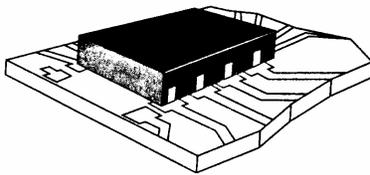


PTE 405

Curriculum Guide for SECONDARY ELECTRONICS TECHNOLOGY



**State Division of Professional Technical Education
650 W. State Street
Boise, ID 83720**

June 2002

Idaho State Board for Professional Technical Education

Tom Boyd
President

Karen McGee
Vice President

James Hammond

Blake Hall

Curtis Eaton

Dr. Marilyn Howard

Darrel Manning

Rod Lewis

Mr. Gary Stivers
Executive Director

Dr. Mike Rush
Administrator
Division of Professional Technical Education

The Idaho Division of Professional Technical Education is an equal opportunity employer. Hiring is done without regard to race, color, religion, national origin, sex, age, or disability. Appropriate consideration shall be given to veterans in accordance with applicable state and federal laws and regulations.

Costs associated with this publication are available from State Division of Professional Technical Education in accordance with Section 60-202, Idaho Code .06/02/PTE405.

ACKNOWLEDGMENTS

This publication is a description of the Electronics Technology curriculum that is being recommended as the State Curriculum Guide for Secondary level programs. It is a reflection of the National Skills Standards developed by the Electronics Industries Association for the Basic Technician and the Idaho Electronics Technology Curriculum Guide developed in 1997.

The original document was developed by a committee of instructors and industry personnel. The development of the document covered a period of four years. Appreciation is extended to the Electronics Industries Foundation (EIF) for the provision of the National Skills Standards and associated materials. Funded by a grant from the Division of Professional Technical Education, the committee devoted many hours to the development of this guide. It followed the development of Idaho Electronics Technical Committee Report which outlined a proposed task list for Idaho schools.

Committee members to be recognized for their time and efforts in the first phase of development include Robert (Bob) Dodson, Boise State University; Randy Graves, Ronald Willford, Eastern Idaho Technical College; Calvin Christensen, Rob Robertson, Idaho State University; Mike Bradley, Lewis-Clark State College; Brian Coons, John Dunn, North Idaho College; Dean Baker, Burley High School; George Siegner, Advanced Input Devices; Ernie Marks, Micron Technology, Inc.; Mike Bir, Hewlett Packard; Jim McIver, Lewiston Tribune; and Rick Kramer, AMC Gould.

Special recognition is given to Committee members who served on both the first and second phases of development including: Ben Bartlett, College of Southern Idaho; Glenn Brusse, Micron Technologies.; Paul Evans, Lockheed Martin Idaho Technologies; Steve Hall, S & S Hall and Associates; Mike Lyons, Boise State University; Stan Sluder, Boise State University; and Harlan Vandenbark, Lewis-Clark State College.

The major emphasis of the committee in preparing this document was to align Idaho's Secondary Electronics Technology Curriculum with National Skills Standards. Some of the competencies identified in this document will also prepare students to meet the Idaho Achievement Standards proposed by the State Board of Education. A separate Achievement Standards Mapping Matrix is included as a part of this Guide.

The **Secondary Curriculum Committee** met over a period of time to align the content of the Electronics programs in the State with National Standards and identify competencies which would be appropriate for secondary level instruction. The committee consisted of the following personnel:

Eric Allred	Preston High School	Curt Thomas	Hillcrest High School
Tony Di Viesti	Malad High School	Ron Willford	EITC Secondary level
Bill Weekes	Cassia Regional Center	Harold Nevill	Vallivue High School
Paul Fischer	Meridian Academy	Lloyd Verhage	Boise PTS
Dave Darling	Sandpoint High School	Cindy Watts	Pocatello High School
Mike Lyons	BSU Program Manager	Glenn Brusse	Micron Technology
Stan Sluder	BSU Manufacturing/Electronics	Nancy Ness	BSU Tech Prep Coordinator

Don Eshelby, Ed.D.
Program Manager
Trade and Industry Education

INTRODUCTION

The Idaho Electronics Technology Curriculum Guide is intended to describe the scope of Electronics programs in Idaho institutions and high schools. The document consists of two main parts; the Basic Technician curriculum and the Optional programs available through Idaho postsecondary institutions. The Basic Technician curriculum includes Performance and Enabling Objectives while the Optional modules list only tasks to be offered. Time did not permit the development of objectives for the optional modules because there are significant variations in program offerings that exist between institutions during the second year of the program. Not all the instructional content provided by Idaho programs is reflected in this publication as some institutions cover additional topics specific to their programs only.

The Basic Technician curriculum is considered to be the core curriculum for Electronics programs in all institutions in Idaho. Of significance to the program offering is the intent of the Electronics Technical Committee that no institution should begin to teach the optional areas until the students have mastered the competencies identified in the Basic Technician Module. The committee expected that all programs be consistent in the content of the Basic Technician Module but did not want to limit the course content to one year. Institutions have the option of offering the Basic Technician module for two or more semesters, if it is necessary.

A footnote to the development of the National Skills Standards would show that Mike Bir, Paul Evans, and Don Eshelby served on the EIA National Skills Standards Project (NSSP) Technical Committee along with 24 members from industry across the USA. Glenn Brusse also served on the committee in the latter stages. The NSSP committee adapted the task list developed by Idaho's Technical Committee for Electronics Technology as the basis for the national task list. Idaho also served as an ad-hoc committee site for four regional meetings in which thirty-two different industry personnel provided information to the NSSP director during the development of the Skills Standards. Surveys were also provided to selected Idaho industries to gather additional feedback and suggestions for the development of the National Skills Standards.

The **Secondary Electronics Curriculum Guide** was developed from the Basic Electronics Skills Module of the Idaho Electronics Technology Curriculum Guide. In addition to basic electronics skills, secondary students are provided related academic and employability skills. These skills parallel the National Skills Standards and include some of the Achievement Standards proposed by the Idaho State Board of Education. The first Unit of Instruction, Employability Skills and Habits, identifies skills that are specific to the related academic competencies and which are also imbedded throughout the technical content in each of the other Units of Instruction.

Idaho has mapped the Task List for Electronics to the Idaho Achievement Standards to reflect the attainment of academic skills of students who enroll in the program. The skills identified in the Mapping Matrix are considered to be content which reinforces the academic standards learned in existing courses at the school.

Course Descriptions

Basic Electronics Technology TI 0501

This is the beginning level course of the Electronics Technology program. Students should completed or be currently enrolled in Algebra I, prior to enrolling in the course. The course will reinforce skill development in applied mathematics and physics through theory and laboratory assignments based on industry procedures. Students will be provided instruction on safety, introduction to the Electronics industry, tool and equipment use, soldering techniques, and employability skills and habits. Students will be involved in activities which will reinforce Problem Solving, Teaming, Language Arts, Science, and Mathematics skills through real-life industry examples and procedures. The course will give students the opportunity to study devices that use DC to Series-Parallel circuits and AC concepts. This course should be offered as a year-long course. (Semester optional)

Intermediate Electronics Technology TI 0502

This is the second level course in the Electronics Technology program This course is a year-long offering. Students will be required to develop a Project Development Plan and do research on the various projects they will build as a part of the course. Students will be involved in activities which will reinforce Problem Solving, Teaming, Language Arts, Science, and Mathematics skills through real-life industry examples and procedures. The course will give students the opportunity to build and test devices that use DC to Series-Parallel circuits, AC concepts, digital, and solid state circuits. This course should be offered as a year long course. TI0501 required or permission of instructor.

Advanced Electronics Technology TI 0503

This is the third level course in Electronics Technology. This course consists of a multiple period block of instruction offered for a full year. Students will refine their Project Development Plan and develop more detailed projects in final form during the course. The course will give students the opportunity to build and test advanced level devices that use DC principles for RC and RL circuits and AC concepts. Digital and Solid State circuits including FET, IC, and combinational logic applications will be studied and tested. Academic subject fields will be reinforced throughout all aspects of the course and students will be expected to practice proper Customer Relations skills at all times. All students will be expected to complete an internship and a number of special projects to earn credit in the course. TI 0502 is required.

Suggested Sequence of Instruction

Trade and Industry programs in Idaho schools are typically offered as a three year sequence of instruction, beginning at the sophomore level. The recommended time of instruction covers approximately 630-720 hours of instruction. Students should have Algebra I prior to enrolling in the program.

The first offering is an introductory course with a few simple applications of electronics concepts and principles. The primary purpose of this course is to provide a basic understanding of DC electronics and sound laboratory procedures. The course is to be offered as a year-long course but some schools may offer it on a semester basis, depending on local conditions, to develop a large base of students to draw from for the junior level class.

The second course offering is a year-long course for all students enrolled. The students are provided laboratory exercises which reinforce Mathematics and Science skills as they relate to DC and AC electronics applications. Some schools offer academic credit for this course in either or both Mathematics and Science.

The Advanced level course is a two period block of instruction offered for a year. Schools that offer trimester courses are also required to provide instruction for a full year. Opportunities for Industry-Based instruction should be offered at this level but laboratory exercises will comprise the bulk of the instructional time. Students are required to master the skills of a Basic Technician and will have the opportunity to take an Industry Examination on completing the program.

Successful completion of the three year sequence of instruction will provide students the articulation or dual course credit for transfer to Postsecondary institutions in Idaho. Competency Profiles will be provided for all students to record their progress and technical competence. Copies of the profiles are available from the Division of Professional-Technical Education in either hardcopy or electronic format. They are accessible from the Division’s web site at www.pte.state.id.us under Trade and Industry Education.

Students must be provided an opportunity to develop and practice leadership skills. The recommended process for these opportunities is to provide a chapter of SkillsUSA for the program. Each instructor is expected to serve as an Advisor to the SkillsUSA Chapter and conduct regular chapter meetings. The Professional Development Plan (PDP) is the basic instructional material to be used with the chapter. Any other leadership offering must be approved by the Program Manager.

Sample Instructional Model for class offerings:

One Block of Instruction for one Period should include one hour of time

Fall Semester

Spring Semester

Basic Electronics Technology TI 0501	Basic Electronics Technology TI 0501
Intermediate Electronics Technology TI 0502	Full Year
Advanced Electronics Technology TI 0503	Full Year

TABLE OF CONTENTS

Acknowledgments.....	ii
Introduction.....	iii
Course Description.....	iv
Table of Contents.....	vi
Workplace Requirements.....	1
Secondary Electronics Technology Task Lists.....	2
Unit 1 Employability Skills and Habits	6
Unit 2 Demonstrate Proficiency in Laboratory Practices	14
Unit 3 Demonstrate Proficiency in Technical Communication Skills.....	20
Unit 4 Demonstrate Proficiency in DC Circuits	25
Unit 5 Demonstrate Proficiency in AC Circuits	34
Unit 6 Demonstrate Proficiency in Discrete Solid-State Devices and Circuits	39
Unit 7 Demonstrate Proficiency in Digital Circuits.....	45
Unit 8 Demonstrate Proficiency in Customer Relations	50
EIA Competency Profiles	55

Workplace Requirements

Job Skills

- Basic reading, writing and math skills - able to pass an entry level skills assessment
- Keyboarding and basic knowledge of computers - can use computers at basic level or level needed in the job
- Problem solving and reasoning skills - able to think logically and find innovative solutions
- Interpersonal communications skills - able to get along well with others; able to work well in groups; able to handle own conflicts

Personal Traits/Attitudes

- Dependability - can be counted on in attendance and job assignments
- Accepts responsibility for self/actions - self motivated; able to accept mistakes without blaming others
- Honesty and integrity - is principled, sincere and genuine; actions match words
- Flexibility and adaptability - able to handle change; willingness to take on any assignment
- Strong work ethic - willing to do whatever it takes to get the job done well
- Enthusiastic and positive - able to leave personal problems at home and contribute to a pleasant work environment
- Continuous learner - willing and able to gain new knowledge and learn new skills
- Resilience and perseverance - ability to overcome adversity and stay focused
- Attention to detail - inspects own work, follows through with all details of job assignments

SECONDARY ELECTRONICS TECHNOLOGY TASK LIST

SECONDARY ELECTRONICS TECHNOLOGY TASK LIST

UNIT ONE: Employability Skills and Habits

- 01.01 Work Ethics and Behavior.
- 01.02 Interpersonal Relationships.
- 01.03 Team Work.
- 01.04 Technical Literacy.
- 01.05 Communicating on the Job.
- 01.06 Solving Problems and Critical Thinking.
- 01.07 Proficiency in Mathematics.
- 01.08 Proficiency in Physics.
- 01.09 Adapt to Change.
- 01.10 General Technical Skills.

