

Course Outline

Energy, Environment, and Utilities

REVISED: August/2017

Job Title
Electrician

72-75-70

Career Pathway:
Energy and Power Technology

Electric Motor Controls

Credits: 30

Hours: 360

Industry Sector:
Energy, Environment, and
Utilities

Course Description:

This competency-based course is the last in a sequence of five designed for electrical technician and electrician trainees. It provides students with technical instruction and practical experience in motor operation. It focuses on the features, functions, and control of magnetic full voltage starters. It also covers the basic operation of manual motor starters, the operation and application of motor overload devices and control pilot devices, the use and troubleshooting techniques for two-wire, three-wire, and separate control circuits, and employability skills. The course also features a review of classroom and workplace safety procedures and resource management. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards and the California Career Technical Education Model Curriculum Standards.

O*NET-SOC CODE:
47-2111.00

CBEDS Title:
Introduction to Electrical Power
Systems

CBEDS No.:
5583

Prerequisites:

Enrollment requires successful completion of the Electrician/4: Industrial (72-75-65) course.

NOTE: For Perkins purposes this course has been designated as a **capstone** course.

This course cannot be repeated once a student receives a Certificate of Completion.



COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS

LOCATION

GOALS AND PURPOSES

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES

pp. 7-13

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPETENCY-BASED COMPONENTS
(continued)

COURSE OUTLINE COMPONENTS

LOCATION

INSTRUCTIONAL STRATEGIES

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Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

pp. 7-13

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

EVALUATION PROCEDURES

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The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

ACKNOWLEDGMENTS

Thanks to PAUL PIDOUX and MARCELA BAKER for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS

Energy, Environment and Utilities Industry Sector

Knowledge and Performance Anchor Standards

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Energy, Environment, and Utilities academic alignment matrix for identification of standards.

2.0 Communications

Acquire, and accurately use Energy, Environment, and Utilities sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Energy, Environment, and Utilities sector workplace environment.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Energy, Environment, and Utilities sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Energy, Environment, and Utilities sector workplace environment.

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Energy, Environment, and Utilities sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Energy, Environment, and Utilities sector.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Energy, Environment, and Utilities anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

Energy, Environment, and Utilities Sector Pathway Standards

B. Energy and Power Technology Pathway

The Energy and Power Technology pathway provides learning opportunities for students interested in preparing for careers in the energy and power industries.

Sample occupations associated with this pathway:

- ◆ Energy Efficiency Evaluation Specialist
- ◆ Energy Engineer
- ◆ Energy Generation/Power Distribution, Maintenance, Inspection, and Repair Technicians
- ◆ Energy/Building Retrofit Specialist
- ◆ Plant/Field Weatherization Installer

- B1.0 Explore the basic conventional and emerging principles and concepts of the energy industry, including energy production, energy transmission, and alternative energy technologies.
- B2.0 Identify various conventional electric power generation fuel sources and the cost and efficiency issues associated with each.
- B3.0 Investigate emerging and alternative electric power generation technologies and fuel sources.
- B4.0 Understand nonnuclear power generation plant operations (coal, oil, natural gas, solar, wind, geothermal power, hydroelectric, or biofuel).
- B5.0 Understand and apply basic knowledge and skills necessary for nuclear power generation and nuclear power plant personnel.
- B6.0 Research methods of energy procurement, transmission, distribution, and storage.
- B7.0 Understand the interrelationships among components of systems.

