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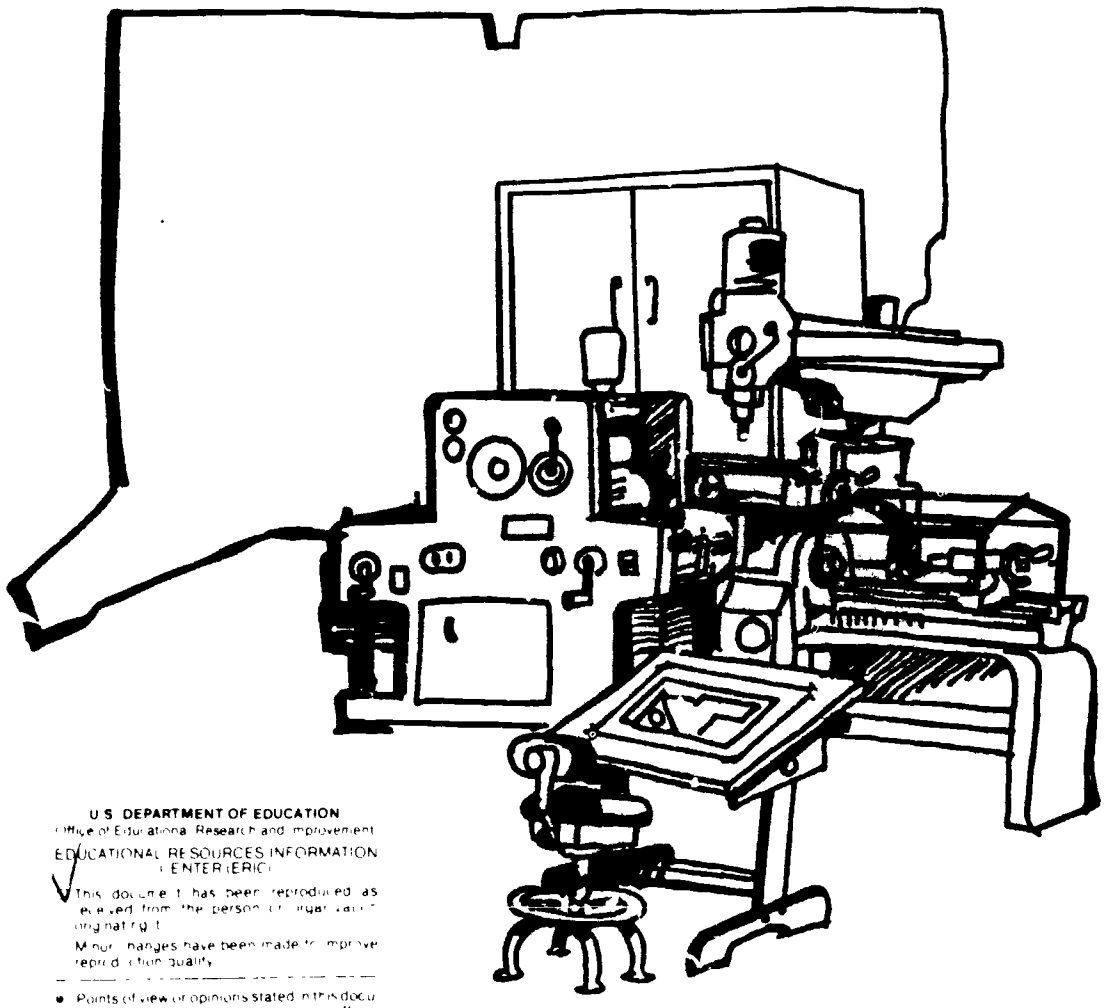
ABSTRACT

Consistent with the principles of the Connecticut Common Core of Learning, this competency-based curriculum guide for electronics provides a reference guide for educators to research and prepare for teaching the field of electronics. The guide contains 22 units that cover the following topics: theory of matter; safety; direct current; magnetism; electromagnetism; sources of electricity; alternating current; inductance; transformers; capacitance; R C L circuits; basic semiconductors; power supplies; transistor amplifiers; operational amplifiers; electronic instruments; electronic assembly methods; electronic wiring symbols; digital integrated circuits; radio receiver; radio transmitter; and computer theory. Each unit contains a list of competencies and a short content outline. A list of 27 references is included. (KC)



Technology Education Curriculum Guide

Connecticut State Department of Education
Division of Vocational, Technical, and Adult Education

ELECTRONICS

C U R R I C U L U M G U I D E

F O R

E L E C T R O N I C S

I N

T E C H N O L O G Y E D U C A T I O N

Prepared for

State Department of Education
Division of Vocational, Technical, and Adult Education

Prepared by

Connecticut Industrial Technology Association

All opinions expressed reflect the views of the
authors and are not necessarily those of
the State Department of Education.

