This document contains 519 criterion-referenced multiple choice and true or false test items for a course in electronics. The test item bank is designed to work with both the Vocational Instructional Management System (VIMS) and the Vocational Administrative Management System (VAMS) in Missouri. The items are grouped into 15 units covering the following topics: electronic safety; fundamentals of electronics; AC power supply; semiconductor devices; amplifiers; frequency generation; receivers and transmitters; test equipment; microprocessor and computer systems; optical electronics; digital logic application; electromechanical devices and controllers; circuit construction techniques; logical steps of troubleshooting; and leadership. The 28 references used in constructing the test item bank are listed, and electronic diagrams needed for the test questions are provided. The following information is provided for each test item: unique item number; duty area and task number (Missouri competency profile); letter of correct answer; source; date; learning domain (cognitive, affective, psychomotor); writer(s)/reviewer(s); and accompanying artwork. (KC)
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Criterion-Referenced Test Items for **ELECTRONICS**
Criterion-Referenced Test (CRT) Items for

ELECTRONICS

Diane Davis, editor/project coordinator
Instructional Materials Laboratory
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Catalog No. 70-5000-E
1991
The activity which is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Vocational and Adult Education. However, the opinions expressed herein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Vocational and Adult Education, and no official endorsement should be inferred.
FOREWORD

Rapid advances in technology are placing heavy demands on both teachers and students in vocational education. These Criterion-Referenced Test Items for Electronics are designed to help meet those demands.

All test writers face one basic challenge: to produce test items that accurately measure what they are intended to measure. This challenge was kept firmly in mind by all those who participated in the development of the bank. The items in the bank are based upon competencies found on the Missouri Electronics Competency Profile. Much care was taken to ensure that the test items will accurately measure a student's knowledge in regard to these competencies. Every effort was made to ensure the items are presented in a fair and unbiased manner.

The items in this book are designed to work with both the Vocational Instructional Management System (VIMS) and VAMS. The test item bank will allow instructors and administrators to manage testing and evaluation activities in the most efficient way possible. Instructors pulling items from this bank for individual tests should still evaluate the new test to see that one question does not give away the answer to another question. For word processing and test-item generation purposes, an ASCII disk of the item bank has been included with this printed copy.

This test bank should be viewed as a beginning. It is hoped that future revisions and additions will build the bank into an even more powerful and reliable evaluation and management tool.

Judith Moore, supervisor
Industrial Education
Department of Elementary and Secondary Education

Charles "Chuck" Waibel, director
Industrial Education
Department of Elementary and Secondary Education
ACKNOWLEDGMENTS

These Criterion-Referenced Test (CRT) Items for Electronics represent a continuing commitment to Missouri's Vocational Instructional Management System (VIMS). The bank is keyed to the Electronics Competency Profile developed by industry and education professionals in the state. The cycle of curriculum development includes the following steps:

1. Development of the competency profile
2. Instructional analysis
3. Search for existing materials and/or a crosswalk of existing curriculum materials to the competency profile
4. Development of the curriculum guide
5. Field-test of the curriculum guide
6. Development of mediated curriculum (videos)
7. Development of the test-item bank

To ensure that test items are firmly based on information available to students, development of the test-item bank is the final component in the development cycle.

These teachers contributed as writers and advisory committee members.

Ron Boyer, Jefferson College
Barry Charter, Crowder College
Don Mallory, Cass County AVTS
C. Paul Miller, Monett AVTS
Mark Murphy, Davis H. Hart Mexico AVTS
Ralph "Randy" Muselman, Kirksville AVTS
Don Waters, Carthage AVTS

These CRTs were technically reviewed and/or field-tested by the following educators.

Charles Oviatt, educational consultant, Vienna, Mo.
Ron Boyer, Jefferson College
Don Mallory, Cass County AVTS
Mark Murphy, Davis H. Hart Mexico AVTS
Ralph "Randy" Muselman, Kirksville AVTS
Don Waters, Carthage AVTS

Support and contributions of IML staff members were instrumental to this project's development.

Harley Schlichting, director
Amon Herd, associate director
Phyllis Miller and Dan Stapleton, assistant directors
Fiona Gammonley, graphic artist II
Lori Holliday, word processor III
### REFERENCES USED FOR ELECTRONICS CRTs

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Edition</th>
<th>Publisher</th>
<th>Location</th>
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<tr>
<td>Gernish and Dugger</td>
<td>Electricity and Electronics</td>
<td></td>
<td>The Goodheart-Willcox Company, Inc.</td>
<td>South Holland, IL</td>
<td>1989</td>
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<td>Floyd</td>
<td>Principles of Electric Circuits</td>
<td></td>
<td>The Charles E. Merrill Publishing Company</td>
<td>Columbus, OH</td>
<td>1988</td>
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<tr>
<td>Floyd</td>
<td>Electronic Devices</td>
<td>2nd ed.</td>
<td>The Charles E. Merrill Publishing Company</td>
<td>Columbus, OH</td>
<td>1988</td>
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<tr>
<td>Hewlett-Packard</td>
<td>Feeling Comfortable with Logic Analyzers</td>
<td>2nd ed.</td>
<td>Hewlett-Packard Inc.</td>
<td>Palo Alto, CA</td>
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<tr>
<td>Fry</td>
<td>Semiconductor Devices</td>
<td></td>
<td>Heath Company</td>
<td>Benton Harbor, MI</td>
<td>1985</td>
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<td>Slack</td>
<td>Electronics</td>
<td></td>
<td>University of Missouri-Columbia</td>
<td>Instructional Materials Laboratory, 1989-90</td>
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<td>MAVCC</td>
<td>Advanced Microcomputer Service Technology</td>
<td></td>
<td>Mid-America Curriculum Consortium</td>
<td>Stillwater, OK</td>
<td>1985</td>
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<tr>
<td>MAVCC BE1</td>
<td>Basic Electronics 1</td>
<td></td>
<td>Mid-America Vocational Curriculum Consortium, Inc.</td>
<td>Stillwater, OK</td>
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<td>Mid-America Vocational Curriculum Consortium, Inc.</td>
<td>Stillwater, OK</td>
<td>1981</td>
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TABLE OF CONTENTS

Duty and task

A. Electronic Safety

1. Identify various types, purposes and operation of fire extinguishers
2. Identify electrical hazards
3. Identify and practice shop safety
4. Identify and practice safe soldering methods
5. Demonstrate safe and proper use of hand tools
6. Identify hazard of RF radiation devices
7. Demonstrate safe and proper use of AC line operated equipment; i.e., isolation transformers, grounding, GFI

B. Fundamentals of Electronics

1. Describe atomic structure and its relationship to electricity
2. Describe the basic physics of semiconductor materials
3. Describe the relationship between electrical and magnetic properties
4. Describe the electrical and magnetic properties of a magnet
5. Describe the photoelectric effect
6. Describe the thermocouple effect
7. Describe the electrical effect of friction
8. Describe the concept of resistance, voltage and current and how they relate to each other
9. Describe the concept of capacitance, voltage and current and how they relate to each other
10. Describe the concept of inductance, voltage and current and how they relate to each other
11. Solve AC network problems utilizing appropriate theorems and laws
12. Identify and test resistors
13. Identify and test capacitors
14. Identify and test inductors
15. Calculate series and parallel; resistive, capacitive and inductive networks

vi
16. Identify and replace parts and components on printed circuit boards and chassis
17. Interpret symbols and schematic diagrams
18. Calculate RC time constant circuits
19. Describe and identify filter networks
20. Test and evaluate filter performance

C. AC Power Supply

1. