="list-style-type: none"> <li>• Compose questions</li> <li>• Compose consent forms</li> <li>• Compose student evaluation reports</li> <li>• Select and use appropriate format for written communication</li> <li>• Use reference materials as appropriate</li> <li>• Use proper grammatical techniques <ul style="list-style-type: none"> <li>• Abbreviate for words used in addresses, measurements, and months and days of the year</li> </ul> </li> <li>• Use proper punctuation</li> </ul>	3/3
B.18	Interpret and follow written directions and information	3/3
B.19	Interpret and follow oral directions	3/3
B.20	Use job-related terminology, symbols, and abbreviations	3/3
B.21	Use basic keyboarding skills and computer skills <ul style="list-style-type: none"> <li>• E-mail</li> <li>• File transfer protocol (FTP)</li> <li>• Internet</li> <li>• Operating System</li> <li>• Office Suite Products</li> </ul>	2/2
B.22	Use effective communication techniques with peers, co-workers, and customers <ul style="list-style-type: none"> <li>• Pronounce words correctly</li> </ul>	3/3
B.23	Use verbal and non-verbal communication techniques	3/2
B.24	Apply behavioral management techniques to workplace situations <ul style="list-style-type: none"> <li>• Use personal coping skills</li> </ul>	2/2

	<ul style="list-style-type: none"> <li>• Deal with customers and co-worker attitudes</li> <li>• Exhibit a sense of humor</li> <li>• Use positive feedback techniques <ul style="list-style-type: none"> <li>• Emphasize strengths</li> </ul> </li> <li>• Use negative feedback techniques <ul style="list-style-type: none"> <li>• Stress main points the person could do differently</li> </ul> </li> </ul>	
B.25	Identify personal and work-related goals and monitor progress <ul style="list-style-type: none"> <li>• Chart and set long, medium, and short term goals</li> <li>• Determine educational needs</li> <li>• Set professional goals</li> <li>• Set personal goals</li> </ul>	2/2
B.26	Respond to compliments, complaints, conflicts, and criticism appropriately	2/3
B.27	Compile research data	2/2
B.28	Apply electronics-related mathematical concepts <ul style="list-style-type: none"> <li>• Addition, subtraction, multiplication, and division of: <ul style="list-style-type: none"> <li>• Whole numbers</li> <li>• Fractions</li> <li>• Decimals</li> <li>• Percentages</li> </ul> </li> <li>• Exponents</li> <li>• Scientific notations</li> <li>• Significant digits</li> <li>• Basic trigonometry functions</li> <li>• Measurements <ul style="list-style-type: none"> <li>• U.S. to metric</li> <li>• Metric to U.S.</li> </ul> </li> <li>• Use of calculator</li> <li>• Concept of coins and currency</li> <li>• Estimation</li> <li>• Reading charts, graphs, and tables</li> <li>• Basic geometry</li> <li>• Application of formulas <ul style="list-style-type: none"> <li>• Word problems</li> <li>• Thought problems</li> </ul> </li> </ul>	2/2
B.29	Use negotiation skills <ul style="list-style-type: none"> <li>• Interpret how to reasonably disagree</li> <li>• Interpret ways to overcome objections</li> <li>• Solve everyday human relation problems</li> </ul>	2/2
B.30	Use career development skills <ul style="list-style-type: none"> <li>• Write cover/application letter</li> <li>• Complete job application</li> <li>• Interpret Form W-2</li> <li>• Write a job description</li> <li>• Investigate an occupation</li> <li>• Explore career opportunities</li> <li>• Compare career options</li> <li>• Develop a personal career plan</li> <li>• Negotiate salary and benefits</li> </ul>	2/2
B.31	Use multi-cultural sensitivity skills <ul style="list-style-type: none"> <li>• Recognize and respect diverse customs and accommodate them in the work environment</li> </ul>	2/2

B.32	Understand anti- discriminatory laws and take steps to comply with laws relating to: <ul style="list-style-type: none"> <li>• Gender</li> <li>• Race</li> <li>• Disability</li> <li>• Age</li> <li>• Religion</li> <li>• National origin</li> <li>• Color</li> </ul>	2/2
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**DUTY C: Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment**