June 1988

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Introduction

There are twenty-two units outlined in this guide. Their format is in two forms; competencies and unit outlines. Upon completion of the unit, the student will have the competences described in the beginning of each unit. If the student exhibits the competencies, it can be assumed that they have reached a sufficient level of performance and knowledge. The goals in each unit are broad in scope. Educators are encouraged to expand upon any unit, as needed.

In order to enable the instructor to quickly review the content and competencies of each unit, unit outlines have been prepared. This will permit the educator to select, and identify, essential information necessary for class presentations.

Connecticut Common Core of Learning

This competency-based curriculum guide for Electronics is meant to be supportive of and in harmony with the Connecticut Common Core of Learning document developed in 1987.

The study of electronics by its very nature develops the following common Core skills:

> Attributes and Attitudes - positive self-concept, motivation, responsibility, intellectual curiosity, interpersonal relations, moral and ethical values, reading, writing, quantitative skills, reasoning and problem solving, and learning skills
>
> Understanding and Applications - careers and vocations, mathematics, and science and technology.

TECHNOLOGY EDUCATION SCOPE AND SEQUENCE

Technology Education learning experiences are sequential, beginning in the lowest grades and continuing through adult and higher education. As an integral part of the total educational program, Technology Education is designed to meet students' needs as they relate to a modern technological society. Through manipulative and research experiences, with a variety of tools, machines, processes and products of industry, students develop an awareness of how industry and its many components function.

A comprehensive Technology Education program will provide for a sequence of courses in industrial areas. These include, but are not limited to:

Communication Technology
- Drafting
- Graphic Communications

Construction Technology
- Industrial Ceramics
- Woods
- Electricity

Manufacturing Technology
- Metals
- Plastics

Transportation Technology
- Electronics
- Power/Energy

The objectives of Technology Education are:

. . . . . To develop an insight and understanding of industry, its place in our society, and the free enterprise system.

. . . . . To develop problem solving skills related to the materials, tools, processes and products of industry.

industrial areas with vocational emphasis at the advanced levels.

. . . . . To develop knowledge of the tools, machines, materials, and processes of industry through their practical and safe use.

. . . . . To develop an appreciation of good design and craftsmanship.

. . . . . To develop an understanding of industrial and technological career opportunities and their requirements.

. . . . . To develop those traits which will help students obtain and maintain employment.

. . . . . To develop consumerism regarding the goods and services of industry.

. . . . To discover avocational and recreational interests.

. . . . . To understand the effects of industry and civilization upon the environment.

The following sequential phases represent a range of Technology Education activities from kindergarten through adulthood. Reference is made to grade level to assist local education agencies (LEA's) in planning. It is understood that the manner in which grades are organized depends on local situations.

I. Self-Awareness (grades K-6)

Technology Education at this level is designed to familiarize students with the many kinds of work people

do and the tools and materials they use. It is at the elementary level that Technology Education activities are used to enhance basic skills and understandings in all curriculum areas by providing relative hands-on experiences.

II. Technology Exploration (grades 7 & 8)

Technology Education at the middle school/jr. high school level is designed to foster the development of a strong foundation in the concepts, skills, knowledge and attitudes regarding not only the technical but also the related and social aspects of general education.

Technology Education experiences at this level are exploratory in nature. The program provides students with the opportunity to develop a better understanding of their interests, abilities and aspirations. Consumer knowledge as it relates to industrial products and processes is an inherent part of these activities. A broad exploratory Technology Education program at the middle school/jr. high school level allows individual student's interests to become focused, enabling greater concentration at the senior high level.

III. Occupational Orientation (grades 9 & 10)

Technology Education at this level emphasizes occupational orientation. It is here that the transition from middle school/jr. high school

exploratory experiences to specialization at the upper levels is made. Students may explore in greater depth a wider variety of areas, evaluate their performance, aptitudes and interests and begin to formulate career plans.

IV. Technology Specialization (grades 11 & 12)

At this level students are provided the opportunity to specialize in one or more occupational areas and to develop pre-vocational skills. Training at this level should prepare students to maximize their career options after high school.

This level should also assist individuals in making informed and meaningful occupational choices and/or prepare them for entry into advanced trade and industrial or technical education programs.

V. Adult, Continuing and High Education Technology

Education programs are designed for adults and out-of-school youth. These programs are avocational, or vocational in nature depending upon the needs of the individual and the demands of society.

Specific Guidelines for Technology Education

Grade Level

7 - 12 and adult

Selection of Students

Open to all students who can profit from instruction, and work safely in a Lab/Shop situation.

Length of Program

Level One (Exploratory) grades seven (7) and eight (8) - Lab/Shop classes meet a minimum of 60 hours per year. Lab/Shop periods must be of at least 40 continuous minutes and should not exceed 60 minutes.