CBE
Competency-Based Education

COMPETENCY-BASED COMPONENTS
for the Electric Motor Controls Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. SAFETY AND REVIEW OF FUNDAMENTALS</p> <p>Review, apply, and evaluate the classroom and workplace safety procedures; understand the fundamentals of motor, multimeter, and power systems.</p> <p>(15 hours)</p>	<ol style="list-style-type: none"> 1. Demonstrate safe work procedures in the classroom. 2. Demonstrate proper techniques for operating electrical equipment. 3. Demonstrate correct use of the voltage tester. 4. Describe precautions to be taken when using any meter. 5. Describe the megohmmeter and its use. 6. Identify the clamp-on ammeter and demonstrate its proper use. 7. Identify various motors by reading nameplate information. 8. Explain the proper connections for various motors. 9. Describe the components that are fundamental to motor maintenance. 10. Demonstrate the ability to follow written and spoken instructions. 11. Demonstrate the ability to read and apply reference text material. 12. Pass the designated safety test with 100% accuracy. 	<p>Career Ready Practice: 1, 3, 5, 6</p> <p>CTE Anchor: Communications: 2.1, 2.2, 2.3, 2.4 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.6, 6.8, 6.9, 6.11, 6.12, 6.13, 6.15, 6.16 Technical Knowledge and Skills: 10.2, 10.5</p> <p>CTE Pathway: B7.4</p>
<p>B. MANUAL MOTOR STARTERS</p> <p>Understand, apply, and evaluate the features and function of manual motor starters.</p>	<ol style="list-style-type: none"> 1. Identify fractional horsepower manual motor starters. 2. Identify three-phase manual motor starters. 3. Differentiate between code approved/not approved items. 4. Identify the on, off, and tripped positions of starters. 	<p>Career Ready Practice: 1, 3, 5</p> <p>CTE Anchor: Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.4 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)		CTE Pathway: B4.2, B5.2
<p>C. MAGNETIC FULL VOLTAGE STARTERS</p> <p>Understand, apply, and evaluate the features, functions, and control of full-voltage starters.</p>	<ol style="list-style-type: none"> 1. Describe the basic operation of a starter. 2. Differentiate between single- and three-phase starters. 3. Describe the various sizes of motor starters. 4. Describe the standard connection numbering of National Electrical Manufacturers Association (NEMA) devices. 5. Describe International Electrotechnical Commission (IEC) devices and their numbering system. 6. Disassemble and rebuild starters. 7. Describe the internal parts of starters and their function during a rebuild. 8. Wire starter in given circuits and test the circuits. 9. Demonstrate correct wiring of the overload switch(es). 10. Demonstrate ways and means of starting and stopping motors. 11. Describe and demonstrate the operation of a magnetic coil. 12. Describe the use of controllers. 13. Demonstrate the correct sizing of magnetic starters and controllers. 14. Explain the difference between magnetic starters and controllers. 15. Describe the following aspects of overload protective devices: <ol style="list-style-type: none"> a. function b. operation c. characteristics 16. Draw schematics for various control circuits. 17. Describe and demonstrate the use of interlocking methods. 18. Describe and demonstrate the following: <ol style="list-style-type: none"> a. reversing controllers b. sequential controllers 19. Define the following terms: <ol style="list-style-type: none"> a. jogging b. inching c. plugging 20. Describe and demonstrate the use of the following: <ol style="list-style-type: none"> a. multiple start-stop controls b. selector switches 21. Describe and demonstrate the use of phase failure relays. 22. Demonstrate various manual and automatic speed control techniques. 23. Describe the characteristics of variable frequency drive systems. 24. Describe the following aspects of variable frequency drive systems: <ol style="list-style-type: none"> a. function b. operation 25. Describe the characteristics of programmable logic controllers (PLC). 26. Describe the following aspects of PLCs: <ol style="list-style-type: none"> a. function 	<p>Career Ready Practice: 1, 2, 3, 4, 5, 10, 11</p> <p>CTE Anchor: Communications: 2.1, 2.2, 2.3, 2.4 Technology: 4.1, 4.2, 4.3 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6, 6.8, 6.11, 6.13, 6.15, 6.16 Technical Knowledge and Skills: 10.1, 10.4</p> <p>CTE Pathway: B1.4, B7.4</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
	<ul style="list-style-type: none"> b. operation 27. Demonstrate installation procedures of PLCs. 28. Describe the function of a central processing unit (CPU). 29. Describe the need for various memory types. 30. Describe different memory sizes. 31. Explain the difference between user and storage memory. 32. Describe the need for a back-up battery. 33. Define the concept of peripheral devices. 34. Describe the function of various peripheral devices. 35. Describe the characteristics of timers. 36. Describe the following aspects of timers: <ul style="list-style-type: none"> a. function b. operation 37. Describe the characteristics of counters. 38. Describe the following aspects of counters: <ul style="list-style-type: none"> a. function b. operation 39. Describe the characteristics of sequencers. 40. Describe the following aspects of sequencers: <ul style="list-style-type: none"> a. function b. operation 41. Locate appropriate information in the service manual regarding start-up. 42. Locate appropriate information in the service manual regarding maintenance. 43. Locate appropriate information in the service manual regarding testing. 44. Interpret schematics for the following devices: <ul style="list-style-type: none"> a. manual starters b. automatic starters c. speed regulators d. controllers 45. Describe the characteristics of switches. 46. Describe the following aspects of switches: <ul style="list-style-type: none"> a. function b. operation 47. Describe the characteristics of relays. 48. Describe the following aspects of relays: <ul style="list-style-type: none"> a. function b. operation 49. Describe the characteristics of contactors. 50. Describe the following aspects of contactors: <ul style="list-style-type: none"> a. function b. operation 51. Describe the characteristics of pilot devices. 52. Describe the following aspects of pilot devices: <ul style="list-style-type: none"> a. function b. operation 53. Describe the characteristics of sensors. 	

