

WESTERN IOWA TECH COMMUNITY COLLEGE

Course Syllabus

Electrical Technician Level 3

Course Title: Electrical Technician – Level 3
Total Hours: 76
Meeting time/ location :TBA
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COURSE DESCRIPTION AND PREREQUISITES/COREQUISITES:

The Electrical Maintenance Certificate combines the disciplines of Industrial Safety, Electrical Concepts, Blueprint Reading, Motor Controls, Industrial Wiring, and Programmable Logic Controllers. Each of the levels contains portions of each of these disciplines to present a holistic and competency driven approach to the mastering of the skills necessary for an Electrical Maintenance Technician. Each level is designed to be delivered in such a way that the student attends the levels in a sequential order to ensure a complete understanding of the material. This training can be transcribed into college credit. Test outs are available to ensure the students are prepared for each level prior to registering for the training.

COURSE OBJECTIVES

The course will provide information which should enable the student to:

1. Describe the function of a transformer and give an application
2. Describe the operation of a transformer and give its schematic symbol
3. Describe how to calculate the output voltage of a transformer
4. Describe how to troubleshoot a transformer
5. Describe how to size a transformer
6. Describe a transformer's input and output power relationship and explain its importance
7. Describe how to calculate the current load of a transformer
8. Describe the function of two basic categories of transformers
9. Describe the function of a tap on the secondary of a transformer and give an application
10. Describe the function of a control transformer
11. Describe how to test and analyze circuit signals
12. Describe how to select a DMM to measure voltage for a given application
13. Describe how to use a voltage tester (wiggy)
14. Describe how to use a clamp-on ammeter
15. Describe how to use a continuity tester
16. Describe a six step troubleshooting sequence
17. Describe four methods of systems level troubleshooting and give an advantage of each
18. Describe five types of in-circuit component tests
19. Describe the function of four common electrical test instruments used in troubleshooting
20. State the NEMA and IEC standard for reversing the rotation of a three-phase motor
21. List two common control methods used to reverse a three-phase motor
22. Describe the function and operation of a drum switch
23. Describe the function and operation of a reversing magnetic motor starter
24. Describe the function of interlocking control and give an application
25. Describe three interlocking methods used in reversing motor control
26. Describe the operation of a hand-off-automatic motor control circuit

27. Describe the operation of two types of motor jogging circuits
28. Describe the function of manual and automatic modes and give an application of each
29. Describe the functions of the seven steps used to design a PLC program
30. Describe the operation of a PLC program with manual and automatic modes
31. Describe three methods of stopping a PLC-controlled machine
32. Describe the operation of a retentive timer on-delay instruction
33. Describe the function of two types of timer instructions and give an application of each
34. Describe the function and application of two types of non-retentive timer instructions
35. Describe the operation of an off-delay timer instruction
36. Describe the operation of the non-retentive timer on-delay instruction
37. Define time-driven sequencing and give three applications
38. Describe the operation of a time-driven sequence program
39. Understand the Responsibilities of Construction Personnel, Architects, Engineers, Contractors, Trades workers, Building Inspectors, Overview of Construction Process, Site Preparation, Building Core, Electrical Construction, Mechanical Construction, Construction Documentation, Responsibilities of Maintenance Personnel
40. Describe the Overview of Maintenance Processes, Preventive Maintenance, Predictive Maintenance, Maintenance Documentation, Rules and Regulations
41. Describe the operation of Power and Control Circuits, Water Tower Application
42. Basic Rules of Ladder (Line) Diagrams, One Load Per Line.
43. Load (Component) Connections, Control Device connections, Control Circuit Numbering Systems, Line Reference Numbers, Numerical Cross-References, Wire Reference Numbers, Manufacturer Terminal Numbers, Cross-Referencing Mechanically Connected Contacts, Control Circuit Logic Functions,
44. Understand AND Circuit Logic, OR Circuit Logic, NOT Circuit Logic, NOR Circuit Logic, NAND
45. Identify blueprint Power Distribution, Types of Power Distribution, 120/240 V, Single Phase 3-Wire Service, Receptacle and Plug Configurations, Grounding, NEC" Phase Arrangement and High-Phase Markings, 120/208 V, 4-Wire Service • 277/480 V, 3, 4-Wire Service • 120/240 V, Power Distribution System Conductor Color-Coding • Busways • Industrial Power Circuit Application
46. Explain how body parts are vulnerable to Musculoskeletal Disorders (MSD).
47. Identify ergonomic risk factors
48. Recognize benefits of breaks and exercises
49. Lifting with the body
50. Lifting with tools
51. Recognize chemical hazards
52. Describe OSHA's hazard communication standard
53. Locate information on safety data sheets
54. Read and interpret labels
55. Identify chemical exposure
56. Identify safe work practices through a system of controls
57. Identify exceptions to the hazard communication standard
58. Determine the risks involved in entering a confined space
59. Identify a confined space and permit required confined space
60. List the steps for safely working in a confined space and permit required confined space
61. Describe the team approach for working in a confined space and permit required confined space