Level Two (Occupational Orientation) grades nine (9) through twelve (12), or grades ten (10) through twelve (12) - students electing Level Two Technology Education courses must have the opportunity to participate in a minimum of 225 minutes of Lab/Shop activities per week, per semester. Daily Lab/Shop period must be of at least 45 continuous minutes and should not exceed 60 minutes.

Level Three & Four (Specialization and Pre-Vocational grades eleven (II) and twelve (12). Students who elect Level III & IV Technology Education courses must have a minimum of 450 minutes per week, per year of Lab/Shop

activities. Daily Lab/Shop periods must be of at least 90 continuous minutes.

The definition of a year is a minimum of 180-day school days.

A semester is 90 continuous school days.

Pre-Requisites

Successful completion of Level Two course prior to participating in Level Three. Successful completion of Level Three course prior to Level Four.

Enrollments

Based on Lab/Shop size and facilities, 16 students per class maximum in Lab/Shop areas, such as Electronics, and 20 students per class in drafting. The recommended and minimum square footage are as follows:

	Recommended		Minimum	
Jr. & Sr. H.School	s.f./pupil station	Net total s.f. area	s.f./pupil station	Net Total s.f. area
Drafting (including storage)	48 sf	1200 sf	40 sf	1000 sf
T.E. Jr. H.S. Level One (including storage)	100 sf	2500 sf	82 sf	2050 sf
T.E. Sr. H.S.Levels Two, Three (including storage)	144 sf	3600 sf	120 sf	3000 sf

A classroom should be made available for related study, adjacent to the Shop/Lab areas. All facilities must comply with OSHA regulations.

Teachers' Schedule

Technology Education contact hours for a full-time instructor should comprise 70% to 80% of their school week, with 20% to 30% of their time should be spent in Technology Education related non-teaching duties, such as maintenance and preparation of I.T. materials.

Equipment

All equipment must be in safe operating condition and conform to all federal, state, and local standards. Equipment must:

A. Be applicable to the level being taught, i.e., size, capacity, quantity, and necessity.

B. Enhance the program level and be similar to that found in industry.

C. Take into consideration: occupational education, consumer competency, leisure time activity, and environmental awareness.

Evaluation

Continuous evaluation by students, teachers, school, vocational, advisory committee, and state. Evaluation results must become an integral part of program

development and improvement.

School Credit

Equal to other academic credit granted for similar periods of time and activities.

Youth Organizations

It is recommended that the American Industrial Technology Student Association (AITSA) be an integral part of the curriculum.

Teacher Certification

Instructors shall meet the minimum standards for Technology Education teachers provisional certification as outlined in the 'Rules and Regulations Concerning State Teacher Certification" section 10-146-21 and section 10-146-22.

Standard certification requires three (3) years of teaching under a provisional certificate, the last two (2) years consecutive and a master's degree or thirty (30) semester hours, consisting of a planned program at an approved institution of higher learning and an individual program, mutually determined and approved by teacher and supervising agent.

Teachers of Technology Education to be funded through

the Vocational Education Acts must comply with section 10-146-22 above, have one (1) year of appropriate occupational experience and complete Principles of Vocational Education, a three (3) semester hour Vocational-Technical Education course.

Sex Stereotyping

Existing activities and future plans must show evidence of actions directed toward the elimination of sex stereotyping, including continual effort to attract females to elective Technology Education courses traditionally chosen by males. Technology Education courses which are required for any students at a particular level must be required of all students, male and female.

HOW TO USE THIS GUIDE

This guide was developed to help the Technology Educator have a central source of information. It is to be used as a reference guide for educators to research and prepare for teaching the ever changing field of electronics. This guide was not written with the intent of being used as a daily lesson plan, rather as a flexible source of information.

The authors of the Institute for Teaching & Learning 1988-1989 Catalog Overview, believe that, "Change may be the only certainty in our children's lives. Technological advancement and the challenges brought on by social, economic, and political change will make their lives more complex than those of any previous generation. Our children must be able to adapt and succeed today and in the future..."[1] With this in mind, the Educator should supplement the units in this guide, with Activity orientated assignments. These activities should reflect the new trends in technology, and be integrated into the everyday learning experiences of the student.

If Electronics is being taught, or is planned to be taught at a lower grade level than 9th grade, the Committee recommends the following. The experiences in the 6th, 7th, and 8th grades should be presented on a "systems approach" basis.

1
CT. Continuum State Dept. of Ed. 1988 p.1

The students should be given the chance to explore a wide variety of "systems approach" experiences, which will help them think and act independently.

It should be noted that there are no time lines or grade levels given for each unit. The committee feels that this should be left up to the local municipal school district. Each municipality decides the envolvement of Technology Education within its school district. Local educators should be able to decide what and how Electronics is to be taught within their classroom. This is determined by the equipment and text available.

