

Mitchell Technical Institute

IC-106 Intro to Motor Controls

# Course Outcome Summary

### Course Information

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|  | Description | Controls language, with an understanding of electrical symbols, wiring, and ladder diagrams. How electrical devices function, in relation to one another, in control logic circuits, Major types of timers and timing circuits and various types of control devices used in common control circuits. |
|  | Total Credits | 3.00 |

Textbooks

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| Industrial Control Electronics: Devices, Systems, and Applications  3rd Edition   Bartelt; TerryElectrical Motor Controls for Integrated Systems  4th Edition    Rockis; Gary and Mazur; GlenElectrical Wiring Industrial  14th Edition     Herman; Stephen |

### Course Competencies

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| 1. | Identify Electrical Symbols and Abbreviations |
|  | Learning Objectives |
|  | 1.a. | Correlate device to electrical symbol |
|  | 1.b. | Correlate electronic device to electronic symbol |
|  | 1.c. | Correlate electrical symbol to proper abbreviation |
|  | 1.d. | Identify components in print reading |
|  | 1.e. | Use symbols to aide in troubleshooting  |
| 2. | Identify diagram types |
|  | Learning Objectives |
|  | 2.a. | Interpret wiring diagrams |
|  | 2.b. | Interpret schematic diagrams |
|  | 2.c. | Interpret line (ladder) diagrams |
|  | 2.d. | Interpret one-line diagrams |
| 3. | Differentiate electrical circuits |
|  | Learning Objectives |
|  | 3.a. | Recognize manual control circuits |
|  | 3.b. | Recognize automatic control circuits |
|  | 3.c. | Describe magnetic control circuits |
| 4. | Break down Line Diagram Layout |
|  | Learning Objectives |
|  | 4.a. | Determine rail placement in ladder diagram |
|  | 4.b. | Determine rung placement in ladder diagram |
|  | 4.c. | Explain how more than one load is connected in ladder diagram |
|  | 4.d. | Explain load connections in a ladder daigram |
|  | 4.e. | Explain control device connections in a ladder diagram |
| 5. | Describe references in a line diagram |
|  | Learning Objectives |
|  | 5.a. | Explain line number referencing |
|  | 5.b. | Explain numerical cross-referencing |
|  | 5.c. | Explain wire reference numbering |
|  | 5.d. | Recognize manufacturer's terminal numbering |
|  | 5.e. | Recognize different methods of cross-referencing mechanically connected contacts |
| 6. | Differentiate the three basic sections of the line diagram |
|  | Learning Objectives |
|  | 6.a. | Describe signal section |
|  | 6.b. | Describe decision section |
|  | 6.c. | Describe action section |
| 7. | Determine circuit logic functions |
|  | Learning Objectives |
|  | 7.a. | Recognize AND logic function |
|  | 7.b. | Recognize OR logic function |
|  | 7.c. | Recognize NOT logic function |
|  | 7.d. | Recognize NAND logic function |
|  | 7.e. | Recognize NOR logic function |
|  | 7.f. | Recognize combination logic functions |
|  | 7.g. | Identify memory in ladder logic circuits |
| 8. | Identify troubleshooting methods and faults |
|  | Learning Objectives |
|  | 8.a. | Describe tie-down troubleshooting method |
|  | 8.b. | Describe open circuit readings on a DMM |
|  | 8.c. | Describe shorted circuit reading on a DMM |
| 9. | Explain electromechanical relay construction |
|  | Learning Objectives |
|  | 9.a. | Identify poles of a relay |
|  | 9.b. | Identify throws of a relay |
|  | 9.c. | State difference between single-break and double-break |
| 10. | Differentiate solid-state switching methods |
|  | Learning Objectives |
|  | 10.a. | Describe zero switching relay |
|  | 10.b. | Describe instant-on switching relay |
|  | 10.c. | Describe peak switching relay |
|  | 10.d. | Describe analog switching relay |
| 11. | Compare electromechanical relays and solid-state relays |
|  | Learning Objectives |
|  | 11.a. | List advantages of a electromechanical relay |
|  | 11.b. | List limitations of a electromechanical relay |
|  | 11.c. | List advantages of a solid-state relay |
|  | 11.d. | List limitations of a solid-state relay |
| 12. | Describe troubleshooting electromechanical relay circuits |
|  | Learning Objectives |