UNIT TWO: Demonstrate Proficiency in Laboratory Practices

- 02.01 Apply proper OSHA safety standards (some generic across other areas).
- 02.02 Demonstrate proficiency in troubleshooting techniques.
- 02.03 Practice good electrostatic discharge (ESD) damage prevention.
- 02.04 Identify and use hand tools properly.
- 02.05 Identify and use power tools properly.
- 02.06 Demonstrate acceptable soldering and desoldering techniques, including through-hole and surface mount device applications.
- 02.07 Demonstrate ability to make solderless connections.
- 02.08 Demonstrate proficiency in basic electronic fabrication skills.
- 02.09 Document all lab projects/procedures in a clear concise written format.
- 02.10 Demonstrate computer skills.

UNIT THREE: Demonstrate Proficiency in Technical Communication Skills

- 03.01 Interpret written, graphic and/or oral instruction.
- 03.02 Develop pertinent written, graphic, and/or oral instruction/information.
- 03.03 Interpret electronic schematics and/or mechanical drawings.
- 03.04 Prepare electronic schematics and drawings.
- 03.05 Record data and prepare curves and graphs.
- 03.06 Write technical reports and interoffice communications.
- 03.07 Perform oral presentations.
- 03.08 Maintain written documentation as appropriate to the industry.
- 03.09 Write formal reports of laboratory experiences.

UNIT FOUR: Demonstrate Proficiency in DC Circuits

- 04.01 Practice proper safety techniques.
- 04.02 Solve mathematical problems relating to DC circuits.
- 04.03 Relate the phenomenon of electricity to the nature of matter.
- 04.04 Describe the operation of electrochemical sources.
- 04.05 Describe electrical quantities and units.
- 04.06 Apply Ohm's Law and power formulas.
- 04.07 Read and interpret markings to identify electronic component values and tolerances.
- 04.08 Measure properties of a circuit using analog and digital test equipment.
- 04.09 Use applicable laws in series circuit analysis.
- 04.10 Use applicable laws in parallel circuit analysis.
- 04.11 Use applicable laws in series-parallel circuit analysis.
- 04.12 Demonstrate magnetic properties, circuits and devices.
- 04.13 Determine physical and electrical characteristics of capacitors in DC circuits.
- 04.14 Determine physical and electrical characteristics of inductors in DC circuits.
- 04.15 Demonstrate applicable laws for RC network analysis.
- 04.16 Demonstrate applicable laws for RL network analysis.

UNIT FIVE: Demonstrate Proficiency in AC Circuits

- 05.01 Practice proper safety techniques.
- 05.02 Solve mathematical problems relating to AC circuits.
- 05.03 Analyze the characteristics of wave forms.
- 05.04 Measure properties of an AC circuit.
- 05.05 Troubleshoot and repair RC circuits.
- 05.06 Troubleshoot and repair RL circuits.
- 05.07 Troubleshoot and repair transformer circuits.
- 05.08 Troubleshoot and repair RLC circuits.
- 05.09 Describe the theory and operation of AC/DC generation.
- 05.10 Troubleshoot and Repair Frequency Response Circuits.

UNIT SIX: Demonstrate Proficiency in Discrete Solid-State Devices and Circuits

- 06.01 Practice proper safety techniques.
- 06.02 Describe properties of semiconductor materials.
- 06.03 Describe operating characteristics of PN junctions.
- 06.04 Demonstrate the operation of diodes and diode circuits.
- 06.05 Troubleshoot and repair diode circuits.
- 06.06 Analyze operating characteristics of bipolar transistors.
- 06.07 Analyze biasing techniques of bipolar transistor circuits.
- 06.08 Analyze operating characteristics of field effect transistors (FETs).
- 06.09 Analyze biasing techniques for FET circuits.
- 06.10 Describe operating characteristics of special diodes/transistors.

UNIT SEVEN: Demonstrate Proficiency in Digital Circuits

- 07.01 Practice proper safety techniques.
- 07.02 Operate electronic test equipment applicable to digital circuits.
- 07.03 Describe characteristics of integrated circuit (IC) logic families.
- 07.04 Analyze power distribution and noise problems.
- 07.05 Analyze logic gates and their truth tables.
- 07.06 Describe the principles and operation of numbering systems, codes, and arithmetic operation.
- 07.07 Analyze combinational logic circuits.
- 07.08 Simplify combinational logic circuits.
- 07.09 Analyze digital display circuits.

UNIT EIGHT: Demonstrate Proficiency in Customer Relations

- 08.01 Introduction to customer relations.
- 08.02 Demonstrate proficiency in understanding people.
- 08.03 Demonstrate proficiency in communication.
- 08.04 Demonstrate proficiency in non-verbal communication.
- 08.05 Demonstrate perception with emphasis in listening.
- 08.06 Demonstrate proficiency of the concept of defensiveness and self-concept.
- 08.07 Demonstrate the ability of explaining.
- 08.08 Demonstrate proficiency in the art of persuasion.
- 08.09 Demonstrate proficiency in handling complaints.

Unit 1
Employability Skills and Habits

UNIT ONE: Employability Skills and Habits

01.01 TASK: Work Ethics and Behavior

PERFORMANCE OBJECTIVE: Given the information resources of a library and material supplied by the instructor, demonstrate appropriate work patterns regarding work ethics and behavior.

ENABLING OBJECTIVES:

- 001 Implement responsibilities of job position including exhibiting dependability and meeting organizationally defined objectives.
- 002 Follow rules, regulations and policies as established including interpreting employer/employee handbook procedures.
- 003 Understand and practice cost effectiveness.
- 004 Practice time management and follow work schedule.
- 005 Assume responsibility for own decisions and actions.
- 006 Exhibit pride.
- 007 Display initiative in undertaking new tasks.
- 008 Show assertiveness appropriate to the situation.
- 009 Seek work challenges.
- 010 Understand and apply ethical principles to decision making.
- 011 Comply with company standards including dress, personal hygiene, and cleanliness.
- 012 Understand the importance of providing good customer service (internal and external).

01.02 TASK: Interpersonal Relations

PERFORMANCE OBJECTIVE: Given appropriate information and various case studies, demonstrate acceptable interpersonal relationships within a workplace environment.

ENABLING OBJECTIVES:

- 001 Respond constructively to suggestions for improvement.
- 002 Provide praise and suggestions for improvement.

- 003 Channel/control emotional reactions constructively.
- 004 Recognize problems and work toward their solution.
- 005 Exhibit positive behavior.
- 006 Exhibit sensitivity to internal and external customer needs.
- 007 Treat people with respect.
- 008 Recognize non-verbal communication.

01.03 TASK: Teamwork

PERFORMANCE OBJECTIVE: Given the assignment to work within a team environment, demonstrate team operating procedures and interactive relationship to resolve a given problem.

ENABLING OBJECTIVES:

- 001 Understand interactive relationships required for effective teamwork.
- 002 Understand team's operating procedures.
- 003 Adapt as necessary to complete the team task.
- 004 Evaluate outcome.

1.04 TASK: Technical Literacy

PERFORMANCE OBJECTIVE: Given the responsibility of an employee in a new job, demonstrate knowledge of technical literacy across all aspects of the work assignment.

ENABLING OBJECTIVES:

- 001 Demonstrate basic keyboarding skills.
- 002 Demonstrate ability to use standard applications software such as word processors, database management, and spreadsheets.
- 003 Maintain state-of-the-art skills through participation in in-service or other training.
- 004 Participate in continuing education.
- 005 Demonstrate an understanding of and apply continuous improvement principles .
- 006 Demonstrate knowledge of the business products/services.

01.05 TASK: Communicating on the Job

PERFORMANCE OBJECTIVE: Given the responsibility of an employee in a new job, demonstrate various communication skills used on the job site.

ENABLING OBJECTIVES:

- 001 Use effective written and other communication skills.
- 002 Use telephone etiquette including relaying messages accurately.
- 003 Employ appropriate skills for gathering and retaining information.
- 004 Interpret written, graphic, and oral instructions.
- 005 Interact with co-workers and customers in a logical, clear, and understandable manner.
- 006 Use language appropriate to the situation.
- 007 Participate in meetings in a positive and constructive manner.
- 008 Use job-related terminology.
- 009 Write technical reports, letters, and memoranda as appropriate to the audience (e.g., management, customers, co-workers, and manufacturers).
- 010 Document work projects, procedures, tests, and equipment failures.
- 011 Read and apply various sources of technical information (e.g., manufacturer literature, codes and regulations).

01.06 TASK: Solving Problems and Critical Thinking

PERFORMANCE OBJECTIVE: Given various scenarios and technical problems, solve the problems and demonstrate the ability to think critically.

ENABLING OBJECTIVES:

- 001 Identify the problem.
- 002 Clarify purposes and goals.
- 003 Identify available solutions and their impact, including evaluating credibility of information, and locating information.
- 004 Evaluate options.
- 005 Set priorities.

- 006 Select/implement options/decisions including predicting results of proposed action.
- 007 Organize personal workloads.
- 008 Participate in brainstorming sessions to generate new ideas and solve problems.

01.07 TASK: Proficiency in Mathematics

PERFORMANCE OBJECTIVE: Given the responsibility to perform the duties of a new job, demonstrate knowledge of how to successfully solve mathematical problems.

ENABLING OBJECTIVES:

- 001 Determine if a solution is reasonable.
- 002 Demonstrate ability to use a simple electronic calculator.
- 003 Round and/or truncate numbers to designated place value.
- 004 Compare order and determine equivalences of real numbers (e.g., fractions, decimals, percentages).
- 005 Solve problems and make applications involving integers, fractions, decimals, percentages, and ratios using order of operations.
- 006 Translate written and/or verbal statements into mathematical expressions.
- 007 Compare, compute, and solve problems involving binary, octal, decimal, and hexadecimal numbering systems.
- 008 Convert, compare, and compute with common units of measurement within and across measurement systems.
- 009 Read scale on measurement device(s) and make interpolations where appropriate.
- 010 Understand statistical terms and charts needed for interpretation of continuous improvement processes.
- 011 Collect and organize data into tables, charts, and/or graphs.
- 012 Interpret and use tables, charts, maps, and/or graphs.
- 013 Identify patterns, note trends, and/or draw conclusions from tables, charts, maps, and/or graphs.
- 014 Compute and interpret mean, median, and/or mode.
- 015 Simplify and solve algebraic expressions and formulas.