Electronics Applications Units

ELECTRONICS CURRICULUM GUIDE

UNIT: Theory of Matter

COMPETENCIES:

Students will be able to:

a. State the basic properties of matter.

b. Differentiate between solids, liquids, and gases.

c. Define energy.

d. List four forms of energy.

e. State the laws of conservation of energy and matter.

f. List the atomic sub-particles.

g. Diagram the Bohr atom showing the relative position, and charges of particles.

h. State the law of charges, describing the laws of attraction and repulsion.

i. List the 3 Force Fields.

h. Describe the location and movement of electrons at various energy levels within the atom.

j. Describe the electric force.

k. Determine atomic weight and number of the common elements used in electronics.

l. Describe ions in terms of electron loss or gain.

m. List the current carriers in solids, liquids, and gases.

n. Describe Valance Bands in conductors, non-conductors, and semiconductors.

o. List three common conductors used in electrical distribution.

p. List five, common, nonconducting materials used in electrical circuitry.

q. List the common semiconducting materials that are used in electronic circuitry.

r. Use an ohmmeter or continuity tester to identify conductors and nonconductors.

UNIT CONTENT OUTLINE:

I. Properties of Matter

A. Composition of matter
   1. Elements
   2. Compounds
   3. Molecules

B. States of matter

II. Atomic Structure

A. Nucleus
   1. Protons
   2. Neutrons
B. Electrons
   1. Energy Levels
   2. Valence Electrons

III. Electrical Properties

A. Protons
B. Electrons
C. Neutrons
D. Law of attraction and repulsion
E. Force
F. Conductors
G. Insulators
F. Semiconductors

UNIT: Safety

COMPETENCIES:

Students will be able to:

a. Practice safe working habits at all times.

b. Describe the effects of electrical current on the human body.

c. Describe the factors that determine body resistance.

d. List dangerous electrical circumstances to be avoided.

e. Describe the function of equipment grounding.

f. Describe the safe and proper use of various tools and equipment.

g. Describe the use of wearing of safety glasses in all laboratory situations.

h. Describe and locate:
   1) Emergency exits.
   2) Safety panic buttons.
   3) Fire extinguishers and blankets.

UNIT CONTENT OUTLINE:

I. Safety in the Workplace

II. Effects of Electrical shock

III. Grounding of equipment

IV. Safe use of equipment and tools

V. Safety in the classroom
   A. Exits
   B. Fire and safety equipment
   C. Behavior

ELECTRONICS CURRICULUM GUIDE

UNIT: Direct Current

COMPETENCIES:

Students will be able to:

a. Define voltage, current, resistance, and power.

b. List the units of measure, unit, and letter symbols for voltage, current, resistance, and power.

c. Describe the relationship of voltage and resistance to current.

d. List the conditions necessary to form a simple DC circuit.

e. Draw a diagram of a simple circuit using schematic symbols.

f. Construct a circuit to meet specifications.

g. Use a meter to measure voltage, current, and resistance in a DC circuit.

h. Differentiate between open and short circuits.

i. List the three Ohm's Law Formulas.

j. Use Ohm's Law to solve word problems

k. Design a simple circuit to specifications for voltage, current, and resistance.

l. State the Power Law Formula.

m. List examples of electrical energy dissipation.

n. Describe the relationship of electrical power to voltage and current.

o. Use the power formula to solve for unknowns.

p. Use the PIRE wheel to solve problems in DC circuits.

q. Read a watt hour meter.

r. Compute electrical power cost for common appliances using utility rates.

s. Define a series circuit.

t. State Kirchoff's Law.

u. Apply Kirchoff's Law to a circuit.

v. Compute voltage drops in a series circuit.

w. Describe current in series circuits.

x. Compute power ratings in a series circuit.

y. Calculate total resistance in a series circuit.

z. Measure voltage drops, current, and resistance in a series circuit.

aa. Use series resistors to meet circuit requirements.

ab. Draw a diagram of a series circuit using schematic symbols.

ac. List devices that are usually wired in series with other circuit components.

ad. Compare the characteristics of series and parallel circuits in terms of voltage, current, resistance, and power.

ae. Calculate effective resistance of parallel circuits.

af. Measure voltage, current, and resistance in parallel circuits.

ag. Design and construct a parallel circuit.

ah. Draw the schematic diagram of a parallel circuit.

ai. Diagram series and parallel combinations.

aj. Solve for total resistance by forming equivalent circuits in compound circuits.

ak. Compute voltage drops and current flow in combination circuits.

al. Measure voltage, current, and resistance in a combination circuit.

am. Calculate voltage drops, current, and total resistance in bridge circuits.

an. Design and construct combination circuits.

