**CHAMP Course Map**

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| **Course Name:** Motors & Controls ELT 252 |
| **Instructor Name:** Brian Willis | **Date:** 14 May, 2014 |
| Covers the fundamentals of Industrial Motor Controls) as they are applied in Industrial application and automation. Includes history, terminology, typical applications and hardware. Incorporates lab and project activities that address operating, monitoring, Building, troubleshooting, and repairing Motor controls lab trainers as well as actual industrial equipment.1. Describe the cause and effect of electrical shock.
2. Review and practice measures to prevent electrical shock.
3. List and observe special precautions necessary when dealing with motors and controllers.
4. Explain the construction and uses of industrial switching components (manually operated switches, mechanically operated switches, solenoids, electromagnetic relays, solid-state relays).
5. Understand the design and installation of industrial power supplies (linear voltage regulators, switching voltage regulators, emergency power supplies, and three-phase power supplies).
6. Test and analyze the characteristics of AC and DC motors (series motor, compound motor, shunt motor, universal motor, induction motor, synchronous motor, and stepper motor).
7. Test and analyze the characteristics of armature current, field current, and load characteristics (series generators, shunt generators, separately excited generators, and generator regulators).
8. Recognize and analyze the effects of series field troubles on motor current and R.P.M.
9. Recognize and analyze the effects of shunt motors (open field, shorted field).
10. Diagnose troubles in field control circuits and armature circuits.
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**Course Materials (Text, Edition and any other publisher items)**

**Textbooks and/or Resources:**

**Electric Motors and Control Systems, Frank D. Petruzella, ISBN 978-0-07-352182-4, McGraw Hill**

**Activities Manual; For Electric Motors and Control Systems, Frank D. Petruzella, ISBN 978-0-07-734257-9, McGraw Hill**

**Constructor 9 software (included in Activities Manual)**

**Resources:**

**Rubrics:** Rubrics and specific grading criteria for EACH assessment should be included at the end of the course map.

| **Module # and Title** | **CCNS Competencies** | **Content, Activities or Challenges****(Learner Interaction** **& Engagement)** | **Assessments, Rubrics (Feedback)** | **Publish to OER** |
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| Module 1SafetyAndElectrical Drawing | 1, 2, 3, 4 | 1. Lecture on: a. Electrical Safety b. 2. Lecture on: a. Evolution and history of Motor Controls b. Electrical Drawings, Schematic Symbols, Block Diagrams and Component Rating used in Motor Control Circuits.3. Reading: 1. Safety in the Workplace
2. Understanding Electrical Drawings
3. [Seven Electrical Safety Habits for a Safer Workplace](http://www.rendermagazine.com/articles/2010-issues/2010-october/2010-10-tech-topics/)

4. Videos:1. [Arc Flash Fatality Video](https://www.youtube.com/watch?v=hfnEuRA7-vo)
2. [Electrical Fundamentals - Protection against electric shock (1hr:13min:19sec)](https://www.youtube.com/watch?v=mpgAVE4UwFw)
3. [Common Control Equipment, Devices, and Symbols](https://www.youtube.com/watch?v=u_ZRlmLmbV0)

4. Lab:  a. Safety:1. Complete Activities Book Chapter 1 Part 1 and 2
2. Write a procedure using the Occupational Safety and Health Standards for the class to follow
3. Follow the Lockout Tagout Procedure and Lockout and Tagout disconnect on main MCC for your Lab Unit.
4. Complete Troubleshooting Scenarios in text book.

 b. Electrical Drawings1. Complete Activities Book Chapter 2 Part 1, 2, 3, 4 and 5
2. Complete Hands on Practical Assignment in activities book.
3. Complete Constructor Assignment Chapter 2 activities book.
4. Complete Troubleshooting Scenarios in text book.

5. Wiring Lab: Students will learn and practice quality wiring.  | 1. Chapter review questions. a. Chapter 1 Parts 1-2  (100 Points) b. Chapter 2 Parts 1-5  (100 Points)2. Lab Activities Manual a. Chapter 1 (100 Points) b. Chapter 2 (100 Points)3. Chapter 2 Quiz (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Questions  Rubrics |
| Module 2Motor Controls | 4,5 | 1. Lecture on: a. Motor Transformers and Distribution System. b. Motor Control Devices2. Reading:1. Motor Transformers and Distributions Systems
2. Motor Control Devices

 4. Videos1. [Electrical Transformer Tutorial](https://www.youtube.com/watch?v=GMePE7NZcxw)

5. Lab: Transformers and Distribution Systems1. Complete Practical Assignment Chapter 3
2. Complete Constructor 9 Chapter 3
3. Complete Troubleshooting Scenarios Text Book all parts.
4. Lab students to Wire transformer in to Lab Units

 6. Lab: Motor Control Devices1. Complete Activities Manual Chapter 4 Parts 1, 2, 3 and 4
2. Complete Practical Assignment Chapter 4
3. Complete Constructor 9 Chapter 4
4. Complete Troubleshooting Scenarios Text Book all parts.
5. Lab students to Wire control devices in to Lab Units.

7. Wiring Lab: Students will install and practice quality wiring of Control Transformer and Distribution System.  | 1. Chapter review questions. a. Chapter 3 Parts 1-3  (100 Points) b. Chapter 4 Parts 1-8  (100 Points)2. Lab Activities Manual a. Chapter 3 (100 Points) b. Chapter 4 (100 Points)3. Chapter 3 and 4 Quiz (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Question and  Activities Manual Rubrics |
| Module 3Electric Motors | 6,7,8 | 1. Lecture on: a. Motor principles and Control System. b. Motor Type, Sizing and Installing.2. Reading: a. Electric Motors3. Lab: Electric Motor* 1. Complete Activities Manual Chapter 5 Parts 1, 2, 3, 4, 5, 6 7 and 8
	2. Complete Practical Assignment Chapter 5
	3. Complete Constructor 9 Chapter 5
	4. Complete Troubleshooting Scenarios Text Book all parts.
	5. Lab students to Wire motor to Motor Terminal Block in MCC Lab Units.4. Wiring Lab: Students Install and wire Electric Motor.

 4. Single phase and 3 phase  | 1. Chapter 5: parts 1-8 review questions. (100 Points)2. Lab Activities Manual a. Chapter 5: (100 Points)3. Chapter 5 Quiz (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Question and  Activities Manual Rubrics |
| Module 4Motor Starter and Relays | 5,6 | 1. Lecture on: a. Motor Starter and Contactors. b. Starter Type, Sizing and Installation. c. Relay Logix, Types and usage of relays2. Reading: a. Contactors and Motor Starters b. Relays3. Lab:1. Contactors and Motor Starters
2. Complete Activities Manual Chapter 6 Parts 1, 2 and 3
3. Complete Practical Assignment Chapter 6
4. Complete Constructor 9 Chapter 6
5. Complete Troubleshooting Scenarios Text Book all parts.
6. Lab students to Wire motor to Motor Terminal Block in MCC Lab Units.
7. Wiring Lab: Teams will Wire and Install a Motor Control Section for the MCC.
8. Relays
9. Complete Activities Manual Chapter 7 Parts 1, 2, 3, 4 and 5
10. Complete Practical Assignment Chapter 7
11. Complete Constructor 9 Chapter 7
12. Complete Troubleshooting Scenarios Text Book all parts.
13. Lab students to Wire motor to Motor Terminal Block in MCC Lab Units.
14. Wiring Lab. Install relay timer to control motor starting by 15 Sec. delay.

4. Wiring Lab: Students will Install Starter and relay Control in lab Units and Conveyor System.  | 1Chapter review questions.  a. Chapter 6: parts 1-3 review questions.  (100 Points) b. Chapter 7: parts 1-5 review questions.  (100 Points)2. Lab Activities Manual a. Chapter 6: (100 Points) b. Chapter 7: (100 Points)3. Chapter 6 and 7 Quiz  (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Question and  Activities Manual Rubrics |
| Module 5Motor Control Circuits  | 2,3,4,5,6,7,8,9,10 | 1. Lecture on: a. Motor Control Circuits b. Motor Control Circuits Electronic Controls2. Reading: a. Motor Control Circuits b. Motor Control Electronics3. Lab:1. Motor Control Circuits
	1. Complete Activities Manual Chapter 8 Parts 1, 2, 3, 4 and 5
	2. Complete Practical Assignment Chapter 8
	3. Complete Constructor 9 Chapter 8
	4. Complete Troubleshooting Scenarios Text Book all parts.
	5. Lab students to Wire motor to Motor Terminal Block in MCC Lab Units.
	6. Wiring Lab: Teams will test and troubleshoot the Installation in there Motor Control Section for the MCC.
2. Motor Control Electronics
	1. Complete Activities Manual Chapter 9 Parts 1, 2, 3, and 4
	2. Complete Practical Assignment Chapter 9
	3. Complete Constructor 9 Chapter 9
	4. Complete Troubleshooting Scenarios Text Book all parts.
3. Wiring Lab: Students will complete the Motor control lab installation.
 | 1Chapter review questions.  a. Chapter 8: parts 1-5 review questions.  (100 Points) b. Chapter 9: parts 1-4 review questions.  (100 Points)2. Lab Activities Manual a. Chapter 8:Parts 1-5  (100 Points) b. Chapter 9:Parts 1-4 (100 Points)3. Chapter 8 and 9 Quiz  (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Question and  Activities Manual Rubrics |
| Module 6VED DrivesAnd PLC controls | 4 | 1. Lecture on: a. Theory of VFD and there usage. b. VFD and PLC Control Circuits. 2. Reading: a. Adjustable Speed Drives and PLC Installations3. Lab: Adjustable Speed Drives1. Complete Activities Manual Chapter 10 Parts 1, 2, 3 and 4
2. Complete Practical Assignment Chapter 10
3. Complete Constructor 9 Chapter 10
4. Complete Troubleshooting Scenarios Text Book all parts.
5. Lab students to Wire motor to Motor Terminal Block in MCC Lab Units.
6. Wiring Lab: Teams will install, wire and test a VFD Drive and a soft starter

4. Wiring Lab: Students will complete the Motor control lab  Installation using Soft starter and VFDs.  | 1Chapter review questions.  a. Chapter 10: parts 1-4 review questions.  (100 Points)2. Lab Activities Manual a. Chapter 10:Parts 1-5  (100 Points)3. Chapter 10 Quiz  (100 points)4. Wiring Lab (100Points) | 1. Lecture Notes2. Home work assignment Sheet.3. Wiring Lab Rubrics4. Review Question and  Activities Manual Rubrics |
| Module 7 MidtermFinal | 1-10 | 1. Lecture on: a. Review of first half material. b. Review of Class material.  | 1. Midterm Test (200 Points)2. Final Test (200 Points)  | 1. Review Notes2. Test Scoring  |