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(200 hours)	54. Describe the following aspects of sensors: <ol style="list-style-type: none"> function operation 55. Describe the characteristics of control transformers. 56. Describe the following aspects of control transformers: <ol style="list-style-type: none"> function operation 57. Describe the purpose of ladder diagrams. 58. Draw a ladder diagram. 59. Create mechanical connections in order to utilize the following: <ol style="list-style-type: none"> starters controllers motors drives clutches pulleys 60. Demonstrate the use of process control systems and devices.	
D. MOTOR OVERLOAD DEVICES Understand, apply, and evaluate the features and functions of overload devices inherent in motor starting devices.	<ol style="list-style-type: none"> Explain the starting and running current of a motor. Explain the effects of overloading a motor. Select the correct current/voltage from the nameplate information. State the service factor of the motor. Identify the overload relay. Explain the function of the overload relay. Identify the position of the overload heaters. Explain the relationship of the number of overload heaters to various applications. Select the correct heaters from charts and nameplates. Explain wiring to the overload switch devices. Wire overload devices correctly in given circuits. 	Career Ready Practice: 1, 3, 5, 10 CTE Anchor: Communications: 2.1, Problem Solving and Critical Thinking: 5.1, 5.4 Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.15, 6.16 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1 CTE Pathway: B7.4, B7.6
E. CONTROL PILOT DEVICES Understand, apply, and evaluate the features and functions of common pilot devices in control devices.	<ol style="list-style-type: none"> Identify various control devices. Describe the operation of various control devices. Explain pilot duty as applies to these devices. Explain the polarity warning on certain devices. Select devices according to given specifications. Differentiate between relays and contactors. Use correct nomenclature for relay parts. 	Career Ready Practice: 1, 3, 5, 10 CTE Anchor: Communications: 2.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	<ol style="list-style-type: none"> 8. Identify common time delay devices. 9. Explain the operation of various time delay devices. 10. Demonstrate the application of various time delay devices in given circuits. 11. Identify components by their schematic symbols. 12. Identify component symbols in drawings before wiring. 13. Wire components in given circuit diagrams. 14. Test and troubleshoot simple control circuits. 	<p>Problem Solving and Critical Thinking: 5.1, 5.4</p> <p>Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.15, 6.16</p> <p>Ethics and Legal Responsibilities: 8.2</p> <p>Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B7.4</p>
<p>F. TWO-WIRE CONTROL CIRCUITS</p> <p>Understand, apply, and evaluate the troubleshooting techniques for two-wire control circuits.</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> 1. Describe the general principle of two-wire control. 2. List possible safety concerns with the two-wire control circuit. 3. Select proper components for use with this circuit. 4. Wire and troubleshoot given circuits. 5. Identify and use the HOA (hand-off-auto) circuit. 6. Add additional components to given circuits. 	<p>Career Ready Practice: 1, 3, 5, 10</p> <p>CTE Anchor: Communications: 2.1, Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.15, 6.16 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: B7.4, B7.6</p>
<p>G. THREE-WIRE CONTROL CIRCUITS</p> <p>Understand, apply, and evaluate the troubleshooting techniques for three-wire control circuits.</p>	<ol style="list-style-type: none"> 1. Explain low voltage release. 2. List components needed for three-wire control circuits. 3. List common names for holding contacts. 4. Identify the correct numbered terminals for the holding contacts. 5. State the three ways the circuit is stopped. 6. State the number of wires needed between enclosures. 7. Draw elementary wiring diagrams. 	<p>Career Ready Practice: 1, 3, 5, 10</p> <p>CTE Anchor: Communications: 2.1</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(20 hours)	<ol style="list-style-type: none"> 8. Draw line and wiring diagrams. 9. Wire given circuits and troubleshoot them. 10. Draw and wire multiple station control circuits. 11. Add components to these circuits as directed. 	Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.15, 6.16 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1 CTE Pathway: B7.4, B7.6
H. SEPARATE CONTROL CIRCUITS Understand, apply, and evaluate the interpretation, wiring, and troubleshooting techniques for specific motor control problems in the lab and practical situations.	<ol style="list-style-type: none"> 1. Explain the main use of a transformer in a separate control circuit. 2. List additional components needed to create a separate control circuit. 3. Explain the needed changes to the circuit when using the transformer. 	Career Ready Practice: 1, 3, 5, 10 CTE Anchor: Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.4 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1 CTE Pathway: B7.6
I. RESOURCE MANAGEMENT REVIEW Review, apply, and evaluate resource management in the electrical industry.	<ol style="list-style-type: none"> 1. Review the following: <ol style="list-style-type: none"> a. resources b. management c. sustainability 2. Review the management of the following resources: <ol style="list-style-type: none"> a. time b. materials c. personnel 3. List specific examples of effective management of the following in the electrical industry: <ol style="list-style-type: none"> a. time b. materials c. personnel 	Career Ready Practice: 1, 2, 3, 7, 8, 9, 10, 12 CTE Anchor: Communications: 2.1 Problem Solving and Critical Thinking: 5.1, 5.4 Responsibility and Flexibility: 7.1, 7.2, 7.3, 7.4, 7.6