UNIT CONTENT OUTLINE:

I. Circuit Characteristics

A. Complete Circuit

1. Source
2. Conductor
3. Load
4. Control Device

B. Symbols

I . Ohm's Law

A. Theory and application

1. Current
2. Voltage
3. Resistance

B. Meters

1. Measure current
2. Measure voltage
3. Measure resistance

III. Kirchhoff's Law

A. Theory

B. Application

IV. Power Law

A. Theory

B. Application

V. Series Circuits

A. Identification

B. Construction

VI. Parallel Circuits

A. Identification

B. Construction

VII. Combination Circuits

A. Identification

B. Construction

ELECTRONICS CURRICULUM GUIDE

UNIT: Magnetism

COMPETENCIES:

Students will be able to:

a. Describe the Earth's magnetic field and the location of the geographic poles.

b. Compare man-made to natural magnets.

c. Construct a compass using a bar magnet and a string.

d. Use iron filings, paper, and a bar magnet to illustrate lines of magnetic force.

e. Demonstrate the laws of attraction and repulsion of magnetic fields.

f. Describe the effect of adding the magnetic fields of two or more magnets.

g. Describe the effects of magnetic and non-magnetic materials on lines of force.

h. Describe induced magnetism.

UNIT CONTENT OUTLINE:

I. Classification of Magnets

A. Natural

B. Man made

II. Earth Magnetism

III. Magnetic Poles

IV. Lines and Fields of Magnetic Force

V. Non-Magnetic and Magnetic Materials

VI. Induced Magnetism

UNIT: Electromagnetism

COMPETENCIES:

Students will be able to:

a. Describe the magnetic effect of electrons moving through a conductor.

b. Diagram the lines of force around a current carrying conductor.

c. Describe the effect of current direction on magnetic polarity.

d. State the left-hand rule for conductors.

e. Demonstrate the relationship of current intensity to field strength.

f. State the left-hand rule for coils.

g. Construct an Electromagnet.

h. Describe the effect of permeability of core material.

i. Describe the operation of a solenoid.

j. List 3 applications of solenoids.

k. Describe the operation of a relay.

l. List common uses of relays.

m. List other common applications of electromagnets.

UNIT CONTENT OUTLINE:

I. Electromagnetism

A. Principles
B. Applications

II. Solenoids

A. Principles
B. Applications

III. Relays

A. Principles
B. Applications

IV. Other Electromagnet devices

UNIT: Sources of Electricity

COMPETENCIES:

Students will be able to:

a. List various methods of producing electricity.

b. Describe the processes of each method.

c. Construct a device to demonstrate one method of production.

d. Differentiate between methods of electrical production.

e. Indicate practical applications of each.

f. Compare AC to DC.

g. Describe the law of conservation of energy.

h. List common energy convertors.

i. List examples of primary and secondary voltaic cells.

UNIT CONTENT OUTLINE:

I. Common Methods of Producing Electricity

II. Batteries

A. Construction
B. Types

III. Alternating verses direct current

UNIT: Alternating Current

COMPETENCIES:

Students will be able to:

a. List common uses for alternating current.

b. Diagram sine, square, and triangle wave-forms.

c. List comparisons of DC and AC voltages.

d. Describe a rotating vector's relationship to a sine pattern.

e. Define common terms assocated with AC voltages.

f. Convert period to frequency.

g. Describe the difference between RMS and Peak voltage.

h. Compute equivalent voltages of RMS and Peak values.

i. Use an oscilloscope to measure AC voltage.

UNIT CONTENT OUTLINE: Alternating Current

I. Introduction

A. Production

B. Wave-forms

C. Frequency

II. Amplitude measurements

UNIT: Inductance

COMPETENCIES:

Students will be able to:

a. Describe:
    1. Inductance
    2. Inductor
    3. Counter EMF / B EMF
    4. Unit of measurement
b. Describe the effect of inductance.
c. List common cores found in inductors.
d. Analyze series and parallel combinations of inductors.
e. Define inductive reactance.
f. Compute inductive reactance.
g. Compute the L/R time constant.
h. Compare effective resistance to ohmic resistance.
i. Demonstrate mutual inductance.
j. Demonstrate coupling.
k. Describe energy storage in an inductor's magnetic field.
l. Draw symbols of inductors.
m. List common applications of inductors.

UNIT CONTENT OUTLINE:

I. Properties of Inductance

A. Principles and Measurements

B. Mutual Induction

C. Energy Storage

II. Inductors

1. Types and Symbols

2. BEMF/CEMF

3. Applications

4. Series and Parallel

UNIT: Transformers

COMPETENCIES:

Students will be able to:

a. Describe transformer action.

b. Compare input to output; voltage, current, and power.

c. List common core materials.

d. Describe energy losses in transformers.

e. Draw transformer symbols.

f. List various applications of transformers.

g. Compute voltages from turns ratios.

h. Identify primary and secondary windings.

i. Describe energy transfer between primary and secondary windings.

j. Describe safety precautions to be observed when testing a transformer.

k. Analyze a transformer for defects using a meter.

