

Las Positas College  
3000 Campus Hill Drive  
Livermore, CA 94551-7650  
(925) 424-1000  
(925) 443-0742 (Fax)

## Course Outline for DSNT 57

### ELECTRICAL SYSTEMS

Effective: Fall 2002

#### I. CATALOG DESCRIPTION:

DSNT 57 — ELECTRICAL SYSTEMS — 2.00 units

Introduction to electrical systems, components for electrical systems and circuits, basic electrical theorem, magnetism, and electrostatics for application to design process.

1.00 Units Lecture 1.00 Units Lab

#### Strongly Recommended

-

or

MATH 38 - Trigonometry with Geometry

#### Grading Methods:

Letter Grade

#### Discipline:

|                       | <u>MIN</u> |
|-----------------------|------------|
| <b>Lecture Hours:</b> | 18.00      |
| <b>Lab Hours:</b>     | 54.00      |
| <b>Total Hours:</b>   | 72.00      |

#### II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

#### III. PREREQUISITE AND/OR ADVISORY SKILLS:

**Before entering this course, it is strongly recommended that the student should be able to:**

A. MATH38

#### IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

- A. illustrate electrical theory and explain what is meant by electric current, voltage, resistance, and Ohm's law;
- B. demonstrate correct procedure for using an ammeter, a voltmeter, and an ohmmeter;
- C. conduct experiments and perform basic electrical circuit calculations;
- D. distinguish between electrical components by their electrical characteristics;
- E. identify different conductor types, insulation materials, and understand factors that influence conductance;
- F. define work, power, and horsepower for determination of efficiency;
- G. list, present examples of, and compare the six basic sources of electricity;
- H. develop an awareness of electrical safety issues;
- I. determine total resistance, voltage drops, current and wattage values of a series, parallel or combination circuit;
- J. apply Ohm's law to solve for unknown voltage, current, or resistance in a series or parallel circuit;
- K. explain the principles and practical application of magnetism;
- L. identify and explain how specific devices convert mechanical energy into electrical energy and others convert in the opposite direction;
- M. explain how resistance, capacitance, and inductance in an AC circuit lay the foundation for radio and television transmission and reception;
- N. demonstrate writing capability in producing technical laboratory reports;
- O. demonstrate capability to perform laboratory experiments and acquire and reduce test data.

#### V. CONTENT:

- A. Science of Electricity and Electronics
  - 1. Nature of Matter and structure of the atom
  - 2. Applications of Static Electricity
    - a. Demonstrating the Law of Charges
    - b. Methods of measuring electricity - Coulomb
    - c. Existence and representation of Electrostatic Fields

- d. Induction vs. Conduction
- 3. Operation of a basic electrical circuit
  - a. Measuring and representing Voltage, Current, Resistance
  - b. AC and DC electrical current
  - c. Current flow conventions
  - d. Series and Parallel circuits
- 4. Ohm's Law - EIR formulas and relationships, electrical prefixes
- B. Basic Instruments and Measurement
  - 1. Measurement Concepts
    - a. Sensitivity, Precision, and Accuracy
    - b. Guidelines for handling and operation of meters
  - 2. Basic Analog Meter Movement
  - 3. Operation and reading of Ammeter, Voltmeter, Ohmmeter, Volt-Ohm-Milliammeter (VOM), and Digital multimeters (DMM)
  - 4. Electrical Diagrams standards per ANSI Y32.2 and Y32.16
- C. Basic Electrical Circuit Materials
  - 1. Determining conductor sizes, insulation codes, color conventions
  - 2. Common Circuit Devices
    - a. Types and Ratings of Switches
    - b. Connectors - inlet, plug, receptacle, connector
    - c. Circuit Protection - fuses, circuit breakers
  - 3. Lighting Types and Ratings
  - 4. Resistor Composition, Types, and color code translation
  - 5. EMF hazard evaluation
- D. Principles of Energy
  - 1. Work, Power, and Horsepower - Definitions, formulas, units, symbols, terms
  - 2. Application of Ohm's and Watt's Laws
  - 3. Use of Wattmeter and Watt-hour-meter to measure energy flow in circuit
  - 4. Evaluating Efficiency
  - 5. Determining gear and pulley ratios and power
- E. Sources of Electricity
  - 1. Chemical Action (Anode, Cathode, Electrolyte)
  - 2. Light Energy - function of solar cells and photocells
  - 3. Heat Energy - function of thermocouples and thermopiles
  - 4. Mechanical Pressure Energy- piezoelectric effect
  - 5. Fuel Cell construction and use
  - 6. Magnetohydrodynamic (MHD) power generation
  - 7. Mechanical motion created by generators
  - 8. Electrical Safety - reference Environment, Safety, & Health Manual
- F. Series Circuit Principles
  - 1. Application of Kirchoff's Voltage Law
  - 2. Power calculations in the Series Circuit
- G. Parallel Circuit Principles
  - 1. Application of Kirchoff's Current Law
  - 2. Power calculations in the Parallel Circuit
- H. Combination (Series-Parallel) Circuits
- I. Basic Magnetic Principles
  - 1. Nature of the Force and Laws of Magnetism
  - 2. Link between electric current and magnetism
  - 3. Types of relays and the way they work
- J. Function of generators
  - 1. Generator Losses -  $I^2R$ , Eddy currents, hysteresis
  - 2. Types of Generators
  - 3. Using the Oscilloscope to observe and interpret waveform patterns
- K. Function of DC Motors
  - 1. Types of DC Motors
  - 2. Starting Circuits - Manual, automatic, seal relay
  - 3. Thyristor (SCR) Control
- L. Transformer Theory and device applications
- M. Function of AC Motors
  - 1. Types of AC Motors - Induction, three-phase, single-phase
  - 2. Role of AC motor protection circuits
- N. Inductance and RL Circuits
- O. Capacitance and RC Circuits
- P. Tuned circuits and RCL Networks
  - 1. Resonance
  - 2. Filtering Circuits
- Q. Introduction to Semiconductors and Power Supplies
  - 1. Atomic characteristics of semiconductors
  - 2. Composition and types of semiconductor diodes
  - 3. Power Supply functions
  - 4. Voltage Regulation and Doublers

## VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. **Demonstration** -
- C. **Lab** - Experimentation and hands-on laboratory activities
- D. Textbook reading
- E. Periodical/website references for current updates
- F. Problem solving using calculation

## VII. TYPICAL ASSIGNMENTS:

- A. Problem-solving: 1. Studying the schematic, what is the total circuit resistance of two 10 ohm resistors connected in parallel? 2. There are 10 meter readings indicated below (marked A-J). Record the meter readings by writing the values on the lines provided. Your readings should be accurate to two decimal places. Take special note of the scale selector switch to the right of the scale.

## VIII. EVALUATION:

- A. **Methods**

## B. Frequency

1. Frequency:
  - a. Weekly assignments
  - b. Weekly quizzes
  - c. 1 Semester Project(s)
  - d. 1 Midterm, 1 Final examination

## IX. TYPICAL TEXTS:

1. Gerrish, Dugger, and Roberts *Electricity & Electronics*, Goodheart-Willcox Company, Inc., 1999.
2. Gerrish, Dugger, and Roberts *Electricity & Electronics, Study Guide with Laboratory Activities*, Goodheart-Willcox Company, Inc., 1999.

## X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Calculator with trigonometric function
- B. Engineering paper