

Electricity Course

Part B Course Outline

Subject Area	Hours	
	Lecture	Laboratory
0 Orientation	2.6	0.0
0.1 To the School	1.0	
0.2 To the Course	1.0	
0.3 To the Laboratory	0.3	0.3
0.4 To Possible Emergencies	0.3	
00 Essential Mathematics Review	7.4	2.5
<p>[This Chapter has proven an essential for the varied backgrounds of students in the Electricity Course. It is treated somewhat separate from the main body of the course. After the first morning, we begin 30 minutes early and continue into approximately 30 minutes of the standard class schedule (which begins at 8:30 AM), resulting in “time sharing;” hence only 50% of the total times listed above are included in the course time. This begins with the second morning of the course and continues, typically, through the eighth morning. Teaching Aids used are A1, A2 and A6. Textbooks used are T3 and T10.]</p>		
00.1Part 1, <i>Powers of Numbers</i>		0.5
00.1.1 What is a Power?	0.2	
00.1.2 Square Roots	0.2	
00.1.3 Cube Roots	0.2	
00.1.4 Part 1 Assignment	0.1	
00.2Part 2, <i>Powers of Numbers, cont'd.</i>		0.5
00.2.1 Review of Part 1 Homework		
00.2.2 The Concept of Powers of Ten	0.2	
00.2.3 Addition and Subtraction with Powers	0.2	
00.2.4 Multiplication and Division with Powers	0.2	
00.2.5 Raising to Powers and Taking Roots	0.2	
00.2.6 Scientific and Engineering Notation	0.2	
00.2.7 The Problem of Word Problems	0.2	
00.2.8 Part 2 Assignment	0.1	
00.3Part 3, <i>Basic Algebra</i>		0.5
00.3.1 Review Part 2 Homework		
00.3.2 Signed Numbers	0.2	
00.3.3 Combining Terms	0.2	
00.3.4 Part 3 Assignment	0.1	
00.4Part 4, <i>Basic Algebra, cont'd.</i>		0.5
00.4.1 Review Part 3 Homework		
00.4.2 First Degree Equations	0.2	
00.4.3 Working with Ohm's Law	0.2	
00.4.4 Electric Power Computations	0.2	
00.4.5 Part 4 Assignment	0.1	
00.5Part 5, <i>Basic Trigonometry</i>		0.5
00.5.1 Review Part 4 Homework		
00.5.2 Angles and Triangles	0.2	
00.5.3 The Pythagorean Theorem	0.3	
00.5.4 Proof of the Pythagorean Theorem	0.1	
00.5.5 Similar Polygons and Triangles	0.3	
00.5.6 Part 5 Assignment	0.1	
00.6Part 6, <i>Basic Trigonometry, cont'd.</i>		

Subject Area	Hours	
	Lecture	Laboratory
00.6.1 Review Part 5 Homework		0.5
00.6.2 Trigonometry of the Right Triangle	0.2	
00.6.3 Trigonometry of the Circle	0.2	
00.6.4 Inverse Functions	0.2	
00.6.5 The Concept of Vectors and Phasors	0.2	
00.6.6 Adding Vectors and Phasors	0.2	
00.6.7 Part 6 Assignment	0.1	
00.7Part 7, <i>Conclusion</i>		
00.7.1 Review Part 6 Homework		0.5
00.7.2 Introduction to Differential Calculus	0.3	
00.7.3 Introduction to Integral Calculus	0.3	
00.7.4 Review of Chapter 00	0.3	
00.8Chapter 00 Quiz		1.0
00.8.1 Review of Chapter 00 Quiz	0.5	
1 Fundamentals of Electricity	3.5	0.0
1.1 Presentation of Learning Objectives	0.1	
1.2 The Structure of Matter	0.2	
1.3 The Concept of Current and Voltage	0.2	
1.4 Two Current Flow Theories	0.2	
1.5 Electrical Resistance	0.2	
1.6 Direct vs. Alternating Current	0.2	
1.7 DC and AC Waveforms	0.1	
1.8 Introduction to Schematic Symbols	0.2	
1.9 Conventional Distribution Voltages	0.1	
1.10 Theory of Lightning	0.2	
1.11 Review of Chapter	0.3	
1.12 Chapter 1 Quiz	1.0	
1.13 Review of Chapter 1 Quiz	0.5	
2 Electrical Circuits	4.8	3.0
2.1 Presentation of Learning Objectives	0.1	
2.2 Electric Circuit Basics	0.5	
2.3 Non-Grounded Systems	0.5	
2.4 Voltage Sources and Sinks	0.3	
2.5 Circuit Characteristics	1.0	
2.6 Configurations of Resistors	0.4	
2.7 Typical Wire Specifications	0.3	
2.8 Electrical and Mechanical Information	0.1	
2.9 The Wheatstone Bridge	0.3	
2.10 Examples of DC Circuit Analysis		2.5
2.11 Review of Chapter 2	0.3	
2.12 Chapter 2 Quiz	1.0	
2.13 Review of Chapter 2 Quiz		0.5
3 Instrumentation and Shock	5.2	6.7
3.1 Presentation of Learning Objectives	0.1	
3.2 A Typical Analog Multimeter	1.0	
3.3 Meter "Loading" Resistance	1.0	
3.4 Lab Project 1, <i>The Simpson 260 Analog Multimeter</i>		3.0
3.5 A Typical DMM	0.4	
3.6 Lab Project 2, <i>The Fluke 85 Digital Multimeter</i>		2.0
3.7 Application of Meters	0.4	
3.8 The Insulation Tester	0.4	
3.9 The Wiggins Tester	0.2	