CODE	TASK	F/C
C.11	Use an electrical safety analyzer	3/3
C.12	Use an electrical surgical analyzer	3/3
C.13	Distinguish difference between life support and general biomedical equipment	3/3
C.14	Use appropriate instrumentation to test ESD protective systems	2/3
C.15	Use simulator for vital signs monitoring	2/2
C.16	Use a photo tachometer	1/2
C.17	Use an ultrasound watt meter	1/2
C.22	Use an optical pyrometer to measure temperature	2/2
C.27	Use laser power meter	1/1
C.28	Use a temperature measurement device	2/2
C.29	Use defibrillator analyzer	2/2
C.30	Use a SPO <sub>2</sub>	2/2

**DUTY D: Identify and Demonstrate Proper Use of Common Tools and Test Equipment**

CODE	TASK	F/C
D.01	Use an analog multimeter to measure: <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> <li>• Resistance</li> </ul>	2/3
D.02	Use a digital multimeter to measure: <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Current</li> <li>• Resistance</li> </ul>	3/3
D.03	Use an oscilloscope to measure AC, DC, and time-based waveforms	2/3
D.04	Use a function/signal generator to simulate necessary signals	2/2
D.05	Use frequency counters to measure frequencies and period	2/2
D.06	Use a digital storage oscilloscope to capture and display specialized waveforms	2/3
D.07	Use a logic probe to analyze logic circuits	2/2
D.08	Use capacitor/inductor analyzer to test passive circuit elements	2/2
D.09	Use a pulse injector to insert pulses into digital circuitry	2/2
D.10	Use a video pattern generator to align or troubleshoot video display devices	2/1
D.11	Use a spectrum analyzer to analyze frequency waveforms	2/2

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D.13	Use variac	2/2
D.14	Use isolation transformer	2/2
D.15	Use DC power supply	2/3
D.16	Use an AC circuit polarity tester	2/2
D.18	Use an electrical resistance insulation tester (megger)	1/2
D.20	Use a thermocouple calibration instrument	1/2
D.21	Demonstrate proper use of instrument calibration tools/equipment	2/2
D.22	Demonstrate proper care and use of precision measuring tools and instruments	3/3
D.23	Use clamp on meters (volt or amp)	1/2
D.24	Perform metric and standard mechanical measurements	2/2
D.25	Demonstrate proper use of hand tools	3/3
D.26	Demonstrate proper use of power tools	2/3

**DUTY E: Identify Components, Establish Their Value or Parameters Using Common Reference Material and Color Codes, and Test for Proper Function**

CODE	TASK	F/C
E.01	Distinguish between conductors and insulators – basic materials	2/3
E.02	Identify types of cells and batteries and demonstrate proper storage and handling procedures	2/2
E.03	Identify the types and applications of connectors	2/2
E.04	Identify the types and applications of lamps	1/2
E.05	Identify parts and functions of motors and generators	2/2
E.06	Identify functions of solenoids, relays, and switches	2/2
E.07	Determine resistor values by color code and size	2/3
E.08	Identify diode types and parameters by color codes and/or markings	2/2
E.09	Identify types of transistors and their parameters	2/2
E.10	Identify types of thyristors and their parameters	2/2
E.11	Identify integrated circuit families	2/2
E.12	Identify synchro, servo, and stepper motors, associated components, characteristics, and operations	2/2
E.13	Identify and test circuit protection devices	2/2
E.14	Demonstrate proper handling of static-sensitive devices	2/3
E.15	Identify types and applications of various photo-sensitive devices	2/2
E.16	Determine capacitor values	2/3
E.17	Determine inductor values	2/3
E.18	Identify transformer ratings and lead configurations by color codes and/or markings	1/2
E.19	Identify types of antenna systems and their use	2/2
E.20	Identify and test basic electron tubes	2/2
E.21	Identify and test types and applications of various temperature sensitive devices	1/2
E.22	Identify components of basic x-ray systems	1/1
E.23	Identify types, applications, and characteristics of electronic and pneumatic control	2/2

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	loop components	
E.25	Test conductors and insulators	2/2
E.26	Test cells and batteries	2/2
E.27	Test connectors	2/2
E.28	Test lamps	1/2
E.29	Test motors and generators	2/2
E.30	Test solenoids, relays, and switches	2/2
E.31	Test resistors	3/3
E.32	Test diodes	3/3
E.33	Test transistors	3/3
E.34	Test thyristors	2/2
E.35	Test integrated circuits	2/2
E.36	Test, synro, servo, and stepper motors	2/2
E.37	Test various photo-sensitive devices	1/2
E.38	Test capacitors	2/2
E.39	Test inductors	2/3
E.40	Test transformers	2/2
E.41	Test antenna systems	2/2
E.42	Test common electronic and pneumatic control loop components	1/2
E.45	Identify types/sizes of wire and cable and appropriate applications	2/2