- 016 Select and use formulas appropriately.
- 017 Understand and use scientific notation.
- 018 Use properties of exponents and logarithms.
- 019 Determine slope, midpoint, and distance.
- 020 Graph functions.
- 021 Use Boolean algebra to break down logic circuits.
- 022 Determine perimeters and areas of geometric figures.
- 023 Determine surface areas and volumes of applicable geometric figures.
- 024 Recognize, classify, and use properties of lines and angles.
- 025 Recognize, classify, and use properties of two- and three-dimensional figures (e.g., circles, triangles, rectangles, cylinders).
- 026 Apply Pythagorean theorem.
- 027 Identify basic functions of sine, cosine, and tangent.
- 028 Compute and solve problems using basic trigonometric functions.
- 029 Graph basic functions using polar and/or Cartesian coordinate systems.

01.08 TASK: Proficiency in Physics

PERFORMANCE OBJECTIVE: Given the responsibility to perform the duties of a new job, demonstrate knowledge of how to apply physics skills.

ENABLING OBJECTIVES:

- 001 Understand the fundamental principles of mechanics.
- 002 Understand the fundamental principles of pneumatics.
- 003 Understand the fundamental principles of hydraulics.
- 004 Understand the principles of electricity including its relationship to the nature of matter.

01.09 TASK: Adapt to Change

PERFORMANCE OBJECTIVE: Given the responsibility to perform the duties of a new job, with a new employer, demonstrate knowledge of how to adapt to change.

ENABLING OBJECTIVES:

- 001 Recognize the need to change.
- 002 Demonstrate a willingness to learn.
- 003 Demonstrate flexibility.
- 004 Participate in continuing education.
- 005 Seek challenge in the work place.
- 006 Adjust goals and plans when necessary.

01.10 TASK: General Technical Skills

PERFORMANCE OBJECTIVE: Given the responsibility to perform the duties of a new job, demonstrate the ability to apply technical skills in all aspects of the job assignment.

ENABLING OBJECTIVES:

- 001 Demonstrate an understanding of proper safety techniques for all types of circuits and components (DC circuits, AC circuits, analog circuits, digital circuits, discrete solid-state circuits, microprocessors).
- 002 Demonstrate an understanding of and comply with relevant OSHA safety standards.
- 003 Demonstrate an understanding of proper troubleshooting techniques.
- 004 Demonstrate an understanding of basic assembly skills using hand and power tools.
- 005 Demonstrate an understanding of acceptable soldering/desoldering techniques, including through-hole and surface mount devices.
- 006 Demonstrate an understanding of proper solderless connections.
- 007 Demonstrate an understanding of use of data books and cross reference/technical manuals to specify and requisition electronic components.
- 008 Demonstrate an understanding of the interpretation and creation of electronic schematics, technical drawings, and flow diagrams.

- 009 Demonstrate an understanding of design curves, tables, graphs, and recording of data.
- 010 Demonstrate an understanding of color codes and other component descriptors.
- 011 Demonstrate an understanding of site electrical and environmental survey.
- 012 Demonstrate the use of listening skills or assistive devices to assess signs and symptoms of malfunctions.

Unit 2
Demonstrate Proficiency in Laboratory Practices

UNIT TWO: Demonstrate Proficiency in Laboratory Practices

02.01 TASK: Apply Proper Safety Standards

PERFORMANCE OBJECTIVE: Given a set of OSHA safety standards, the student will demonstrate compliance by practical demonstration in laboratory setting.

ENABLING OBJECTIVES:

- 001 Demonstrate safety with power tools.
- 002 Demonstrate safety with hazardous materials.
- 003 Demonstrate safe procedures when troubleshooting.
- 004 Demonstrate knowledge of accessibility of first aid equipment.
- 005 Demonstrate knowledge of energy isolation procedures.

02.02 TASK: Demonstrate Proficiency in Troubleshooting Techniques

PERFORMANCE OBJECTIVE: Given a defective piece of equipment, demonstrate the ability to determine the failure down to component and affect repair.

ENABLING OBJECTIVES:

- 001 Verify problem.
- 002 Based on operational symptoms, determine or list possible defects.
- 003 Identify the defective stage
- 004 Isolate the defect.
- 005 Identify the cause of failure.
- 006 Correct the defect and verify proper operation of equipment.

02.03 TASK: Practice Good Electrostatic Discharge (ESD) Damage Prevention

PERFORMANCE OBJECTIVE: Given the necessary ESD equipment, demonstrate proper work habits.

ENABLING OBJECTIVES:

- 001 Identify ESD protective equipment.
- 002 Demonstrate proper usage of ESD protective equipment.
- 003 Identify those situations where ESD damage is a hazard.
- 004 Demonstrate proper handling of ESD sensitive circuitry.

02.04 TASK: Identify and Use Hand Tools Properly

PERFORMANCE OBJECTIVE: Given the program's tool list, identify the hand tools and demonstrate their proper use.

ENABLING OBJECTIVES:

- 001 Identify hand tools.
- 002 Demonstrate proper use of the hand tools.

02.05 TASK: Identify and Use Power Tools Properly

PERFORMANCE OBJECTIVE: Given power tools available in the laboratory, identify and demonstrate the proper use of these tools.

ENABLING OBJECTIVES:

- 001 Identify the power tools used in repair of equipment.
- 002 Identify the proper use of power tools.
- 003 Demonstrate proper use of power tools.

02.06 TASK: Demonstrate acceptable soldering and de-soldering techniques, including through-hole and surface mount device applications

PERFORMANCE OBJECTIVE: Given a circuit board with through-hole and surface mount devices, demonstrate the proper techniques of soldering and de-soldering.

ENABLING OBJECTIVES:

- 001 Demonstrate the proper care of soldering and de-soldering equipment.
- 002 Identify the proper equipment and materials for using through-hole soldering and de-soldering.
- 003 Use the proper techniques for soldering and de-soldering on printed circuit boards with through-hole components.
- 004 Identify the proper equipment and materials for using surface mount device soldering and de-soldering techniques.
- 005 Use the proper techniques for soldering and de-soldering on printed circuit boards with surface mount devices.

02.07 TASK: Demonstrate ability to make proper solderless connections

PERFORMANCE OBJECTIVE: Given the necessary equipment, demonstrate the ability to interconnect circuitry using solderless connections.

ENABLING OBJECTIVES:

- 001 Identify the different types of solderless connections.
- 002 Make proper electrical and mechanical solderless connections.

02.08 TASK: Demonstrate proficiency in basic electronic fabrication skills

PERFORMANCE OBJECTIVE: Given the appropriate materials, tools, and equipment demonstrate proficiency in fabrication skills.

ENABLING OBJECTIVES:

- 001 Demonstrate the ability to read and understand a schematic diagram.
- 002 Demonstrate the ability to read and understand a layout diagram.
- 003 Demonstrate the ability to read and understand a mechanical diagram.

- 004 Generate a layout diagram from a schematic diagram and parts list.
- 005 Generate a mechanical diagram.
- 006 Identify location for parts on a chassis, module or panel using a generated layout and mechanical diagram.
- 007 Prepare a panel, chassis or module to receive necessary parts for the following conditions:
 - a. correct location of holes.
 - b. correct size holes.
 - c. labels where required.
 - d. correcting for sharp edges, burrs.
 - e. countersink preparation.
- 008 Install parts with proper orientation
- 009 Prepare wire/cable for installation.
- 010 Install wires and/or cables per a schematic using the following conditions:
 - a. routing.
 - b. separation of power and data lines.
 - c. access for troubleshooting.
 - d. labeling.
 - e. service loops.
- 011 Perform a continuity check for correct location of circuits on project.

02.09 TASK: Document all lab projects/procedures in a clear concise written format

PERFORMANCE OBJECTIVE: Given a work assignment, the student will produce a formal written report and daily log based on data and observations obtained.

ENABLING OBJECTIVES:

- 001 Demonstrate the mechanics of composition when writing or editing laboratory projects/procedures.
- 002 Record technical data from laboratory projects/procedures in lab notebooks or daily logs using correct format in an understandable manner.

02.10 TASK: Demonstrate computer skills

PERFORMANCE OBJECTIVE: Given a written assignment, the student will keyboard and correctly format written reports; resumes; business correspondence.

ENABLING OBJECTIVES:

- 001 Demonstrate correct usage of word processing skills by completing written assignments.
- 002 Demonstrate correct procedures for word processing by accessing, keyboarding, editing, saving, filing, printing, exiting.
- 003 Demonstrate proper care of computer components.
- 004 Demonstrate proper computer terminology.
- 005 Demonstrate courtesy in usage of the computer lab.
- 006 Demonstrate proper ethics in use of software.

Unit 3
Demonstrate Proficiency in Technical
Communication Skills

UNIT THREE: Demonstrate Proficiency in Technical Communication Skills

03.01 TASK: Interpret written, graphic and/or oral instruction

PERFORMANCE OBJECTIVE: Given a work assignment through oral, written, and/or graphic instructions, the student will see the assignment through to conclusion following the given instructions.

ENABLING OBJECTIVES:

- 001 Demonstrate listening skills through practicing and completing listening assignments.
- 002 Practice being a willing and active listener.
- 003 Interpret and follow written and oral instructions.
- 004 Interpret graphic instructions.

03.02 TASK: Develop pertinent written, graphic and/or oral instruction/information

PERFORMANCE OBJECTIVE: Given a work situation, the student will convey pertinent information through the use of written, graphic, and/or oral instructions/information.

ENABLING OBJECTIVES:

- 001 Plan and write a set of instructions for a process related to Electronics components.
- 002 Prepare and deliver an oral instruction presentation for a process related to Electronics components.
- 003 Apply ethical conduct rules by taking responsibility for written assignments and oral presentations.
- 004 Demonstrate ability to give instructions.
- 005 Prepare graphic assignment.

03.03 TASK: Interpret electronic schematics and/or mechanical drawings

PERFORMANCE OBJECTIVE: Given an electronic schematic and/or mechanical drawing, the student will interpret the circuit/system operation.

ENABLING OBJECTIVES:

- 001 Identify the appropriate electronic symbols.
- 002 Identify the appropriate mechanical symbols.
- 003 Locate mechanical or electronic components on a schematic/diagram.
- 004 Interpret circuit/system operation.

03.04 TASK: Prepare electronic schematics and drawings

PERFORMANCE OBJECTIVE: Given electronics circuitry, the student will draw a schematic using the appropriate electronic symbology and related documentation.

ENABLING OBJECTIVES:

- 001 Draw appropriate electronic symbols.
- 002 Draw a correct layout for an understandable electronic schematic.
- 003 Draw the appropriate parts location drawing.
- 004 Draw the appropriate wiring diagram.
- 005 Provide title block for identification purposes using correct format.

03.05 TASK: Record data and prepare curves and graphs

PERFORMANCE OBJECTIVE: Using data recorded from a work assignment, the student will develop curves and graphs to reflect the appropriate findings.

