TAFT COLLEGE
West Kern Community College District

Prepared by:	K. Olson
Reviewed by:	K. Bandy
Reviewed by:	P. Blake
Reviewed by:	S. Aunai
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Energy (ENER) 1530 Electricity and Basic Electronics (3 Units) CSU

Advisory: Eligibility for Math 1060 and English 1500 strongly recommended

Total Hours: 44 hours lecture; 18 hours lab (62 hours total)

Catalog Description: This course teaches the fundamentals of electricity and electronics. It covers a wide range of topics such as test equipment, electrical properties, unit of measure, fundamental electrical laws, magnetism, and both AC and DC components and circuits. This course provides a solid foundation for both traditional and emerging electrical/electronic career paths.

Type of Class/Course: Degree Credit

Text: Matt, Stephen R. *Electricity and Basic Electronics.* Tinley Park: The Goodheart-Willcox. 2009. Print.

Course Objectives:

By the end of the course a successful student will be able to:

1. Demonstrate knowledge of the three things required any completed circuit,
2. Demonstrate understanding what is meant by open and closed circuits and short (including "short" and "ground"),
3. Demonstrate understanding of the direction and speed of electron flow in a completed circuit,
4. Demonstrate understanding in how electricity is produced,
5. Demonstrate understanding of how wire size is measured, the different gauges of wire, and their practical applications),
6. Demonstrate understanding why fuses are used to protect circuits, the different types of fuses (homes, industrial machinery, lab devices),
7. Demonstrate understanding of the process of soldering wire and the use of a heat sink,
8. Demonstrate understanding of how a resistor works and what it does,
9. Demonstrate understanding of how a capacitor works and what it does,
10. Demonstrate understanding of the two basic principles of magnetism,
11. Demonstrate understanding of the concept of a P-N junction,
12. Demonstrate the understanding of how a multimeter is used to measure current, voltage and resistance in circuits, and
13. Demonstrate proper safety principles

Course Scope and Content (Lecture):

Unit I Learning and Applying the Fundamentals

A. Use of Electricity
B. Basic Circuit Concepts
C. The Chemistry of Electricity
D. Advances in Electricity

Unit II Sources of Electricity
A. Electricity from Chemical Energy
B. Electricity from Light Energy
C. Electricity from Pressure
D. Electricity from Heat
E. Electricity from Magnetism

Unit III Conductors and Insulators
A. Wire
B. Fuses
C. Switches
D. Wire Insulation
E. Soldering
F. Electrical Codes
G. Superconductors

Unit IV Resistors and Capacitors
A. Resistors
B. Capacitors

Unit V Ohm's Law
A. Three Variables of Ohm's Law
B. Using Ohm's Law
C. Power
D. Kilowatt-Hours
E. Body Resistance

Unit VI Series Circuits
A. Current in a Series Circuit
B. Resistance in a Series Circuit
C. Capacitance in a Series Circuit
D. Polarity
E. Continuity Tester
F. Voltage Drop

Unit VII Parallel Circuits
A. Current in a Parallel Circuit
B. Resistance in a Parallel Circuit
C. Voltage in a Parallel Circuit
D. Calculating Current
E. Capacitance in a Parallel Circuit
F. Uses for Parallel Circuits
G. Drawing Parallel Circuits
H. Parallel Power Sources
I. Equal Resistor in Parallel
J. Measuring Voltage in a Parallel Circuit

Unit VIII Series-Parallel Circuits
- A. Lightning
- B. Resistance in a Series-Parallel Circuit
- C. Circuit Analysis
- D. Series-Parallel Capacitors
- E. Ground
- F. Voltage Divider
- G. Wheatstone Bridge

Unit IX Multimeters
- A. Analog Multimeters
- B. Digital Multimeters
- C. Accuracy of Readings

Unit X Magnetism
- A. Basic Principles of Magnetism
- B. Magnetic Materials
- C. Magnetic Lines of Force
- D. Generating Electricity with Magnetism
- E. Creating Magnetism with Current

Unit XI Alternating Current
- A. How AC is Produced
- B. Sine Waves
- C. Square Waves
- D. Sine Waves and Sound
- E. Signal Generators
- F. Oscilloscopes
- G. Measuring Unknown Frequencies
- H. Phase Relationship
- I. Generators
- J. Eddy Currents