CONTENT OUTLINE:

1. INTRODUCTION TO TRANSFORMERS
2. TRANSFORMER TYPES
3. SIZING A TRANSFORMER
4. TEST EQUIPMENT FOR TROUBLESHOOTING
5. INTRODUCTION TO SYSTEMS TROUBLESHOOTING
6. SYSTEM TROUBLESHOOTING METHODS
7. TROUBLESHOOTING APPLICATION

8. MANUAL MOTOR REVERSING
9. INTERLOCKING FOR REVERSING MOTOR CONTROL
10. REVERSING MAGNETIC MOTOR STARTER
11. MODES OF OPERATION
12. H-O-A CONTROL
13. PLC STOP FUNCTIONS
14. PLC MODES OF OPERATION
15. PLC PROGRAM DEVELOPMENT
16. RETENTIVE TIMER INSTRUCTIONS
17. NON-RETENTIVE TIMER INSTRUCTIONS
18. TIME-DRIVEN SEQUENCING
19. TIMER APPLICATIONS
20. FACILITY CONSTRUCTION AND MAINTENANCE SYSTEMS
21. INDUSTRIAL CONTROL SYSTEMS
22. INDUSTRIAL POWER SYSTEMS
23. Industrial Safety

COMPETENCIES:

At the conclusion of the course the student will be able to:

1. Connect and operate a transformer
2. Calculate the secondary coil voltage of a transformer
3. Troubleshoot a transformer by measuring continuity
4. Size a transformer
5. Calculate the current load on a transformer
6. Design a control transformer circuit to provide a given output voltage
7. Select and use a DMM to measure voltage for a given application
8. Select and use a voltage tester (wiggy) for a given application
9. Select and use a clamp-on ammeter for a given application
10. Select and use a continuity tester for a given application
11. Perform and analyze circuit signal tests
12. Use the symptom and cause troubleshooting method to isolate a bad component
13. Use the output-back troubleshooting method to isolate a bad component
14. Troubleshoot a 3-wire control system
15. Use the shotgun troubleshooting method to isolate a bad component
16. Troubleshoot a 2-wire control system
17. Use the half-split troubleshooting method to isolate a bad component
18. Connect and operate a drum switch to reverse a motor
19. Connect and operate a reversing magnetic motor starter to reverse a motor
20. Design a motor reversing circuit that uses a drum switch and a magnetic motor
21. starter
22. Design a reversing motor control circuit that uses pushbutton interlocking
23. Troubleshoot a reversing motor control circuit
24. Connect and operate a reversing motor circuit with mechanical and auxiliary contact interlocking
25. Connect and operate a control circuit to jog a motor
26. Design a hand-off-automatic motor control circuit
27. Troubleshoot a circuit that has manual and automatic modes
28. Connect and operate a hand-off-automatic motor control circuit
29. Connect and operate a forward/reverse jog control circuit
30. Design a PLC program using a seven-step design process