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	4. Review the following benefits of effective resource management in the electrical industry: <ol style="list-style-type: none"> a. profitability b. company growth c. stability 	Ethics and Legal Responsibility: 8.3, 8.4, 8.5 CTE Pathway: B1.6
J. EMPLOYABILITY SKILLS Understand, apply, and evaluate the processes involved in seeking, gaining, and maintaining employment.	<ol style="list-style-type: none"> 1. Describe the industry standards for employment. 2. Describe the range of organizations within the industry. 3. Describe the importance of knowing the organization at different levels in the industry. 4. Describe job specifics for various positions. 5. List sources for employment information. 6. Describe working conditions and pay scales. 7. Describe the economic considerations that have an impact on the industry and its members. 8. Prepare a cover letter and résumé. 9. Complete application forms. 10. Role-play basic interview skills. 11. Describe work habits required to hold a job. 12. Describe the proven methods of working with others effectively. 13. Describe the steps to effective jobsite management. 14. Describe the importance of regular attendance at professional development training or workshops. 	Career Ready Practice: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12 CTE Anchor: Communications: 2.1, 2.3 Career Planning and Management: 3.1, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9 Technology: 4.1, 4.2 Problem Solving and Critical Thinking: 5.1, 5.2, 5.4 Ethics and Legal Responsibilities: 8.3, 8.4, 8.5 Leadership and Teamwork: 9.6 Demonstration and Application: 11.1, 11.2, 11.3, 11.4, 11.5 CTE Pathway: B1.1, B1.7
(20 hours)		

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTS AND SUPPLEMENTAL BOOKS

Miller, Charles R. NFPA's Pocket Electrical References. Jones and Bartlett Publishers, 2006.

National Fire Protection Association. User's Guide to the National Electrical Code, 2008 Edition. Jones and Bartlett Publishers, 2009

Stallcup, James G. Stallcup's Electrical Grounding and Bonding Simplified, 2008 Edition. Jones and Bartlett Publishers, 2010

Stauffer, H. Brooke. NFPA's Residential Wiring, 3rd Edition. Jones and Bartlett Publishers, 2009.

Trout, Charles M. Essentials of Electric Motors and Controls. Jones and Bartlett Publishers, 2010.

Williams, Noel. NEC Q&A: Questions and Answers on the National Electrical Code. Jones and Bartlett Publishers, 2007.

RESOURCES

Employer Advisory Board members

CTE Model Curriculum Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/energyutilities.pdf>

Local representatives of the IBEW

Representatives/members of the International Association of Electrical Inspectors

www.americangreenjobs.net

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

- A. Lecture and discussion
- B. Multi-media presentations
- C. Visual aids
- D. Reference reading and study
- E. Individualized instruction

EVALUATION

SECTION A – Safety and Review of Fundamentals – Pass the safety test with 100% accuracy.

SECTION B – Manual Motor Starters – Pass all assignments and exams on manual motor starters with a minimum score of 80% or higher.

SECTION C – Magnetic Full Voltage Starters – Pass all assignments and exams on magnetic full voltage starters with a minimum score of 80% or higher.

SECTION D – Motor Overload Devices – Pass all assignments and exams on motor overload devices with a minimum score of 80% or higher.

SECTION E – Control Pilot Devices – Pass all assignments and exams on control pilot devices with a minimum score of 80% or higher.

SECTION F – Two-Wire Control Circuits – Pass all assignments and exams on two-wire control circuits with a minimum score of 80% or higher.

SECTION G – Three-Wire Control Circuits – Pass all assignments and exams on three-wire control circuits with a minimum score of 80% or higher.

SECTION H – Separate Control Circuits – Pass all assignments and exams on separate control circuits with a minimum score of 80% or higher.

SECTION I – Resource Management Review – Pass all assignments and exams on resource management review with a minimum score of 80% or higher.

SECTION J – Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.