Unit XII Electromagnetic Induction
- A. Induced Voltage
- B. Inductance
- C. Inductors
- D. Inductors in Series
- E. Inductors in Parallel
- F. Mutual Inductance
- G. Transformers

Unit XIII Motors
- A. What is a Motor?
- B. Basic Motor Operation
- C. Classifying Motors
- D. DC Motors
- E. Induction Motors
- F. Synchronous Motors
- G. Motor Maintenance and Troubleshooting

H. Motor Selection
I. Current Draw

Unit XIV Reactance and Impedance
A. Inductive Reactance
B. Phase between Voltage and Current
C. Impedance
D. Phase Angle
E. Transformer Loading
F. Capacitive Reactance and Impedance

Unit XV LCR Circuits
A. Simple LCR Circuits
B. Resonance
C. High Definition Ratio

Unit XVI Filters
A. Band-Pass Filter
B. Band-Stop Filter
C. High-Pass Filter
D. Low-Pass Filter
E. Power Supply Filter
F. Filter Arrangements

Unit XVII Diodes
A. Diodes and Hole Flow
B. Diodes in Circuits
C. Zener Diodes
D. Light Emitting Diodes
E. Power Supplies

Unit XVIII Transistors
A. Bipolar Junction Transistors
B. Transistor Functions
C. BJT Configurations
D. Field Effect Transistors
E. Phototransistors
F. Transistor Data
G. Heat Sinks and Transistors

Unit XIX Thyristors
A. Silicon-Controlled Rectifiers
B. DIACs

Unit XX Integrated Circuits
A. Advantage of Integrated Circuits
B. Types of Integrated Circuits
C. IC Manufacturing
D. Logic Gates
E. Printed Circuit Boards

Unit XXI Fiber Optics
- A. Fiber Optics Technology
- B. Advantages of Fiber-Optic Cable
- C. Disadvantages of Fiber-Optic Cable
- D. Splicing Fiber-Optic Cable
- E. Future of Fiber Optics

Unit XXII Switches
- A. Relays
- B. Solenoids

Course Scope and Content (Laboratory):

Unit I Fundamental Application
- A. Electricity
- B. Conductors and Insulators
- C. Resistors and Capacitors
- D. Ohm's Law
- E. Lab and electricity safety

Unit II Practical Application of Circuits
- A. Series Circuits
- B. Parallel Circuits
- C. Series-Parallel Circuits
- D. Multi-meters
- E. Magnetism
- F. Alternating Current
- G. Industry application examples and exercises
- H. Troubleshooting nonfunctional circuits

Unit III Electromagnetic
- A. Induce an electrical current
- B. Functions of a transformer

Unit IV Motors
- A. Components, operation and basic control of a motor
- B. Motor identification
- C. Motor Fuses
- D. Motor use in industry

Unit V Reactance and Impedance and LCR Circuits
- A. Calculate – reactance and impedance of circuits
- B. Calculate – impedance of an LCR circuit
- C. Design resonant circuit
- D. Examples of circuit use in industry

Unit VI Filters, Diodes, Transistors
- A. Design a circuit to filter unwanted frequencies
- B. Design a DC power supply circuit – diodes used
- C. Design a switching and amplifying transistor circuit

Learning Activities Required Outside of Class:

The students in this class will spend a minimum of 6 hours per week outside of the regular class time doing the following:

1. Studying assigned text, handout materials and class notes
2. Reviewing and preparing for quizzes, midterm and final exams
3. Completing group projects

Methods of Instruction:

1. Lecture and discussions
2. Group activities/projects
3. Field trips (places of business including oil and gas production activities)
4. Lab activities & exercises

Methods of Evaluation:

1. Quizzes
2. Exams
3. Class Participation
4. Practical Observations
5. Individual and group exercises & projects
6. Written reports based on field applications

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.
1. Curriculum development for each lab.
2. Published schedule of individual laboratory activities.
3. Published laboratory activity objectives.
4. Published methods of evaluation.
5. Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies.

During laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is physically present in lab when students are performing lab activities.
2. Instructor is responsible for active facilitation of laboratory learning.
3. Instructor is responsible for active delivery of curriculum.
4. Instructor is required for safety and mentoring of lab activities.
5. Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practicals, notebooks, portfolios, etc.) that become a component of the student grade that cover the majority of lab exercises performed during the course.
2. Instructor is responsible for supervision of laboratory clean up of equipment and materials.