31. Design a PLC program which has both Halt and Cycle Stop functions
32. Design a motor control program which uses both manual and automatic modes
33. Enter and edit a PLC program that uses an RTO instruction
34. Enter and edit a PLC program that uses a TOF instruction
35. Enter and edit a PLC program that uses a TON instruction
36. Design a PLC program to control a plastic injection molding machine
37. Design a PLC program that uses a time-driven sequence to control an actuator
38. Design a PLC program that provides low voltage starting of an electric motor

EVALUATION/GRADING CRITERIA:

QUIZZES

OBJECTIVE TESTS

HANDS ON ASSESSMENTS

FINAL TEST

NOTE: REVIEWS AND QUIZZES WILL NOT BE ACCEPTED LATE AFTER THE INDIVIDUALLY ASSIGNED DATE !!!! REVIEWS OR QUIZZES NOT TURNED IN ON TIME WILL BE GIVEN "0" MISSED PRACTICAL TESTS AND FINAL EXAM CAN BE MADE UP ONLY BY THE APPROVAL OF THE INSTRUCTOR.

ATTENDANCE:

Students are expected to attend all sessions of classes for which they are enrolled. Absences do not excuse the student from meeting the course requirements. The student must take the initiative in making up any missed work. Each instructor will provide policies concerning course attendance.

ACADEMIC HONESTY:

Students are responsible for their own learning and development. They have a responsibility to be an active learner by attending class, completing class and laboratory assignments, and preparing in advance of the scheduled class session. Students are expected to understand and maintain high standards of academic honesty. Examples of academic dishonesty include, but are not limited to, the following:

- Cheating
- Plagiarism
- Fabrication
- Dual Submission
- Facilitating Academic Dishonesty

COMPUTER CONDUCT:

College computer systems are provided by WITCC for use by students, faculty, and staff for the purpose of furthering the educational mission of the College. This includes course work, college-related educational endeavors, and business operations. Each user is expected to follow established computer conduct policies and not to interfere with or disrupt the orderly processes of WITCC resources. Users accept the responsibility for utilizing services in ways that are ethical, that demonstrate academic integrity and respect for others who share this resource. Users must follow all existing federal, state, and local laws as they relate to computer conduct.

AMERICANS WITH DISABILITIES ACT (A):

Persons with documented disabilities may request reasonable accommodations through Disability Services, located in the Admissions & Advising Center, A300, or at (712) 274-8733, Ext. 3216.

DISCRIMINATION:

Western Iowa Tech Community College does not discriminate on the basis of race, creed, color, gender, national origin, religion, age, disability, sexual orientation, gender identity, veteran status or any other protected basis as defined in Iowa or federal law as amended from time to time in its educational programs, activities, admission procedures or employment practices. Individuals who believe they have been discriminated against may file a complaint through the College's Grievance or Complaint Procedures. Complaint or Grievance Forms and Procedures may be obtained from the WITCC Human Resources Department, Dr. Robert H. Kiser Building, Room A242, (712) 274-6400, Ext. 1220.

SAFETY AND SECURITY:

WITCC has produced videos regarding safety features and procedures that can be taken by students, staff and faculty. These videos have been posted on the myWIT homepage under the "Safety" tab and may be viewed at any time. An Emergency Response Guide along with Tornado, Fire and Secure Your Area posters have been placed in each classroom and work space area which list specific precautions that should be taken. If you have any questions or concerns, please call the Safety/Security Supervisor at 712-274-8733, extension 3210. If you have an emergency situation at the Sioux City campus, call 1316 or 911 from any telephone on campus immediately. For the outlying campuses call 911 immediately.

As a comprehensive community college, our mission is to provide quality education and to economically enhance the communities we serve.