**DUTY F: Demonstrate Proper Soldering and Desoldering Procedures**

CODE	TASK	F/C
F.01	Perform standard soldering and desoldering techniques	2/3
F.03	Identify multi-layer boards and demonstrate knowledge of procedural differences	2/2
F.04	Perform surface-mount soldering and desoldering techniques	2/2
F.06	Perform high and low temp soldering	2/2

**DUTY G: Identify Fasteners and Terminals and Demonstrate Proper Installation Procedures**

CODE	TASK	F/C
G.01	Identify types of fasteners and terminals	1/1
G.02	Demonstrate use of fasteners and terminals	1/1
G.03	Differentiate between types and sizes of screws	2/1

**DUTY H: Read and Interpret Schematics, Diagrams, and Blueprints**

CODE	TASK	F/C
H.01	Identify and use common notations and symbols	2/3
H.02	Use schematics, diagrams, and blueprints to locate and identify specific equipment within areas	3/3

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H.03	Use schematics, diagrams, and blueprints to interface subassemblies/peripherals	3/3
H.04	Trace signal/power flow	3/3
H.05	Recognize proper waveforms	2/3
H.06	Use schematics, diagrams, and blueprints to construct/assemble equipment	2/2
H.07	Maintain service documentation library/Internet file	2/3

#### **DUTY I: Interpret and Apply Industry-Specific Codes and Regulations**

<b>CODE</b>	<b>TASK</b>	<b>F/C</b>
I.01	Research and apply appropriate codes and regulations	1/2
I.02	Define occupationally-specific required licenses/certifications	1/2
I.04	Research and apply NFPA-99, NEC 76, FDA Safe Medical Device Act (SMDA), OSHA CFR Part 29, AAMI, JCAHO, and AHA	1/2
I.05	Research and apply appropriate sections of the National Electrical Code, Building Officials Code Administration (BOCA), and the National Fire Protection Agency (NFPA) fuel gas code	1/2
I.06	Demonstrate familiarity with coding and certifying agencies (CENELEC, UL, CSA, FM, etc.)	1/2

#### **DUTY J: Evaluate Direct Current Circuits**

<b>CODE</b>	<b>TASK</b>	<b>F/C</b>
J.01	Solve basic algebraic problems as applicable to electronics	2/3
J.02	Relate electricity to nature of matter	1/2
J.03	Identify sources of electricity <ul style="list-style-type: none"> <li>• Chemical</li> <li>• Mechanical</li> <li>• Thermal</li> <li>• Tibro (static)</li> <li>• Piezo</li> <li>• Photo voltaic</li> </ul>	2/2
J.04	Define voltage, current, resistance, power, and energy	2/3
J.05	Apply and relate Ohms Law	2/3
J.06	Measure properties of a circuit using VOM and DVM meters	3/3
J.07	Compute and measure conductance and resistance of conductors and insulators	2/2
J.08	Analyze, construct, and troubleshoot series circuits, parallel circuits, series-parallel circuits, and voltage dividers	2/3
J.09	Define magnetic properties of circuits and devices	1/2
J.10	Apply logical and systematic approach to troubleshooting DC circuits	2/3
J.11	Solve network theorem problems using Kirchhoff, Thevenin, Norton, and Superposition	1/2
J.12	Analyze and measure RL and RC time constants	1/2

**DUTY K: Evaluate Alternating Current Circuits**

CODE	TASK	F/C
K.01	Identify properties of an AC signal	2/3
K.02	Identify AC sources	2/2
K.03	Set up and operate test equipment for AC circuits	2/2
K.04	Analyze and measure AC signals using proper test equipment	2/3
K.05	Analyze and apply principles in transformers to AC circuits	2/2
K.06	Apply logical and systematic approach to troubleshooting AC circuits	3/3
K.07	Analyze basic motor theory and operation	1/2
K.08	Identify and configure Delta and Wye configurations	1/2
K.09	Analyze basic generator theory and operation	1/2
K.10	Solve basic trigonometric problems as applicable to electronics	1/2
K.11	Construct, analyze, and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (series, parallel, complex) series and parallel resonant circuits, filter circuits, and polyphase circuits	2/2
K.12	Analyze, construct, and troubleshoot maximum power transfer theory	2/2