UNIT CONTENT OUTLINE:

I. Transformer Operation and Construction

A. Review of Inductance

B. Construction

C. Turns ratio

D. Types and Applications

E. Testing and safety practices

UNIT: Capacitance

COMPETENCIES:

Students will be able to:

a. Define capacitance.

b. Describe storage of electrical energy in a capacitor.

c. Observe appropriate safety precautions when working with capacitors.

d. Compare the effect of capacitance on AC and DC circuits.

e. Describe the materials used in the construction of capacitors.

f. Compute RC time constants.

g. Construct basic capacitor circuits for timing, wave shaping, blocking and coupling electronic signals.

h. Use a meter to test a capacitor.

i. List factors that determine capacitance.

j. Describe the phase relationship between current and voltage in AC capacitive circuits.

k. Determine values of capacitive reactance.

l. Describe the effect of reactance on AC current.

m. Calculate total capacitance in series and parallel circuits.

n. Draw capacitor symbols.

o. List units of measure.

p. Describe package styles of capacitors.

UNIT CONTENT OUTLINE:

I. Capacitors

A. Manufacture

B. Theory of Capacitance

C. Types and classification

D. Symbols

II. Characteristics

A. Units of measurement and ratings

B. Storage and discharge of energy

C. Circuit construction

1. Series

2. Parallel

3. Compound

D. Capacitive reactance

E. Identification of package styles

ELECTRONICS CURRICULUM GUIDE

UNIT: RCL Circuits

COMPETENCIES:

Students will be able to:

a. Compute voltage and current relationships using phase vectors.

b. Compute impedance using the Pythagorean Theorem.

c. Compute resonant frequency in an LC circuit.

d. List common terms used to identify LC circuits.

e. List common uses of LC circuits.

f. Calculate the impedance of a parallel resonant circuit.

g. Describe the filter characteristics of RCL circuits:

   1. Low-Pass filters

   2. High Pass filters

   3. Band Pass filters

   4. Band Reject filters

h. Describe different types of filters.

i. Describe common applications of filter circuits.

j. Compute reactance in RCL circuits.

k. Compare true power to apparent power.

l. Compute true power.

m. Define the Q factor.

UNIT CONTENT OUTLINE:

I. Impedance

A. Identification

B. Uses

C. Calculations

II. Resonant Frequency

III. LC phase characteristics

IV. Power factor

ELECTRONICS CURRICULUM GUIDE

UNIT: Basic Semiconductors

COMPETENCIES:

Students will be able to:

a. Diagram the crystal lattice structure of a semiconductor.

b. Describe the difference between N-type and P-type materials.

c. Describe doping and its effect.

d. Identify the minority and majority carriers in N-type and P-type materials.

e. Identify the region of depletion in a PN junction.

f. List the bias voltages for Si and Ge diodes.

g. Draw the symbols for NPN and PNP transistors.

h. Describe common methods of biasing transistors.

i. Describe the effects of base current on collector, emitter current.

j. Use reference materials to determine various semiconductors characteristics and ratings.

k. Exercise necessary precautions when working with solid state devices.

l. Use a meter to test transistors or diodes.

m. Describe the use of transistors in amplifier and control circuits.

n. Describe semiconductor manufacturing processes.

UNIT CONTENT OUTLINE:

I. Semiconductor materials
   A. Structure
   B. Manufacturing processes

II. Basic PN junction
   A. Characteristics
      1. Silicon
      2. Germanium
   B. Biasing
   C. Uses
   D. Symbols

III. Transistors
   A. Characteristics
   B. Uses
   C. Types and Biasing
   D. Symbols

IV. Test Equipment

ELECTRONICS CURRICULUM GUIDE

UNIT: Power Supplies

COMPETENCIES:

Students will be able to:

a. Describe the use of transformers in power supplies.

b. Construct rectifier circuits.

   1. Half wave

   2. Full wave

      A. Full wave

      B. Full wave bridge

c. Define peak inverse voltage.

d. Construct filter circuits.

   1. Capacitive filter

   2. Inductive filter

e. Diagram filter combinations.

f. Describe the characteristics of silicon rectifiers.

g. Describe the characteristics of tunnel diodes.

h. Describe the use of silicon controlled rectifiers in phase control.

i. List common uses of thyristors.

j. Describe the need for heat sinking.

k. Analyze voltage divider networks.

l. Warrant the use of regulator circuits.

m. Describe the action of voltage regulating devices;

1. Zener diodes
2. Transistors
3. Integrated circuits
   A. Single chip
   B. Fixed
   C. Adjustable

n. Construct and test semiconductor regulators.

1. Shunt

2. Series

o. Construct an AC to DC power supply.

p. Define and calculate "ripple voltage".

q. Troubleshoot faulty power supplies using an oscilloscope.

r. Describe the use of a bleeder resistor.