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	Lecture	Laboratory
3.10 Clamp-On Ammeters	0.2	
3.11 Electric Shock	0.6	0.4
3.12 The AED	0.2	
3.13 ESD	0.2	
3.14 Lock Out/Tag Out Procedures	0.2	0.3
3.15 Review of Chapter 3	0.3	
3.16 Chapter 3 Quiz		1.0
3.17 Review of Chapter 3 Quiz		0.5
4 Magnetism and Electromagnetism	4.0	5.0
4.1 Presentation of Learning Objectives	0.1	
4.2 Magnetic Fields	0.4	
4.3 The Magnetization Process	0.5	
4.4 Generator/Motor Action	0.3	
4.5 Inductors	0.5	
4.6 Lab Project 3		2.0
4.7 Transformers	0.7	
4.8 Lab Project 4		2.5
4.9 Review of Chapter 4	0.5	
4.10 Chapter 4 Quiz	1.0	
4.11 Review of Chapter 4 Quiz		0.5
5 Relays and Contactors	4.4	5.0
5.1 Presentation of Learning Objectives	0.1	
5.2 Introduction to Relays and Contractors	0.2	
5.3 Control Relays	0.5	
5.4 Contactors	0.6	
5.5 The Pneumatic Time Delay Relay	0.4	
5.6 The Electronic Time Delay Relay	0.5	
5.7 The Solid State Relay	0.2	
5.8 Lab Project 5		5.5
5.9 The Semiconductor Diode	0.6	
5.10 Specialty Diodes	0.4	
5.11 The Silicon Controlled Rectifier	0.3	
5.12 The TRIAC	0.3	
5.13 Review of Chapter 5	0.3	
6 AC Electric Circuits	5.7	5.0
6.1 Presentation of Learning Objectives	0.1	
6.2 AC Circuit Analysis	0.1	
6.3 Examination of the Sine Wave	0.2	
6.4 The Capacitor	0.3	
6.5 Energy Storage in the Capacitor	0.3	
6.6 Types of Capacitors	0.2	
6.7 The Capacitive Circuit Time Constant	0.2	
6.8 Capacitors in Series and Parallel	0.2	
6.9 Capacitive Reactance	0.2	
6.10 Lab Project 6		2.0
6.11 Capacitive Phase Angle	0.5	
6.12 Inductive Reactance	0.2	
6.13 Vectors and Phasors	0.2	
6.14 Series RC and RL Circuits	0.5	
6.15 Reactive Power	0.3	
6.16 Power Factor	0.2	

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	Lecture	Laboratory
6.17 Lab Project 7		3.0
6.18 Review of Chapter 6	0.4	
6.19 Chapters 5 & 6 Quiz	1.0	
6.20 Review of Chapters 5 & 6 Quiz	0.0	
7 Circuit Protection	2.1	0.0
7.1 Presentation of Learning Objectives	0.1	
7.2 One-Line Diagram Analysis	0.6	
7.3 Categories of Fuses	0.2	
7.4 Time-Delay and One Time Fuses	0.2	
7.5 Fuse Packages	0.3	
7.6 Fuse vs. Circuit Breaker	0.3	
7.7 Checking Fuses with the “Wiggy”	0.2	
7.8 Review of Chapter 7	0.2	
8 Three Phase Fundamentals	1.2	3.7
8.1 Presentation of Learning Objectives	0.1	
8.2 Three Phase Generation	0.2	
8.3 Phase Sequence	0.1	
8.4 Three Phase Transformer Connections	0.4	
8.5 Transformer-to-Transformer Connections	0.4	
8.6 Lab Project 8, <i>Three Phase Fundamentals</i>	0.1	3.1
8.7 Lab Project 9, <i>Three Phase Transformers</i>	0.1	0.6
8.8 Review of Chapter 8	0.3	
9 AC Induction Motors	6.3	2.5
9.1 Presentation of Learning Objectives	0.1	
9.2 Introduction to the Squirrel-Cage Induction Motor	0.9	
9.3 Rotor Bar Design	0.5	
9.4 Motor Nameplates	1.1	
9.5 Review of Information in EASA Booklet	0.3	
9.6 Review of Motor Losses	0.2	
9.7 Review of types of Motor Enclosures	0.1	
9.8 The Consequent Pole Motor	0.2	
9.9 The 9-Lead Induction Motor	0.5	
9.10 Other Types of Motor Connection	0.2	
9.11 The Wound Rotor Motor	0.2	
9.12 The Synchronous Motor	0.7	
9.13 Lab Project 10, <i>Phase Sequence Detector</i>		2.0
9.14 Review of Chapter 9	0.3	
9.15 Chapters 7, 8 & 9 Quiz	1.0	
9.16 Review of Chapters 7, 8 & 9 Quiz		0.5
10 AC Motor Controllers	2.6	10.3
10.1 Presentation of Learning Objectives	0.1	
10.2 Additional Relevant Schematic Symbols	0.2	
10.3 Summary of Switch and TDR symbols	0.2	
10.4 Types of Motor Controllers	0.1	
10.5 Why Reduced Voltage Starters?	0.1	
10.6 Introduction of Several Different Starters	0.6	
10.7 Reduced Voltage Starters	0.7	
10.8 Related Helpful Information	0.6	
10.9 Lab Project 11, <i>Dual Voltage Squirrel-Cage Motor</i>		3.1
10.10 Lab Project 12, <i>AC Induction Motor Controls</i>		3.6
10.11 Lab Project 13, <i>Solid-State Motor Controller</i>		3.6