**DUTY L: Evaluate Common Semi-Conductor Devices**

CODE	TASK	F/C
L.01	Identify properties of semi-conductor materials	2/2
L.02	Analyze and measure characteristic of P-N junction diodes	2/2
L.03	Analyze and measure characteristics of special diodes	2/2
L.04	Analyze, construct, and troubleshoot diode circuits	2/2
L.05	Identify, define, and measure characteristics of unipolar and bipolar devices, thyristors, and integrated circuits	2/2
L.06	Apply logical and systematic approach to troubleshooting semi-conductor devices	2/3
L.07	Set up and operate test equipment for solid state devices	2/3

**DUTY M: Evaluate Analog Circuit Devices**

CODE	TASK	F/C
M.01	Analyze, construct, and troubleshoot single stage amplifiers	2/2
M.02	Analyze, construct, and troubleshoot multi-stage amplifiers	2/2
M.03	Analyze, construct, and troubleshoot operational amplifiers	2/2
M.04	Analyze, construct, and troubleshoot basic power supplies and filters	2/2
M.05	Analyze, construct, and troubleshoot oscillators	2/2
M.06	Analyze motor or phase control circuits	2/2
M.07	Apply logical and systematic approach to troubleshooting analog circuit devices	2/3
M.08	Analyze, construct, and troubleshoot power supply regulators	2/2
M.09	Analyze, construct, and troubleshoot active filters	2/2
M.10	Set-up and operate test equipment for analog circuits	2/3
M.11	Troubleshoot switching power supplies	2/3

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M.12	Analyze and troubleshoot phase-locked-loop systems	2/2
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**DUTY N: Evaluate Digital Logic Devices**

CODE	TASK	F/C
N.01	Define and apply number systems to codes and arithmetic operations	2/2
N.02	Analyze, construct, and troubleshoot logic gates, logic arithmetic circuits, flip-flops, and encoders and decoders	2/2
N.03	Analyze, construct, and troubleshoot registers and counters, clock and timing circuits, multiplexers and demultiplexers, digital to analog and analog to digital devices, and discrete inputs and discrete outputs	2/2
N.04	Analyze, construct, and troubleshoot displays and representative digital systems	2/2
N.05	Apply logical and systematic approach to troubleshooting digital logic devices	3/3
N.06	Set-up and operate test equipment for digital devices	3/3

**DUTY O: Evaluate Microprocessor Systems**

CODE	TASK	F/C
O.01	Analyze and troubleshoot processors	2/2
O.02	Analyze and troubleshoot memory systems	2/2
O.03	Analyze and troubleshoot input/output systems	2/2
O.04	Apply logical and systematic approach to troubleshooting microprocessor systems	2/2
O.05	Analyze and troubleshoot bus systems and protocols	2/2
O.06	Execute computer instruction sets	2/2
O.07	Demonstrate proper use of system diagnostics	2/2

**DUTY P: Evaluate Electro-Mechanical Devices and Controls**

CODE	TASK	F/C
P.01	Demonstrate knowledge of and ability to work on mechanical systems	3/3
P.02	Disassemble and reassemble complex electro-mechanical systems	2/3
P.03	Demonstrate knowledge of preventative and ongoing maintenance procedures and the effects on electro-mechanical equipment	2/2
P.04	Analyze and evaluate electro-mechanical sensors and transducers	3/3
P.05	Analyze and evaluate proximity indicators or switches	2/2
P.06	Analyze and evaluate syncro, servo, and stepper systems	2/2
P.07	Analyze and evaluate electrically-operated valves	2/2
P.08	Analyze and evaluate positional measurement devices	2/2
P.10	Analyze and evaluate flow measurement devices	2/2
P.11	Analyze and evaluate load cells	2/2
P.12	Analyze and evaluate temperature measurement devices	2/2
P.13	Analyze and evaluate pressure measurement devices	2/2
P.14	Analyze and evaluate level measurement devices	2/2

P.16	Analyze and evaluate receiving units for telemetry	2/2
P.19	Analyze and evaluate analytical measurement devices	2/2

**DUTY Q: Evaluate Communications Techniques and Equipment**

CODE	TASK	F/C
Q.01	Test and troubleshoot AM circuits	2/2
Q.02	Test and troubleshoot FM circuits	2/2
Q.04	Demonstrate knowledge of digital communication systems	2/2
Q.05	Demonstrate knowledge of fiber optic communication systems	2/2
Q.06	Demonstrate knowledge of telemetry communication systems	2/2
Q.07	Demonstrate knowledge of analog communication systems	2/2
Q.08	Demonstrate knowledge of principles of electro-magnetic wave propagation	2/2
Q.10	Analyze and troubleshoot antennae systems and transmission lines	1/2
Q.12	Demonstrate knowledge of preventative and ongoing maintenance procedures and the effects on electronic communications equipment	2/2