UNIT CONTENT OUTLINE:

I. Introduction to Power Supplies

A. Definition
B. Purpose
C. Applications

II. Rectifiers

A. Purpose
B. Operation
C. Characteristics

III. Voltage Regulators

A. Definition
B. Zener
C. Transistor
   1. Series
   2. Shunt
   3. Multiple transistor regulators
D. IC voltage regulators
   1. Single chip
   2. Three legged devices (fixed)
   3. Adjustable IC Regulators

IV. Filtering

A. Capacitive
B. Inductive
C. Combination

   1. L network
   2. PI network
   3. PI-L network

V. Bleeder resistor

ELECTRONICS CURRICULUM GUIDE

UNIT: Transistor Amplifiers

COMPETENCIES:

Students will be able to:

a. Define amplification.

b. Describe amplifier characteristics in terms of:

   1. Classification/Configuration

   2. Frequency response

   3. Biasing

   4. Gain

c. Construct a basic transistor amplifier.

d. Describe CE, CB, and CC amplifier characteristics.

e. Describe Push-Pull amplifier characteristics.

f. Describe cascading and coupling methods.

g. Construct a two-stage R-C Coupled Transistor Amplifier to specified gain.

h. Analyze operating characteristics

   A. Ideal
   B. Real

i. Analyze distortion

j. Describe the need for heat sinking.

k. Describe and compare manufacturers' specifications to an actual transistor.

UNIT CONTENT OUTLINE:

I. Definition of Amplification

II. Characteristics of Transistor Amplifiers

A. Configurations

B. Manufacturing Specifications
1. Beta
2. Frequency response

III. Coupled and Cascaded Amplifiers
A. Characteristics
B. Feedback

IV. Power Amplifiers
A. Characteristics
1. Single ended
2. Push-pull

B. Circuit configurations
C. Heat sinking requirements

UNIT: Operational Amplifiers

COMPETENCIES:

Students will be able to:

a. Compute the signal gain of an amplifier from input and output signal amplitudes.

b. Define common mode signals.

c. Describe the result of a common mode signal applied to a differential amplifier.

d. Define common mode rejection ratio.

e. List the ideal values of gain, input and output impedance, and common mode rejection ratio.

f. Describe the effect of negative feedback.

g. Draw a dual voltage power supply diagram for an op-amp.

h. Consult reference material to identify pin-outs.

i. Using slew rate and bode plot data, predict gain and maximum signal output.

j. Describe the use of the offset null feature.

k. Design, construct, and evaluate inverting and non-inverting amplifiers for specific gain.

l. Compute gain from measured signals.

m. Describe the functions of comparitor and mixer circuits.

n. Describe the effect of positive feedback.

o. Describe the function of a Schmitt trigger

p. Describe the use of an op-amp as a multiplier.

q. Analyze the effect of cascading op-amps.

UNIT CONTENT OUTLINE:

I. Op-amp Characteristics
   A. Gain
   B. Distortion
   C. Phase Shifts
   D. Biasing
   E. Used as an amplifier
   F. Used as a multiplier
   G. Cascading Op-amps

II. Inverting/Non-Inverting Amps
   A. Design
   B. Application

III. Special applications

ELECTRONICS CURRICULUM GUIDE

UNIT: Electronic Instruments

COMPETENCIES:

Students will be able to:

a. Observe safety rules in the placement of electronic metering instruments.

b. Measure and record voltage readings of individual circuit components.

c. Measure and record the resistance of componets.

d. Use an oscilloscope to measure AC and DC voltages.

e. Trace an injected signal through an amplifier to determine gain and phase of each stage.

f. Measure the period of AC signals using an oscilloscope.

g. Use a signal generator to produce a specified signal.

h. Use a dual trace oscilloscope to analyze digital pulses.

i. Use a pulse generator to trigger counts in digital circuits.

j. Use a RF signal generator.

k. Use a frequency counter.

l. Use a transistor tester to determine beta and leakage, and compare the results to manufacturers specifications.

m. Determine the characteristic curves of a transistor using a transistor curve tracer.

n. Measure the firing voltage and condition of a silicon controlled rectifier by using the SCR tester.

o. Analyze signals in a digital circuit using a logic probe.

p. Measure the values and condition of capacitors and inductors using a RCL bridge.

UNIT CONTENT OUTLINE:

I. Safety using meters

II. Voltmeter, Ammeter, and Ohmmeter

III. Oscilloscope

IV. Signal Generators

V. Signal Tracer

VI. Frequency Meter

VII. Transistor Tester

VIII. Digital Logic Probe

IX. Capacitance/Inductance Tester

ELECTRONICS CURRICULUM GUIDE

UNIT: Electronic Assembly Methods

COMPETENCIES:

Students will be able to:

a. Tin, solder a wire, and a component to a lug.

b. Assemble and wire a given circuit using a soldering iron.

c. Use a wire wrapping tool.

d. Compare the advantages and disadvantages of wire wrapping to those of soldering.

e. Use common mechanical fastening tools.

f. Design and construct a single sided P.C. board layout from a schematic.

g. Breadboard a simple circuit.