ENABLING OBJECTIVES:

- 001 From data points, determine appropriate graph scale and location as well as type, i.e. linear, log, semilog, and polar.
- 002 Graph appropriate results.

03.06 TASK: Write technical reports and interoffice communications

PERFORMANCE OBJECTIVE: Using the correct format, mechanics of composition, and terminology, the student will write a variety of technical reports and interoffice communications related to a job assignment.

ENABLING OBJECTIVES:

- 001 Define and spell technical terms.
- 002 Describe the uses and types of memorandums and form reports.
- 003 Prepare and edit technical reports using correct format and mechanics of composition.

03.07 TASK: Perform oral presentations

PERFORMANCE OBJECTIVE: Given oral presentation guidelines, the student will prepare and present oral presentations.

ENABLING OBJECTIVES:

- 001 Develop and write an outline for oral presentation
- 002 Recognize and prepare an introduction, body, and conclusion for each oral presentation
- 003 Prepare and deliver an Informative presentation, a Persuasive/Proposal presentation and a Technical Demonstration related to Electronics components using the correct mechanics of oral presentations.
- 004 Prepare and demonstrate use of visual aides in oral presentations.
- 005 Demonstrate ability to answer technical questions/problems during oral presentations.
- 006 Demonstrate the ability to recognize and use non-verbal signals in oral presentations.
- 007 Demonstrate correct telephone techniques through participation in role playing situations.
- 008 Demonstrate ability to conduct and participate in meetings through participation in role playing situations.
- 009 Evaluate video-taped oral presentations.

03.08 TASK: Maintain written documentation as appropriate to the industry

PERFORMANCE OBJECTIVE: Given the appropriate forms and equipment information, the student will prepare documentation.

ENABLING OBJECTIVES:

- 001 Maintain test logs as appropriate.
- 002 Prepare appropriate equipment-failure reports.
- 003 Initiate requisitions for electronic components as appropriate.
- 004 Write and/or complete form reports related to industry needs using correct format and mechanics of composition.

03.09 TASK: Write formal reports of laboratory experiences

PERFORMANCE OBJECTIVE: Given the laboratory assignment, the student will document the laboratory experiment.

ENABLING OBJECTIVES:

- 001 Demonstrate the mechanics of composition sentence structure, word usage, punctuation, capitalization, and spelling when writing or editing laboratory projects/procedures.
- 002 Record technical data from laboratory projects/procedures in lab notebooks or daily logs using correct format and mechanics of composition.

Unit 4
Demonstrate Proficiency in DC Circuits

UNIT FOUR: Demonstrate Proficiency in DC Circuits

04.01 TASK: Practice Proper Safety Techniques

PERFORMANCE OBJECTIVE: Given the necessary laboratory equipment, tools, chemicals, and supplies, observe safety rules when working with DC circuits.

ENABLING OBJECTIVES:

- 001 Work safely with electrical equipment.
- 002 Identify the correct procedures for safety techniques.
- 003 Take necessary steps to eliminate hazards.
- 004 Work safely with tools.
- 005 Work safely with soldering and de-soldering equipment.
- 006 Read and comply with material safety data sheets (MSDS).
- 007 Practice good electrostatic discharge (ESD) and damage prevention.

04.02 TASK: Solve Mathematical Problems Relating To DC Circuits

PERFORMANCE OBJECTIVE: Given a dimensional analysis problem, convert between the SI system of measurement and the English system of measurement and express results obtained using the proper units of measurement and “powers of ten” prefixes as used within the SI system and solve algebraic equations.

ENABLING OBJECTIVES:

- 001 Measure quantities in the English and SI system.
- 002 Convert between English and SI units.
- 003 Estimate results and perform math operations using powers of ten/scientific and engineering notation.
- 004 Find the reciprocal of any given number.
- 005 Perform arithmetic operations on literal numbers.
- 006 Solve algebraic equations, using grouping, arithmetic operations, factoring, and other simplification techniques.

- 007 Solve linear equations for all variables.
- 008 Solve logarithmic expressions and equations.
- 009 Utilize proper graphing techniques.

04.03 TASK: Relate the Phenomenon of Electricity to the Nature of Matter

PERFORMANCE OBJECTIVE: Given reference material, relate the phenomenon of electricity to the nature of matter.

ENABLING OBJECTIVES:

- 001 Define terms associated with the nature of matter.
- 002 Define a coulomb.
- 003 Identify charged particles and the charge associated with each.
- 004 Define current flow in terms of electron flow and conventional current.
- 005 Describe DC and AC current and give example of each.
- 006 Identify six sources of electricity.

04.04 TASK: Describe the Operation of Electrochemical Sources

PERFORMANCE OBJECTIVE: Given various types of batteries, describe the principles and applications.

ENABLING OBJECTIVES:

- 001 Discuss rules for handling and disposing of electrochemical sources.
- 002 Identify different types of electrochemical sources.
- 003 Describe “memory” conditions of batteries.
- 004 Using appropriate test equipment, determine the operating condition of the electrochemical sources (batteries).

04.05 TASK: Describe Electrical Quantities and Units

PERFORMANCE OBJECTIVE: Given the appropriate material, describe voltage, current, resistance, power and energy and perform relative calculations.

ENABLING OBJECTIVES:

- 001 Identify electrical quantities.
- 002 Describe electrical units.
- 003 Calculate conductance.
- 004 Describe the concepts of energy.

04.06 TASK: Apply Ohm's Law And Power Formulas

PERFORMANCE OBJECTIVE: Given a simple electrical circuit and the power formulas, apply Ohm's Law to solve for voltage, resistance, current, or power.

ENABLING OBJECTIVES:

- 001 Solve for voltage.
- 002 Solve for resistance.
- 003 Solve for current.
- 004 Solve for power.

04.07 TASK: Read and Interpret Markings to Identify Electronic Component Values and Tolerances

PERFORMANCE OBJECTIVE: Given the necessary components used in DC circuits, read and interpret color codes and markings to identify electronic components.

ENABLING OBJECTIVES:

- 001 Determine the value and tolerance of components from color codes and markings.
- 002 Match components to electronic symbols.
- 003 Identify components by physical appearance, shape or configuration or measurement with test equipment.

04.08 TASK: Measure Properties of a Circuit Using Analog and Digital Test Equipment

PERFORMANCE OBJECTIVE: Given the analog and digital test equipment, measure properties of a circuit.

ENABLING OBJECTIVES:

- 001 Describe safety procedures for using test equipment.
- 002 Demonstrate proper use of electronic test equipment to determine correct circuit parameters such as voltage, current, and resistance.
- 003 Define short circuit.
- 004 Define open circuit.
- 005 Determine shorts, opens, using resistance readings.
- 006 Determine shorts, opens, using voltage readings.
- 007 Determine shorts, opens, using current readings.
- 008 Set up and operate DC power supplies.

04.09 TASK: Use Applicable Laws in Series Circuit Analysis

PERFORMANCE OBJECTIVES: Given a series DC circuit and test equipment, apply the appropriate laws to determine circuit operations.

ENABLING OBJECTIVE:

- 001 Calculate total resistance in series DC circuits.
- 002 Calculate total current in series DC circuits.
- 003 Calculate total voltage in series DC circuits.
- 004 Calculate total power consumed in series DC circuits.
- 005 Calculate individual voltage drops in series DC circuits.
- 006 Calculate power consumed by each component in series DC circuits.
- 007 Calculate current flow through each component in series DC circuits.
- 008 Use voltage divider formula.
- 009 Troubleshoot and repair series DC circuits.

- 010 Graph Ohm's law results.
- 011 Use Kirchhoff's voltage law to analyze series DC circuits.

04.10 TASK: Use Applicable Laws in Parallel Circuit Analysis

PERFORMANCE OBJECTIVE: Given appropriate parallel circuits and test equipment, apply the applicable laws in parallel circuit analysis.

ENABLING OBJECTIVES:

- 001 Calculate total resistance in parallel circuits.
- 002 Calculate current flow in each branch of a parallel circuit.
- 003 Calculate voltage drop across each component in a parallel circuit.
- 004 Calculate total power in parallel circuits.
- 005 Use current divider formula.
- 006 Troubleshoot and repair parallel DC circuits.
- 007 Use Kirchhoff's current law to analyze parallel DC circuits.

04.11 TASK: Use Applicable Laws in Series-Parallel Circuit Analysis

PERFORMANCE OBJECTIVE: Given appropriate series-parallel circuit and test equipment, apply the applicable laws to determine circuit operation.

ENABLING OBJECTIVES:

- 001 Calculate total resistance in series-parallel DC circuits.
- 002 Calculate voltage drops in series-parallel DC circuits.
- 003 Calculate current through each component in series-parallel DC circuits.
- 004 Calculate power for each component in series-parallel DC circuits.
- 005 Calculate individual resistor values.
- 006 Calculate total power in series-parallel DC circuits.
- 007 Determine circuit conditions in loaded voltage divider circuits.
- 008 Analyze circuit conditions in bridge circuits.

- 009 Troubleshoot and repair series-parallel DC circuits.
- 010 Use network theorems and laws such as Thevenin, Norton, Superposition, Kirchhoff Voltage and Current to analyze a series-parallel DC circuit.
- 011 Discuss loading effects of test equipment.
- 012 Demonstrate maximum power transfer.

04.12 TASK: Demonstrate Magnetic Properties, Circuits, and Devices

PERFORMANCE OBJECTIVE: Given the appropriate materials and devices, demonstrate the effects of magnetic properties.

ENABLING OBJECTIVES:

- 001 Explain the terms associated with magnets.
- 002 Discuss “Ohm’s law” for magnetic circuits.
- 003 Discuss properties of permanent magnets.
- 004 Discuss how electromagnets work.
- 005 Demonstrate the effects of magnetic properties.

04.13 TASK: Determine Physical and Electrical Characteristics of Capacitors in DC Circuits

PERFORMANCE OBJECTIVE: Given the appropriate reference materials, determine the physical and electrical characteristics of capacitors in DC circuits.

ENABLING OBJECTIVES:

- 001 Identify a capacitor and draw the schematic symbol.
- 002 Discuss the construction techniques used to produce capacitors.
- 003 Discuss how physical dimensions and materials affect capacitance.
- 004 Discuss the electrostatic field within a capacitor.
- 005 Calculate total capacitance in series.
- 006 Calculate total capacitance in parallel.
- 007 Discuss effects of stray capacitance.
- 008 Calculate voltage and current in capacitive circuits.

- 009 Evaluate RC time constants.
- 010 Analyze RC time constant graphs.

4.14 TASK: Determine Physical and Electrical Characteristics of Inductors

PERFORMANCE OBJECTIVE: Given the appropriate reference materials, determine the physical and electrical characteristics of inductors in DC circuits.

ENABLING OBJECTIVES:

- 001 Discuss effects of physical factors on inductance.
- 002 Calculate inductance in terms of physical characteristics.
- 003 Calculate inductance in terms of electrical characteristics.
- 004 Discuss the effects of an electromagnetic field on an inductor.
- 005 Calculate induced voltage in the coil.
- 006 Calculate total inductance in series.
- 007 Calculate total inductance in parallel.
- 008 Discuss effects of stray inductance.
- 009 Evaluate RL time constants and their effect on pulsating DC circuits.
- 010 Calculate voltage and current in inductive circuits.
- 011 Analyze RL time constant graphs.