**DUTY R: Evaluate, Troubleshoot, and Upgrade Microcomputers, Peripherals, and Networks**

CODE	TASK	F/C
R.01	Identify subsystems of a microcomputer	2/2
R.02	Install, troubleshoot, and analyze microcomputer I/O systems	2/2
R.03	Demonstrate a working knowledge of hardware used to troubleshoot	2/2
R.04	Demonstrate a working knowledge of software used to troubleshoot	2/2
R.05	Demonstrate a working knowledge of various operating systems	2/2
R.06	Demonstrate knowledge of functions of application programs	2/2
R.07	Install and verify proper operation of microcomputer systems	2/2
R.08	Install and verify proper operation of microcomputer power supplies	2/2
R.09	Install and verify proper operation of microcomputer memory systems	2/2
R.10	Install and verify proper operation of microcomputer processor circuits	2/2
R.11	Install and verify proper operation of microcomputer co-processor circuits	2/2
R.13	Install and verify proper operation of diskette drives	2/2
R.14	Install and verify proper operation of hard disk drives	2/2
R.15	Install and verify proper operation of CD ROM drives	2/2
R.16	Install and verify proper operation of tape drives	2/2
R.17	Install and verify proper operation of monitor systems	2/2
R.18	Install and verify proper operation of keyboards	3/2
R.19	Install and verify proper operation of printers and plotters	2/2
R.22	Demonstrate the ability to configure installed software/hardware to work with installed peripherals	2/2
R.25	Install and troubleshoot cables	2/2
R.30	Construct and install cable connectors and interfaces	2/2

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R.31	Configure, install, and troubleshoot network applications software	2/2
R.33	Demonstrate knowledge of preventative and ongoing maintenance procedures and the effects on electronic communications equipment	2/2

**DUTY T: Generate Technical Documentation**

CODE	TASK	F/C
T.01	Prepare customer documents used for removal, repair, and reinstallation of an electronic system or component	2/2
T.02	Prepare typical work orders, logbooks, and historical records	3/3
T.03	Perform proper and complete documentation of maintenance and repair actions	3/3
T.04	Research and order parts	2/2
T.05	Demonstrate the ability to properly document engineering changes or field modifications	2/2
T.07	Identify the sign-off authority and responsibilities of technician	2/2
T.08	Complete work order using electronic documentation	2/2

**DUTY W: Demonstrate Knowledge of Basic Biomedical Electronics Technician Functions**

CODE	TASK	F/C
W.01	Describe the relationship of biomedical equipment to the human anatomy/physiology and biopotentials	2/2
W.02	Demonstrate knowledge of basic medical terminology	3/3
W.03	Demonstrate knowledge of basic organization of field, industry, and hospital	2/2
W.04	Explain the basic functions of biomedical instrumentation <ul style="list-style-type: none"> <li>• Monitoring</li> <li>• Measurement</li> <li>• Analysis</li> </ul>	2/2
W.05	Demonstrate knowledge of basic principles of imaging equipment <ul style="list-style-type: none"> <li>• Ultrasound</li> <li>• MRI</li> <li>• CT</li> <li>• PET</li> <li>• Mammography</li> <li>• Radiology</li> <li>• Nuclear medicine</li> </ul>	2/2
W.06	Demonstrate basic knowledge of biophysical electrodes and transducers	2/2
W.07	Demonstrate knowledge of basic respiratory equipment and their functions	2/2
W.08	Demonstrate grounding and leakage current measurements	3/3
W.09	Explain basic functions of surgical instrumentation <ul style="list-style-type: none"> <li>• Lasers</li> <li>• Electrosurgical units</li> <li>• Fiberoptic light sources</li> <li>• Endoscopic video systems</li> <li>• Blood recovery units</li> </ul>	2/2
W.10	Explain basic functions of clinical laboratory equipment <ul style="list-style-type: none"> <li>• Centrifuges</li> <li>• Chemical analyzers</li> </ul>	2/2

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	<ul style="list-style-type: none"><li>• Slide strainers</li></ul>	
W.11	Demonstrate knowledge of basic hemodialysis equipment	1/2