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	Lecture	Laboratory
11 Miscellaneous Electrical Systems	2.9	0.0
11.1 Presentation of Learning Objectives	0.1	
11.2 SS Guayama Forced Draft Fan Controls	0.3	
11.3 Review of Chapters 10 & 11	1.0	
11.4 Chapters 10 & 11 Quiz	1.0	
11.5 Review of Chapters 10 & 11 Quiz	0.5	
12 DC Motors	3.5	3.3
12.1 Presentation of Learning Objectives	0.1	
12.2 Introduction to DC Motors	0.5	
12.3 Series DC Motors	0.2	
12.4 Universal Motors	0.2	
12.5 Shunt DC Motors	0.2	
12.6 Compound DC Motors	0.2	
12.7 DC Motor Considerations	0.6	
12.8 Field and Armature Speed Control	0.2	
12.9 Ward-Leonard Speed Control System	0.2	
12.10 Constant Horsepower vs. Constant Torque	0.2	
12.11 Starting DC Motors	0.2	
12.12 The Armature Power Supply	0.2	
12.13 Shunt Field Sensing	0.2	
12.14 Armature Current Sensing	0.2	
12.15 Lab Project 14, <i>DC Motors</i>		3.3
12.16 Review of Chapters 11 & 12	0.3	
13 Batteries	3.9	3.5
13.1 Presentation of Learning Objectives	0.1	
13.2 Batteries, Primary and Secondary Cells	0.2	
13.3 The Voltaic Cell	0.2	
13.4 Internal Resistance	0.1	
13.5 The Electromotive Series	0.2	
13.6 The Carbon-Zinc Cell	0.2	
13.7 The Alkaline Cell	0.2	
13.8 Other Primary Cells	0.5	
13.9 The Lead-Acid Wet Cell	0.7	
13.10 Other Types of Secondary Cells	0.1	
13.11 Series and Parallel Cells	0.1	
13.12 Current Drain and Load Resistance	0.7	
13.13 Battery Maintenance	0.2	
13.14 Discharge Performance	0.1	
13.15 Lab Project 15, Batteries		3.5
13.16 Review of Chapter 13	0.3	
14 Variable Frequency Drives	1.9	0.0
14.1 Presentation on Learning Objections	0.1	
14.2 Motor Speed Control	0.2	
14.3 Pulse Width Modulation	0.3	
14.4 Pros and Cons of VSDs	0.2	
14.5 VSD-Motor Cable Length	0.2	
14.6 Selection of a VSD	0.2	
14.7 Lab Project 16, <i>Variable Frequency Drives</i>		2.5
15 Cathodic Protection	1.9	0.0
15.1 Presentation of Learning Objectives	0.1	

Subject Area	Hours	
	Lecture	Laboratory
15.2 Introduction to Cathodic Protection	0.1	
15.3 Corrosion Mechanisms	0.2	
15.4 Theory of Cathodic Protection	0.2	
15.5 Reference Cell Potential	0.2	
15.6 System Selection	0.2	
15.7 Review of Chapters 14 & 15	0.3	
15.8 Review of the Course	0.6	
16 Final Examination	2.0	0.6
17 Course Cleanup and Review	3.2	0.5
17.1 Exam and Course Review	2.0	
17.2 Lab Equipment Check-In		0.6
17.3 Textbook Return	0.2	
17.4 Graduation	1.0	
SUBTOTALS	66.4	53.6
TOTAL HOURS	120.0	