04.15 TASK: Demonstrate Applicable Laws for RC Network Analysis

PERFORMANCE OBJECTIVE: Given the appropriate reference materials and circuits, demonstrate applicable laws for RC network analysis.

ENABLING OBJECTIVES:

- 001 Calculate time constant of RC circuit.
- 002 Calculate voltage and current in RC circuit.
- 003 Discuss RC differentiator circuits.
- 004 Discuss RC integrator circuits.
- 005 Use appropriate network analysis methods to determine RC time constants in pulsed

series-parallel circuit.

- 006 Demonstrate applicable laws for RC circuits.
- 007 Graph the predicted wave shape across components.

04.16 TASK: Demonstrate Applicable Laws for RL Network Analysis

PERFORMANCE OBJECTIVE: Given the appropriate reference materials and circuit, demonstrate applicable laws for RL network analysis.

ENABLING OBJECTIVES:

- 001 Calculate time constant of RL circuits.
- 002 Calculate voltage and current in RL circuits.
- 003 Discuss RL differentiator circuits.
- 004 Discuss RL integrator circuits
- 005 Evaluate RL time constants and their effect on pulsed DC circuits.

Unit 5
Demonstrate Proficiency in AC Circuits

UNIT FIVE: Demonstrate Proficiency in AC Circuits

05.01 TASK: Practice Proper Safety Techniques

PERFORMANCE OBJECTIVES: Given the necessary laboratory equipment, tools, chemicals, and supplies, observe safety rules when working with AC circuits.

ENABLING OBJECTIVES:

- 001 Work safely with electrical equipment.
- 002 Identify the correct procedures for safety techniques.
- 003 Take necessary steps to eliminate hazards.
- 004 Work safely with tools.
- 005 Work safely with soldering and desoldering equipment.
- 006 Read and comply with material safety data sheets (MSDS).
- 007 Practice good electrostatic discharge (ESD) and damage prevention.

05.02 TASK: Solve Mathematical Problems Relating to AC Circuits

PERFORMANCE OBJECTIVE: Given AC circuit problems solve for various parameters using algebraic equations and trigonometric functions.

ENABLING OBJECTIVES:

- 001 Solve linear and non-linear equations for all variables.
- 002 Plot functions using the rectangular coordinate system.
- 003 Express angles in decimal degrees and radians.
- 004 Describe the relationship of trigonometric functions to the solutions of triangles.
- 005 Convert AC voltages, current, impedance (admittance) and power into vector quantities.
- 006 Calculate voltages, current, impedance (admittance), and power by using network theorems and laws.
- 007 Convert between rectangular and polar coordinates.

05.03 TASK: Analyze the Characteristics of Waveforms

PERFORMANCE OBJECTIVE: Given the appropriate reference materials and equipment, analyze the characteristics of waveforms.

ENABLING OBJECTIVE:

- 001 Draw and label sine waveform.
- 002 Determine peak voltage of a waveform.
- 003 Determine peak-to-peak voltage of waveform.
- 004 Determine the effective voltage of waveform.
- 005 Determine average voltage of waveform.
- 006 Calculate frequency of sine wave.
- 007 Calculate phase relationship.
- 008 Calculate the period of the sine wave.
- 009 Calculate instantaneous voltages and currents.
- 010 Identify non-sinusoidal waveforms by name.

05.04 TASK: Measure Properties of an AC Circuit

PERFORMANCE OBJECTIVE: Given the appropriate reference materials and equipment, measure properties of an AC circuit.

ENABLING OBJECTIVES:

- 001 Describe safety procedures for using test equipment.
- 002 Measure properties of a circuit.

05.05 TASK: Troubleshoot and Repair RC Circuits

PERFORMANCE OBJECTIVE: Given the RC circuit and test equipment, troubleshoot and repair circuit.

ENABLING OBJECTIVES:

- 001 Describe the principle and operation of RC circuits.
- 002 Demonstrate the operation of RC circuits.

003 Troubleshoot and repair RC circuits.

05.06 TASK: Troubleshoot and Repair RL Circuits

PERFORMANCE OBJECTIVE: Given the RL circuit and test equipment, troubleshoot and repair circuit.

ENABLING OBJECTIVES:

001 Describe the principle and operation of RL circuits.

002 Demonstrate the operation of RL circuits.

003 Troubleshoot and repair of RL circuits.

05.07 TASK: Troubleshoot and Repair Transformer Circuits

PERFORMANCE OBJECTIVE: Given the appropriate reference equipment troubleshoot and repair transformer circuits.

ENABLING OBJECTIVES:

001 Describe the principles and applications of transformers.

002 Demonstrate the operation of transformer circuits

003 Troubleshoot and repair transformer circuits.

05.08 TASK: Troubleshoot and Repair RLC Circuits

PERFORMANCE OBJECTIVES: Given a RLC circuit and test equipment, troubleshoot and repair RLC circuit.

ENABLING OBJECTIVES:

001 Describe the characteristics of RLC circuits (series, parallel, and complex).

002 Demonstrate the operation of RLC circuits (series, parallel and complex).

003 Troubleshoot and repair RC, RL and RLC circuits.

05.09 TASK: Describe the Theory and Operation of AC/DC Generation

PERFORMANCE OBJECTIVE: Given the appropriate reference materials and equipment, describe the theory and operation of AC/DC generation.

ENABLING OBJECTIVES:

- 001 Describe the purpose of AC/DC generators.
- 002 Compare AC generators to DC generators.
- 003 Describe the purpose of poly-phase generator circuits.

05.10 TASK: Troubleshoot and Repair Frequency Response Circuit Operation

PERFORMANCE OBJECTIVE: Given appropriate reference materials, tools and equipment, troubleshoot and repair the circuit.

ENABLING OBJECTIVES:

- 001 Discuss effects of stray capacitance in RC circuit.
- 002 Describe the properties of a RC circuit that affect the frequency response.
- 003 Discuss effects of stray capacitance in RL circuit.
- 004 Describe the properties of a RL circuit that affect the frequency response.
- 005 Describe the characteristics of series and parallel resonant circuits.
- 006 Demonstrate the operation of series and parallel resonant circuits.
- 007 Describe the principle and operation of filter circuits.
- 008 Demonstrate the operation of filter circuits.
- 009 Troubleshoot and repair filter circuits.

Unit 6
**Demonstrate Proficiency in Discrete Solid-State
Devices and Circuits**

UNIT SIX: Demonstrate Proficiency in Discrete Solid-State Devices and Circuits

06.01 TASK: Practice proper safety techniques

PERFORMANCE OBJECTIVE: Given the necessary laboratory equipment, tools, chemicals, and supplies, observe safety rules when working with discrete solid state devices.

ENABLING OBJECTIVES:

- 001 Work safely with electrical equipment.
- 002 Identify the correct procedures for safety techniques.
- 003 Take necessary steps to eliminate hazards.
- 004 Work safely with tools.
- 005 Work safely with soldering and de-soldering equipment.
- 006 Read and comply with material safety data sheets (MSDS).
- 007 Practice good electrostatic discharge (ESD) and damage prevention.

06.02 TASK: Describe properties of semiconductor materials

PERFORMANCE OBJECTIVE: Given examples of semiconductor materials, describe the effects of doping to produce N and P type semiconductor crystals.

ENABLING OBJECTIVES:

- 001 Define crystal lattice
- 002 Define covalent bonding.
- 003 Define tetravalency.
- 004 Define trivalency.
- 005 Define pentavalency.
- 006 Describe effects of doping of semiconductors.

06.03 TASK: Describe operating characteristics of PN junctions

PERFORMANCE OBJECTIVE: Given PN junction, the student will describe operating characteristics of PN junctions.

ENABLING OBJECTIVES:

- 001 Describe structure and characteristics of diode.
- 002 Define depletion region.
- 003 Define barrier potential.
- 004 Define forward voltage drop.
- 005 Describe breakdown conditions of a diode.

06.04 TASK: Demonstrate the operation of diodes and diode circuits

PERFORMANCE OBJECTIVE: Given necessary schematic diagrams and operating characteristics, the student will determine the operating parameters of diodes and diode circuits.

ENABLING OBJECTIVES:

- 001 Determine operating range of a diode.
- 002 Compare leakage current of ideal and actual diodes.
- 003 Compare barrier potential of ideal and actual diodes.
- 004 Compare linearity of characteristic curve of current and voltage.
- 005 Calculate power dissipation of diodes.
- 006 Discuss characteristics of diode circuitry such as clipper, clamper and peak detector and draw output waveforms.
- 007 Fabricate and test diode circuits.
- 008 Describe applications of diode circuits.
- 009 Analyze the operation of half-wave rectifier circuits.
- 010. Analyze the operation of conventional and bridge full-wave rectifier circuits.
- 011 Analyze the operation of split supply rectifier circuits.
- 012 Analyze the operation of a voltage multiplier.

013 Analyze the operation of filtered regulator circuits.

06.05 TASK: Troubleshoot and repair diode circuits

PERFORMANCE OBJECTIVE: Given appropriate reference materials and equipment, troubleshoot and repair diode circuits.

ENABLING OBJECTIVES:

- 001 Verify problem.
- 002 Based on operational symptoms, determine or list possible defects.
- 003 Identify the defective stage.
- 004 Isolate the defect.
- 005 Identify the cause of failure.
- 006 Correct the defect and verify proper operation of equipment.

06.06 TASK: Analyze operating characteristics of bipolar transistors

PERFORMANCE OBJECTIVE: Given characteristic curve, determine operating parameters of bipolar transistors.

ENABLING OBJECTIVES:

- 001 Describe elements of transistor structure.
- 002 Draw characteristic curves.
- 003 Calculate value of alpha and beta.
- 004 Describe leakage currents.
- 005 Determine leakage currents.
- 006 Describe breakdown voltages.
- 007 Determine breakdown voltages.

06.07 TASK: Analyze biasing techniques and operating characteristics of bipolar transistor amplifier circuits

PERFORMANCE OBJECTIVE: Given functional transistor amplifier circuits, analyze the circuits.

ENABLING OBJECTIVES:

- 001 Calculate biasing current parameters.
- 002 Calculate wattage rating of components in the transistor circuit.
- 003 Calculate collector power dissipation.
- 004 Plot collector dissipation curve on transistor characteristic curve.
- 005 Fabricate biasing circuits.
- 006 Identify various types of biasing circuits.
- 007 Test biasing circuits.
- 008 Troubleshoot biasing circuits.
- 009 Identify various types of transistor configurations.
- 010 Test amplifier circuits.
- 011 Troubleshoot amplifier circuits.

06.08 TASK: Analyze operating characteristics of field effect transistors (FET's)

PERFORMANCE OBJECTIVE: Given characteristic curve, determine operating parameters of field effect transistors.

ENABLING OBJECTIVES:

- 001 Describe how JFET transistors are constructed, and explain how they operate.
- 002 Describe how depletion and enhancement mode MOSFET transistors are constructed, and explain how they operate.
- 003 Draw drain characteristic curves.
- 004 Determine operating parameters for FET's.

06.09 TASK: Analyze biasing techniques and operating characteristics of FET amplifier circuits

PERFORMANCE OBJECTIVE: Given functional FET amplifier circuits, analyze the circuits.