UNIT CONTENT OUTLINE:

I. Point-to-Point Wiring

II. Mechanical and Electrical Hardwares

III. Printed Circuit Wiring

IV. Breadboarding

ELECTRONICS CURRICULUM GUIDE

UNIT: Electronic Wiring Symbols

COMPETENCIES:

Students will be able to:

a. Trace current paths in schematic diagram.

b. Draw common electronic symbols.

c. Construct circuits from schematic diagrams.

d. Interpret schematic diagrams for function.

e. Identify Integrated Circuit pin-outs.

d. Use common color codes.

UNIT CONTEN OUTLINE:

I. Schematic Symbols
   A. Schematic symbols
   B. Circuit tracing
   C. Interpretation

II. Pin-outs

III. Color codes

UNIT: Digital Integrated Circuits

COMPETENCIES:

Students will be able to:

a. Describe integrated circuits and their manufacture.

b. Identify various integrated circuit package styles, families and pin-outs.

c. Describe advantages of integrated circuits as compared to discrete component circuitry.

d. Describe the terms V.L.S.I., M.S.I., and L.S.I.

e. Observe appropriate precautions when working with integrated circuits.

f. Construct and test circuits which are comprised of integrated circuits.

g. Describe the advantages of chip technology.

h. Compare characteristics of various I.C. logic families.

i. Use digital circuits to perform logic operations.

j. Complete truth tables for common logic gates.

k. Describe the advances made in each generation of electronic technology.

l. Explain the difference between digital and linear circuits.

m. Test integrated circuits for faults.

n. Identify the symbols used for connections on various integrated circuit packages.

o. Diagram common gating circuits.

p. Describe fan-in and fan-out values.

q. Use the binary number system for counting.

r. Describe basic multivibrator circuits.

s. List common flip/flop types.

UNIT CONTENT OUTLINE:

I. Introduction
   A. Integrated Circuits
   B. Logic charts
   C. Families
   D. Specifications

II. Logic functions
   A. Gates
   B. Truth tables

III. Flip/flops

IV. Digital Systems

UNIT: Radio Receiver

COMPETENCIES:

Students will be able to:

a. List the various means of communication before radio.

b. Identify major contributions in the field of communication.

c. List the basic parts of a radio.

d. Identify block diagram drawings of the basic AM/FM radio.

e. Draw a block diagram of basic receiver.

f. List the conditions that influence radio propagation.

g. Draw a block diagram of a superheterodyne receiver.

h. Draw the schematic of a tuning circuit.

i. Define selectivity.

j. Diagram the wave form of a demodulated signal.

k. Describe the function of a detector.

UNIT CONTENT OUTLINE:

I. History of Communication

II. Simple Radio

III. Amplitude Modulation

IV. The Tuning Circuit

V. Detection Characteristics

VI. Superheterodyne Receiver

UNIT: Radio Transmitter

COMPETENCIES:

Students will be able to:

a. Block diagram a typical transmitter.

b. Describe the operation of a buffer amplifier.

c. Classify transmitter amplifiers.

d. Describe frequency multipliers.

e. Construct bias circuits.

1. Fixed bias

2. Self bias

3. Cathode bias

f. Measure transmitter output.

g. Make minor supervised tank circuit adjustments.

h. Correctly tune and couple an antenna.

i. Provide for neutralization and parasitic suppression.

j. Identify modulated wave components.

k. Use an oscilloscope to display amplitude modulation.

l. Use an oscilloscope to display frequency modulation.

m. Identify AM & FM modulation circuits.

n. Identify input and output circuit modulation.

o. Compare tube and transistor transmitters.

UNIT CONTENT OUTLINE:

I. Transmitter Circuits

II. Transmitter Tuning

III. Modulation of signal

UNIT: Computer Theory

COMPETENCIES:

Students will be able to:

a. List the system components of a computer.

b. Describe the various methods of information storage.

c. Describe the basic principle of operation.

   1. Retrieval of stored information.

   2. Perform mathematical operations.

   3. Repetition of multiple functions.

d. Understand stored program concepts.

e. Understand the various switching functions.

   1. Switching time

   2. Delay time

   3. Storage time

   4. Turn on-off time

   5. Real time concept

UNIT CONTENT OUTLINE:

I. Introduction to Computers

A. System componets
B. Storage
C. Operation

II. CPU's
A. Types
B. Functions

III. Storage Devices
A. Magnetic media
B. Memories

IV. Switching

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