|  | 12.a. | Explain manual relay operation and precautions |
|  | 12.b. | Summarize procedure of testing with a digital multimeter test |
| 13. | Describe solid-state relay circuit troubleshooting  |
|  | Learning Objectives |
|  | 13.a. | Summarize procedure for relay fails to turn off load |
|  | 13.b. | Summarize procedure for relay fails to turn on load |
| 14. | Summarize manual contactor's usage and construction |
|  | Learning Objectives |
|  | 14.a. | List typical loads |
|  | 14.b. | State advantage of double-break contacts |
|  | 14.c. | Explain difference in single-phase and three-phase contactor |
| 15. | Summarize manual starters |
|  | Learning Objectives |
|  | 15.a. | State difference between motor starter and contactor |
|  | 15.b. | Describe over load protection |
| 16. | State two types of magnetic contactor wiring |
|  | Learning Objectives |
|  | 16.a. | Summarize two-wire control |
|  | 16.b. | Summarize three-wire control |
| 17. | Describe types of magnetic motor starter overload protection |
|  | Learning Objectives |
|  | 17.a. | Explain magnetic overload relays |
|  | 17.b. | Summarize electronic overloads |
|  | 17.c. | Summarize programmable overloads |
| 18. | Describe reversing of different motor types |
|  | Learning Objectives |
|  | 18.a. | Explain method of reversing a three-phase motor |
|  | 18.b. | Explain method of reversing a single-phase motor |
|  | 18.c. | Explain method of reversing a DC motor |
| 19. | Explain reversing motors with drum switches |
|  | Learning Objectives |
|  | 19.a. | Use wiring diagram to reverse three-phase motor |
|  | 19.b. | Use wiring diagram to reverse a single-phase motor |
|  | 19.c. | Use wiring diagram to reverse a DC shunt motor |
|  | 19.d. | Use wiring diagram to reverse a DC series motor |
|  | 19.e. | Use a wiring diagram to reverse a DC compound motor |
| 20. | Discuss types of interlocking for motor reversing |
|  | Learning Objectives |
|  | 20.a. | Describe mechanical interlocking |
|  | 20.b. | Design auxiliary contact interlocking |
|  | 20.c. | Summarize pushbutton interlocking |
| 21. | Examine magnet motor starter reversing applications |
|  | Learning Objectives |
|  | 21.a. | Analyze motor reversing circuit with indicator lights |
|  | 21.b. | Analyze reversing circuit with limit switches |
|  | 21.c. | Analyze revering circuit with selector switch |
|  | 21.d. | Analyze reversing circuit with jog |
| 22. | Describe motor control wiring methods |
|  | Learning Objectives |
|  | 22.a. | Describe direct hard wiring method |
|  | 22.b. | Explain hard wiring using terminal strips method |
|  | 22.c. | Describe PLC wiring method |
| 23. | Generalize reversing circuits troubleshooting procedures |
|  | Learning Objectives |
|  | 23.a. | Summarize procedure for troubleshooting reversing control circuits |
|  | 23.b. | Summarize procedure for troubleshooting reversing power circuits |
| 24. | State categories of timers |
|  | Learning Objectives |
|  | 24.a. | Summarize dashpot timers |
|  | 24.b. | Generalize synchronous timers |
|  | 24.c. | Explain solid-state timers  |
|  | 24.d. | Summarize programmable timers |
| 25. | Differentiate between timing functions |
|  | Learning Objectives |
|  | 25.a. | Explain On-delay timers |
|  | 25.b. | Explain OFF-delay timers |
|  | 25.c. | Explain One-shot timers |
|  | 25.d. | Explain recycle timers |
| 26. | Identify types of controlled timers |
|  | Learning Objectives |
|  | 26.a. | Identify contact-controlled timer and circuit |
|  | 26.b. | Identify transistor-controlled timer and circuit |
|  | 26.c. | Identify sensor-controlled timer and circuit |
| 27. | State procedures of troubleshooting timing circuits |
|  | Learning Objectives |
|  | 27.a. | List the four measurement procedures for troubleshooting timing sircuits |
| 28. | Describe counter functions |
|  | Learning Objectives |
|  | 28.a. | Explain up counter operation |
|  | 28.b. | Describe up counter applications |
|  | 28.c. | Explain up/down counter operation |
|  | 28.d. | Describe up/down counter application |
|  | 28.e. | Explain totalizer operation |
|  | 28.f. | Describe totalizer application |

### Grading Information

100% - 90% A
 89% - 80% B
 79% - 70% C
 69% - 60% D
 59% - Below F