ENABLING OBJECTIVES:

- 001 Calculate biasing current parameters.
- 002 Calculate wattage rating of the components in the transistor circuit.
- 003 Calculate drain power dissipation.
- 004 Plot drain dissipation curve on transistor characteristic curve.
- 005 Fabricate biasing circuits.
- 006 Identify various types of biasing circuits.
- 007 Test biasing circuits.
- 008 Troubleshoot biasing circuits.
- 009 Identify various types of transistor configurations.
- 010 Test amplifier circuits.
- 011 Troubleshoot amplifier circuits.

06.10 TASK: Describe operating characteristics of special diodes/transistors

PERFORMANCE OBJECTIVE: Given the necessary reference materials, describe the operating characteristics of special diodes/transistors (thyristors and opto-electronic devices).

ENABLING OBJECTIVES:

- 001 Describe the operating characteristics of special diodes/transistors.
- 002 Test special diodes/transistors.
- 003 Troubleshoot and repair special diode/transistor circuits.

Unit 7
Demonstrate Proficiency in Digital Circuits

UNIT SEVEN: Demonstrate Proficiency in Digital Circuits

07.01 TASK: Practice proper safety techniques

PERFORMANCE OBJECTIVE: Given the necessary laboratory equipment, tools, chemicals, and supplies, observe safety rules when working with digital circuits.

ENABLING OBJECTIVES:

- 001 Work safely with electronic equipment.
- 002 Identify the correct procedures for safety techniques.
- 003 Take necessary steps to eliminate hazards.
- 004 Work safely with tools.
- 005 Work safely with soldering and de-soldering equipment.
- 006 Read and interpret material safety data sheets (MSDS).
- 007 Apply proper electrostatic discharge practices when working with digital circuits.

07.02 TASK: Operate electronic test equipment applicable to digital circuits

PERFORMANCE OBJECTIVE: Given the appropriate reference material and equipment, operate electronic test equipment applicable to digital circuits.

ENABLING OBJECTIVES:

- 001 Describe safety procedures for using test equipment.
- 002 Demonstrate use of the test equipment to measure properties of a circuit.

07.03 TASK: Describe characteristics of integrated circuit (IC) logic families

PERFORMANCE OBJECTIVE: Given the appropriate reference material and equipment describe characteristics of integrated circuit (IC) logic families.

ENABLING OBJECTIVES:

- 001 List the IC logic families.
- 002 Differentiate between IC logic family characteristics.
- 003 Select appropriate IC logic family for a given application.
- 004 Determine interfacing needs of CMOS and TTL circuits.

07.04 TASK: Analyze power distribution and noise problems

PERFORMANCE OBJECTIVE: Given the appropriate resource material and equipment, analyze power distribution and noise problems.

ENABLING OBJECTIVES:

- 001 Identify various power distribution and noise problems.
- 002 Describe various power distribution and noise problems.
- 003 Troubleshoot and repair various power distribution and noise problems.

07.05 TASK: Analyze logic gates and their truth tables

PERFORMANCE OBJECTIVE: Given appropriate reference materials and equipment, analyze logic gates and their truth tables.

ENABLING OBJECTIVES:

- 001 Describe the principle and operation of various types of logic gates and their truth tables.
- 002 Demonstrate the use of logic gates.
- 003 Troubleshoot and repair logic gate circuits.

07.06 TASK: Describe the principles and operation of numbering systems, codes, and arithmetic operations

PERFORMANCE OBJECTIVE: Given appropriate reference material, describe the principles and operation of numbering systems, codes, and arithmetic operations.

ENABLING OBJECTIVES:

- 001 Define numbering systems (Binary, Decimal, Octal and Hexadecimal).
- 002 Convert between numbering systems.
- 003 Solve arithmetic operations in numbering systems.
- 004 Define numeric codes.
- 005 Convert numeric codes.

07.07 TASK: Analyze combinational logic circuits

PERFORMANCE OBJECTIVE: Given the appropriate reference material and equipment analyze combinational logic circuits.

ENABLING OBJECTIVES:

- 001 Describe the principle and operation of combinational logic circuits.
- 002 Demonstrate the operation of combinational logic circuits.
- 003 Fabricate and test combinational logic circuits.
- 004 Troubleshoot and repair combinational logic circuits.

07.08 TASK: Simplify combinational logic circuits

PERFORMANCE OBJECTIVE: Given the appropriate reference materials simplify combinational logic circuits.

ENABLING OBJECTIVES:

- 001 Describe Boolean and DeMorgan simplification techniques.
- 002 Simplify logic circuit using Boolean and DeMorgan techniques.
- 003 Simplify logic circuits using mapping techniques.

07.09 TASK: Analyze digital display circuits

PERFORMANCE OBJECTIVE: Given the appropriate materials and equipment, analyze various digital display circuits.

ENABLING OBJECTIVES:

- 001 Describe the principle and operation of various digital display circuits.
- 002 Demonstrate the operation of digital display circuits.
- 003 Fabricate and test the operation of digital display circuits.
- 004 Troubleshoot and repair the operation of digital display circuits.

Unit 8
Demonstrate Proficiency in Customer Relations

UNIT EIGHT: Demonstrate Proficiency in Customer Relations

08.01 TASK: Introduction to customer relations

PERFORMANCE OBJECTIVE: Given video and text examples, the student will describe in writing the importance of customer relations.

ENABLING OBJECTIVES:

- 001 Define customer relations.
- 002 Explain why you should be good at customer relations.
- 003 Describe the importance of good customer relations.

08.02 TASK: Demonstrate proficiency in understanding people

PERFORMANCE OBJECTIVE: Given written and video material, the student will demonstrate proficiency in understanding how people interact with others.

ENABLING OBJECTIVES:

- 001 Describe Maslow's Hierarchy of Needs.
- 002 Explain transactional analysis.
- 003 Define how goals and belief relate to one another.
- 004 Explain how goals and belief relate to one another.
- 005 Determine which self is the control.
- 006 Describe how most people react to frustration.
- 007 Recognize the results of a covered transaction.
- 008 Explain social distance.

08.03 TASK: Demonstrate proficiency in communication

PERFORMANCE OBJECTIVE: Given case studies and video examples, the student will demonstrate effective communication techniques.

ENABLING OBJECTIVES:

- 001 Define communication.
- 002 Discover why and how people communicate.
- 003 Identify what interfaces with communication.
- 004 Distinguish between explaining and persuading.
- 005 Determine how to decide whether to explain or persuade.
- 006 Contrast interpersonal with impersonal communication.
- 007 Demonstrate how to achieve credibility.

08.04 TASK: Demonstrate proficiency in non-verbal communication

PERFORMANCE OBJECTIVE: Given text and video material, the student will demonstrate proficiency in open verbal communication.

ENABLING OBJECTIVES:

- 001 Define paralanguage.
- 002 Identify what is communicated best non-verbally.
- 003 Describe different types of eye contact.
- 004 Discuss how wardrobe can influence your effectiveness.
- 005 Demonstrate how to choose a wardrobe.

08.05 TASK: Demonstrate perception with emphasis in listening

PERFORMANCE OBJECTIVE: Given audio examples and role play opportunities, the student will demonstrate the ability to listen effectively to perceive and interpret situations.

ENABLING OBJECTIVES:

- 001 Define perception.
- 002 Discuss the perception process.
- 003 Describe how this process influences what we perceive.
- 004 Explain why listening is important.
- 005 Describe effective listening.
- 006 Demonstrate an understanding of how to listen actively.

08.06 TASK: Demonstrate proficiency of the concept of defensiveness and self-concept

PERFORMANCE OBJECTIVE: Given written material and opportunities to practice defensiveness techniques, the students will demonstrate positive self concept in various conditions.

ENABLING OBJECTIVES:

- 001 Define defensiveness.
- 002 Describe confirming and disconfirming.
- 003 Describe what causes defensiveness and how to avoid it.
- 004 Identify the role of self concepts in relationships.
- 005 Demonstrate the understanding of how to improve your self concepts and your life.

08.07 TASK: Demonstrate the ability of explaining

PERFORMANCE OBJECTIVE: Using role play situations and case studies, the students will demonstrate the ability to explain a variety of conditions to classmates.

ENABLING OBJECTIVES:

- 001 Identify and use the two fundamentals of explaining.
- 002 Choose and apply the right explanation techniques.
- 003 Through role playing demonstrate proficiency of explaining.

08.08 TASK: Demonstrate proficiency in the art of persuasion

PERFORMANCE OBJECTIVE: Using case studies and role play, the students will use persuasion techniques to convince classmates about specific topics.

ENABLING OBJECTIVES:

- 001 Choose a persuasion objective.
- 002 Determine the right persuasive tactics.
- 003 Anticipate objections and prepare to overcome them.
- 004 Practice persuasion through role playing.

08.09 TASK: Demonstrate proficiency in handling complaints

PERFORMANCE OBJECTIVE: Using case studies and role play techniques, the students will demonstrate the proper method of handling complaints.

ENABLING OBJECTIVES:

- 001 Demonstrate the use of the two step complaint handling procedures.
- 002 Choose and apply the right complaint handling procedures.
- 003 Demonstrate through role playing the proper handling of complaints.
- 004 Describe methods of solving problems to prevent future complaints.

National Skills Standards Competency Profile

Basic Electronics Technician

ELECTRONICS

This is a voluntary program at the present time but is strongly endorsed by the National Skills Standards Board.

Feel free to use the Student Competency Achievement profiles in any manner you wish. However, we will be developing competency profiles for Idaho programs based on the information from Module I of the Curriculum Guide. The Idaho profiles will be bar coded for ease of student record management.

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale: **4 - Mastered** - can perform skill independently with no supervision
3 - Moderately Competent - can complete skill with limited supervision
2 - Limited Competence - requires instruction and close supervision
1 - Exposure Only - exposed to the concept, but no hands-on experience
0 - No Exposure - no experience or knowledge in this area

Circle the
Correct Number:

SPECIALTY AREAS *

4 3 2 1 0	Behavioral Skills and Work Habits
4 3 2 1 0	General Technical Skills
4 3 2 1 0	DC Circuits
4 3 2 1 0	AC Circuits
4 3 2 1 0	Discrete Solid State Devices
4 3 2 1 0	Analog Circuits
4 3 2 1 0	Digital Circuits
4 3 2 1 0	Microprocessors and Microcomputers
4 3 2 1 0	Technical Literacy, Communication on the Job, and Solving Problems and Critical Thinking
4 3 2 1 0	Reading, Proficiency in Mathematics, and Proficiency in Physics

*Certificates rating student competency in the specific skills of each specialty area are available for each area rated on this certificate.

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale: **4 - Mastered** - can perform skill independently with no supervision
3 - Moderately Competent - can complete skill with limited supervision
2 - Limited Competence - requires instruction and close supervision
1 - Exposure Only - exposed to the concept, but no hands-on experience
0 - No Exposure - no experience or knowledge in this area

BEHAVIORAL SKILLS AND WORK HABITS

Circle the

Correct Number:

WORK ETHICS AND BEHAVIOR

4 3 2 1 0	Implement responsibilities of job position including exhibiting dependability and meeting organizationally defined objectives
4 3 2 1 0	Follow rules, regulations and policies as established including interpreting employer/employee handbook procedures
4 3 2 1 0	Understand and practice cost effectiveness
4 3 2 1 0	Practice time management and follow work schedule
4 3 2 1 0	Assume responsibility for own decisions and actions
4 3 2 1 0	Exhibit pride
4 3 2 1 0	Display initiative in undertaking new tasks
4 3 2 1 0	Show assertiveness appropriate to the situation
4 3 2 1 0	Seek work challenges
4 3 2 1 0	Understand and apply ethical principles to decision making
4 3 2 1 0	Comply with company standards including dress, personal hygiene, and cleanliness
4 3 2 1 0	Understand the importance of providing good customer service (internal and external)

INTERPERSONAL RELATIONSHIPS

4 3 2 1 0	Respond constructively to suggestions for improvement
4 3 2 1 0	Provide praise and suggestions for improvement
4 3 2 1 0	Channel/control emotional reactions constructively
4 3 2 1 0	Recognize problems and work toward their solution
4 3 2 1 0	Exhibit positive behavior
4 3 2 1 0	Exhibit sensitivity to internal and external customer needs
4 3 2 1 0	Treat people with respect
4 3 2 1 0	Recognize non-verbal communication

TEAMWORK

4 3 2 1 0	Understand interactive relationships required for effective teamwork
4 3 2 1 0	Understand team's operating procedures
4 3 2 1 0	Adapt as necessary to complete the team task
4 3 2 1 0	Evaluate outcome

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale:

- 4 - Mastered** - can perform skill independently with no supervision
- 3 - Moderately Competent** - can complete skill with limited supervision
- 2 - Limited Competence** - requires instruction and close supervision
- 1 - Exposure Only** - exposed to the concept, but no hands-on experience
- 0 - No Exposure** - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the
Correct Number:

	<u>GENERAL</u>	4 3 2 1 0	
4 3 2 1 0	Demonstrate an understanding of proper safety techniques for all types of circuits and components (DC circuits, AC circuits, analog circuits, digital circuits, discrete solid-state circuits, microprocessors)	4 3 2 1 0	Demonstrate an understanding of use of data books and cross reference/technical manuals to specify and requisition electronic components
4 3 2 1 0	Demonstrate an understanding of and comply with relevant OSHA safety standards	4 3 2 1 0	Demonstrate an understanding of the interpretation and creation of electronic schematics, technical drawings, and flow diagrams
4 3 2 1 0	Demonstrate an understanding of proper troubleshooting techniques	4 3 2 1 0	Demonstrate an understanding of design curves, tables, graphs, and recording of data
4 3 2 1 0	Demonstrate an understanding of basic assembly skills using hand and power tools	4 3 2 1 0	Demonstrate an understanding of color codes and other component descriptors
4 3 2 1 0	Demonstrate an understanding of acceptable soldering/desoldering techniques, including through-hole and surface mount devices	4 3 2 1 0	Demonstrate an understanding of site electrical and environmental survey
4 3 2 1 0	Demonstrate an understanding of proper solderless connections	4 3 2 1 0	Demonstrate the use of listening skills or assistive devices to assess signs and symptoms of malfunctions

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale: **4 - Mastered** - can perform skill independently with no supervision
3 - Moderately Competent - can complete skill with limited supervision
2 - Limited Competence - requires instruction and close supervision
1 - Exposure Only - exposed to the concept, but no hands-on experience
0 - No Exposure - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the
Correct Number:

DC CIRCUITS

4 3 2 1 0	Demonstrate an understanding of sources of electricity in DC circuits	4 3 2 1 0	Fabricate and demonstrate DC parallel circuits
4 3 2 1 0	Demonstrate an understanding of principles and operation of batteries	4 3 2 1 0	Troubleshoot and repair DC parallel circuits
4 3 2 1 0	Demonstrate an understanding of the meaning of and relationships among and between voltage, current, resistance, and power in DC	4 3 2 1 0	Understand the principles and operations of DC series-parallel and bridge circuits
4 3 2 1 0	Demonstrate an understanding of measurement of resistance of conductors and insulators and the computation of conductance	4 3 2 1 0	Fabricate and demonstrate DC series-parallel and bridge circuits
4 3 2 1 0	Demonstrate an understanding of application of Ohms Law to series, parallel, and series-parallel circuits	4 3 2 1 0	Troubleshoot and repair DC series-parallel and bridge circuits
4 3 2 1 0	Demonstrate an understanding of magnetic properties of circuits and devices	4 3 2 1 0	Understand the principles and operations of the Wheatstone Bridge
4 3 2 1 0	Demonstrate an understanding of the physical, electrical characteristics of capacitors and inductors	4 3 2 1 0	Understand principles and operations of DC voltage divider circuits (loaded and unloaded)
4 3 2 1 0	Understand principles and operations of DC series circuits	4 3 2 1 0	Fabricate and demonstrate DC voltage divider circuits (loaded and unloaded)
4 3 2 1 0	Fabricate and demonstrate DC series circuits	4 3 2 1 0	Troubleshoot and repair DC voltage divider circuits (loaded and unloaded)
4 3 2 1 0	Troubleshoot and repair DC series circuits	4 3 2 1 0	Understand principles and operations of DC RC and RL circuits
4 3 2 1 0	Understand principles and operations of DC parallel circuits	4 3 2 1 0	Fabricate and demonstrate DC RC and RL circuits
		4 3 2 1 0	Troubleshoot and repair DC RC and RL circuits
		4 3 2 1 0	Demonstrate an understanding of measurement of power in DC circuits

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale:

- 4 - Mastered** - can perform skill independently with no supervision
- 3 - Moderately Competent** - can complete skill with limited supervision
- 2 - Limited Competence** - requires instruction and close supervision
- 1 - Exposure Only** - exposed to the concept, but no hands-on experience
- 0 - No Exposure** - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the
Correct Number:

<u>AC CIRCUITS</u>		4	3	2	1	0	
							Troubleshoot and repair AC circuits using transformers
4	Demonstrate an understanding of sources of electricity in AC circuits	3	2	1	0		
4	Demonstrate an understanding of the properties of an AC signal	3	2	1	0		Understand principles and operations of AC differentiator and integrator circuits (determine RC and RL time constants)
4	Demonstrate an understanding of the principles of operation and characteristics of sinusoidal and non-sinusoidal wave forms	3	2	1	0		Fabricate and demonstrate AC differentiator and integrator circuits
4	Demonstrate an understanding of basic motor/generator theory and operation	3	2	1	0		Troubleshoot and repair AC differentiator and integrator circuits
4	Demonstrate an understanding of measurement of power in AC circuits	3	2	1	0		Understand principles and operations of AC series and parallel resonant circuits
4	Demonstrate an understanding of the principle and operation of various power conditioning: (isolation transformers, surge suppressors, uninterruptible power systems)	3	2	1	0		Fabricate and demonstrate AC series and parallel resonant circuits
4	Demonstrate an understanding of the principle and operation of safety grounding systems: (lightning arresters, ground fault interrupters, etc.)	3	2	1	0		Troubleshoot and repair AC series and parallel resonant circuits
4	Understand principles and operations of AC capacitive circuits	3	2	1	0		Understand principles and operations of AC RC, RL, and RLC circuits
4	Fabricate and demonstrate AC capacitive circuits	3	2	1	0		Fabricate and demonstrate AC RC, RL, and RLC circuits
4	Troubleshoot and repair AC capacitive circuits	3	2	1	0		Troubleshoot and repair AC RC, RL, and RLC circuits
4	Understand principles and operations of AC inductive circuits	3	2	1	0		Understand principles and operations of AC frequency selective filter circuits
4	Fabricate and demonstrate AC inductive circuits	3	2	1	0		Fabricate and demonstrate AC frequency selective filter circuits
4	Troubleshoot and repair AC inductive circuits	3	2	1	0		Troubleshoot and repair AC frequency selective filter circuits
4	Understand principles and operations of AC circuits using transformers	3	2	1	0		Understand principles and operations of AC polyphase circuits
4	Demonstrate an understanding of impedance matching theory	3	2	1	0		Understand principles and operations of AC phase locked loop circuits
4	Fabricate and demonstrate AC circuits using transformers	3	2	1	0		Troubleshoot and repair AC phase locked loop circuits

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale: **4 - Mastered** - can perform skill independently with no supervision
3 – Moderately Competent – can complete skill with limited supervision
2 - Limited Competence - requires instruction and close supervision
1 – Exposure Only – exposed to the concept, but no hands-on experience
0 - No Exposure - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the
Correct Number:

<u>DISCRETE SOLID STATE DEVICES</u>			
4 3 2 1 0	Demonstrate an understanding of the properties of semiconductor materials	4 3 2 1 0	Fabricate and demonstrate optoelectronic circuits (gate isolators, interrupt sensors, infra-red sensors, etc.)
4 3 2 1 0	Demonstrate an understanding of PN junctions	4 3 2 1 0	Troubleshoot and repair optoelectronic circuits (gate isolators, interrupt sensors, infra-red sensors, etc.)
4 3 2 1 0	Demonstrate an understanding of bipolar transistors	4 3 2 1 0	Understand principles and operations of single stage amplifiers
4 3 2 1 0	Demonstrate an understanding of field effect transistors (FET's/MOS-FET's)	4 3 2 1 0	Fabricate and demonstrate single stage amplifiers
4 3 2 1 0	Demonstrate an understanding of special diodes and transistors	4 3 2 1 0	Troubleshoot and repair single stage amplifiers
4 3 2 1 0	Understand principles and operations of diode circuits	4 3 2 1 0	Understand principles and operations of thyristor circuitry (SCR, TRIAC, DIAC, etc.)
4 3 2 1 0	Fabricate and demonstrate diode circuits	4 3 2 1 0	Fabricate and demonstrate thyristor circuitry (SCR, TRIAC, DIAC, etc.)
4 3 2 1 0	Troubleshoot and repair diode circuits	4 3 2 1 0	Troubleshoot and repair thyristor circuitry (SCR, TRIAC, DIAC, etc.)
4 3 2 1 0	Understand principles and operations of optoelectronic circuits (gate isolators, interrupt sensors, infra red sensors, etc.)		

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale: **4 - Mastered** - can perform skill independently with no supervision
3 - Moderately Competent - can complete skill with limited supervision
2 - Limited Competence - requires instruction and close supervision
1 - Exposure Only - exposed to the concept, but no hands-on experience
0 - No Exposure - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the
Correct Number:

<u>ANALOG CIRCUITS</u>		4 3 2 1 0	
4 3 2 1 0	Understand principles and operations of multistage amplifiers	4 3 2 1 0	Understand principles and operations of regulated and switching power supply circuits
4 3 2 1 0	Fabricate and demonstrate multistage amplifiers	4 3 2 1 0	Troubleshoot and repair regulated and switching power supply circuits
4 3 2 1 0	Troubleshoot and repair multistage amplifiers	4 3 2 1 0	Understand principles and operations of active filter circuits
4 3 2 1 0	Understand principles and operations of IF circuits	4 3 2 1 0	Troubleshoot and repair active filter circuits
4 3 2 1 0	Fabricate and demonstrate IF circuits	4 3 2 1 0	Understand principles and operations of sinusoidal and non-sinusoidal oscillator circuits
4 3 2 1 0	Troubleshoot and repair IF circuits	4 3 2 1 0	Troubleshoot and repair sinusoidal and non-sinusoidal oscillator circuits
4 3 2 1 0	Understand principles and operations of linear power supplies and filters	4 3 2 1 0	Understand principles and operations of fiber optic circuits using photodiodes or LASERS
4 3 2 1 0	Fabricate and demonstrate linear power supplies and filters	4 3 2 1 0	Troubleshoot and repair fiber optic circuits using photodiodes or LASERS
4 3 2 1 0	Troubleshoot and repair linear power supplies and filters	4 3 2 1 0	Understand principles and operations of RF circuits
4 3 2 1 0	Understand principles and operations of operational amplifier circuits	4 3 2 1 0	Fabricate and demonstrate RF circuits
4 3 2 1 0	Fabricate and demonstrate operational amplifier circuits	4 3 2 1 0	Troubleshoot and repair RF circuits
4 3 2 1 0	Troubleshoot and repair operational amplifier circuits	4 3 2 1 0	Understand principles and operations of signal modulation systems (AM, FM, stereo)
4 3 2 1 0	Understand principles and operations of audio power amplifiers	4 3 2 1 0	Troubleshoot and repair signal modulation systems (AM, FM, stereo)
4 3 2 1 0	Fabricate and demonstrate audio power amplifiers	4 3 2 1 0	Demonstrate an understanding of motor phase shift control circuit
4 3 2 1 0	Troubleshoot and repair audio power amplifiers	4 3 2 1 0	Understand the principles and operations of microwave circuits

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale:

- 4 - Mastered** - can perform skill independently with no supervision
- 3 - Moderately Competent** - can complete skill with limited supervision
- 2 - Limited Competence** - requires instruction and close supervision
- 1 - Exposure Only** - exposed to the concept, but no hands-on experience
- 0 - No Exposure** - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the

Correct Number:

<u>DIGITAL CIRCUITS</u>			
		4 3 2 1 0	Fabricate and demonstrate clock and timing circuits
4 3 2 1 0	Demonstrate an understanding of the characteristics of integrated circuit (IC) logic families	4 3 2 1 0	Troubleshoot and repair clock and timing circuits
4 3 2 1 0	Demonstrate an understanding of minimizing logic circuits using Boolean operations	4 3 2 1 0	Understand principles and operations of types of arithmetic-logic circuits
4 3 2 1 0	Understand principles and operations of linear integrated circuits	4 3 2 1 0	Troubleshoot and repair types of arithmetic-logic circuits
4 3 2 1 0	Troubleshoot and repair linear integrated circuits	4 3 2 1 0	Understand principles and operations of types of multiplexer and demultiplexer circuits
4 3 2 1 0	Understand principles and operations of types of logic gates	4 3 2 1 0	Troubleshoot and repair types of multiplexer and demultiplexer circuits
4 3 2 1 0	Fabricate and demonstrate types of logic gates	4 3 2 1 0	Understand principles and operations of types of digital to analog and analog to digital circuits
4 3 2 1 0	Troubleshoot and repair types of logic gates	4 3 2 1 0	Troubleshoot and repair types of digital to analog and analog to digital circuits
4 3 2 1 0	Understand principles and operations of combinational logic circuits	4 3 2 1 0	Understand principles and operations of types of digital display circuits
4 3 2 1 0	Fabricate and demonstrate combinational logic circuits	4 3 2 1 0	Troubleshoot and repair types of digital display circuits
4 3 2 1 0	Troubleshoot and repair combinational logic circuits	4 3 2 1 0	Understand principles and operations of power distribution noise problems
4 3 2 1 0	Understand principles and operations of types of flip-flop circuits	4 3 2 1 0	Troubleshoot and repair power distribution noise problems
4 3 2 1 0	Fabricate and demonstrate types of flip-flop circuits	4 3 2 1 0	Understand principles and operations of types of digital encoders and decoders
4 3 2 1 0	Troubleshoot and repair flip-flop circuits	4 3 2 1 0	Troubleshoot and repair types of digital encoders and decoders
4 3 2 1 0	Understand principles and operations of types of registers and counters	4 3 2 1 0	Understand principles and operations of digital display devices
4 3 2 1 0	Fabricate and demonstrate types of registers and counters	4 3 2 1 0	Troubleshoot and repair digital display devices
4 3 2 1 0	Troubleshoot and repair types of registers and counters	4 3 2 1 0	
4 3 2 1 0	Understand principles and operations of clock and timing circuits	4 3 2 1 0	

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

- Rating Scale:**
- 4 - Mastered** - can perform skill independently with no supervision
 - 3 - Moderately Competent** - can complete skill with limited supervision
 - 2 - Limited Competence** - requires instruction and close supervision
 - 1 - Exposure Only** - exposed to the concept, but no hands-on experience
 - 0 - No Exposure** - no experience or knowledge in this area

TECHNICAL SKILLS

Circle the

Correct Number:

<u>MICROPROCESSORS</u>		<u>MICROCOMPUTERS</u>	
4 3 2 1 0	Demonstrate an understanding of microprocessor interfaces	4 3 2 1 0	Demonstrate an understanding of microcomputer operating systems
4 3 2 1 0	Troubleshoot and repair microprocessor interfaces	4 3 2 1 0	Demonstrate an understanding of essential microcomputer components
4 3 2 1 0	Demonstrate an understanding of essential microprocessor components	4 3 2 1 0	Demonstrate an understanding of microcomputer peripherals
4 3 2 1 0	Demonstrate an understanding of microprocessor BUS concepts	4 3 2 1 0	Set up and configure a microcomputer using available operating systems and software packages
4 3 2 1 0	Demonstrate an understanding of microprocessor components and terminology	4 3 2 1 0	Troubleshoot and replace microcomputer peripherals
4 3 2 1 0	Understand principles and operation of types of microprocessor memory circuits		
4 3 2 1 0	Troubleshoot and repair types of microprocessor memory circuits		
4 3 2 1 0	Understand principles and operations of Microprocessor machine code and instruction sets		

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student's degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

Rating Scale:

- 4 - Mastered** - can perform skill independently with no supervision
- 3 - Moderately Competent** - can complete skill with limited supervision
- 2 - Limited Competence** - requires instruction and close supervision
- 1 - Exposure Only** - exposed to the concept, but no hands-on experience
- 0 - No Exposure** - no experience or knowledge in this area

BASIC AND PRACTICAL SKILLS I

Circle the

Correct Number:

	<u>TECHNICAL LITERACY</u>	4 3 2 1 0	Participate in meetings in a positive and constructive manner
4 3 2 1 0	Demonstrate basic keyboarding skills	4 3 2 1 0	Use job-related terminology
4 3 2 1 0	Demonstrate ability to use standard applications software such as word processors, database management, and spreadsheets	4 3 2 1 0	Write technical reports, letters, and memoranda as appropriate to the audience (e.g., management, customers, co-workers, and manufacturers)
4 3 2 1 0	Maintain state-of-the-art skills through participation in in-service or other training	4 3 2 1 0	Document work projects, procedures, tests, and equipment failures
4 3 2 1 0	Participate in continuing education		<u>SOLVING PROBLEMS AND CRITICAL THINKING</u>
4 3 2 1 0	Understand and apply continuous improvement principles	4 3 2 1 0	Identify the problem
4 3 2 1 0	Demonstrate knowledge of the business products/services	4 3 2 1 0	Clarify purposes and goals
	<u>COMMUNICATING ON THE JOB</u>	4 3 2 1 0	Identify available solutions and their impact including evaluating credibility of information, and locating information
4 3 2 1 0	Use effective written and other communication skills	4 3 2 1 0	Evaluate options
4 3 2 1 0	Use telephone etiquette including relaying messages accurately	4 3 2 1 0	Set priorities
4 3 2 1 0	Employ appropriate skills for gathering and retaining information	4 3 2 1 0	Select/implement options/decisions including predicting results of proposed action
4 3 2 1 0	Interpret written, graphic and oral instructions	4 3 2 1 0	Organize personal workloads
4 3 2 1 0	Interact with co-workers and customers in a logical, clear and understandable manner	4 3 2 1 0	Participate in brainstorming sessions to generate new ideas and solve problems
4 3 2 1 0	Use language appropriate to the situation		

ELECTRONICS

Student Competency Achievement

Directions: Evaluate the trainee using the rating scale below and circle the number that best describes the student’s degree of competency. The numerical ratings of 4, 3, 2, 1, and 0 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each number focus on the level of student competence.

- Rating Scale:**
- 4 - Mastered** - can perform skill independently with no supervision
 - 3 – Moderately Competent** – can complete skill with limited supervision
 - 2 - Limited Competence** - requires instruction and close supervision
 - 1 – Exposure Only** – exposed to the concept, but no hands-on experience
 - 0 - No Exposure** - no experience or knowledge in this area

BASIC AND PRACTICAL SKILLS II

Circle the Correct Number:

	Reading	4 3 2 1 0	Simplify and solve algebraic expressions and formulas
4 3 2 1 0	Read and apply various sources of technical information (e.g., manufacturer literature, codes, and regulations.)	4 3 2 1 0	Select and use formulas appropriately Understand and use scientific notation
	Proficiency in Mathematics	4 3 2 1 0	Use properties of exponents and logarithms
4 3 2 1 0	Determine if a solution is reasonable	4 3 2 1 0	Determine slope, midpoint, and distance
4 3 2 1 0	Demonstrate ability to use a simple electronic calculator	4 3 2 1 0	Graph functions
4 3 2 1 0	Round and/or truncate numbers to designated place value	4 3 2 1 0	Use Boolean algebra to break down logic circuits
4 3 2 1 0	Compare order and determine equivalences of real numbers (e.g., fractions, decimals, percentages).	4 3 2 1 0	Determine perimeters and areas of geometric figures
4 3 2 1 0	Solve problems and make applications involving integers, fractions, decimals, percentages, and ratios using order of operations	4 3 2 1 0	Determine surface areas and volumes of applicable geometric figures
4 3 2 1 0	Translate written and/or verbal statements into mathematical expressions	4 3 2 1 0	Recognize, classify, and use properties of lines and angles
4 3 2 1 0	Compare, compute, and solve problems involving binary, octal, decimal, and hexadecimal numbering systems	4 3 2 1 0	Recognize, classify, and use properties of two- and three-dimensional figures (e.g., circles, triangles, rectangles, cylinders)
4 3 2 1 0	Convert, compare, and compute with common units of measurement within and across measurement systems	4 3 2 1 0	Apply Pythagorean theorem
4 3 2 1 0	Read scale on measurement device(s) and make interpolations where appropriate	4 3 2 1 0	Identify basic functions of sine, cosine, and tangent
4 3 2 1 0	Understand statistical terms and charts needed for interpretation of continuous improvement processes	4 3 2 1 0	Compute and solve problems using basic trigonometric functions
4 3 2 1 0	Collect and organize data into tables, charts, and/or graphs	4 3 2 1 0	Graph basic functions using polar and/or Cartesian coordinate systems
4 3 2 1 0	Interpret and use tables, charts, maps, and/or graphs	4 3 2 1 0	Proficiency In Physics
4 3 2 1 0	Identify patterns, note trends, and/or draw conclusions from tables, charts, maps, and/or graphs	4 3 2 1 0	Understand fundamental principles of mechanics
4 3 2 1 0	Compute and interpret mean, median, and/or mode	4 3 2 1 0	Understand fundamental principles of pneumatics
		4 3 2 1 0	Understand fundamental principles of hydraulics
		4 3 2 1 0	Understand principles of electricity including its relationship to the nature of matter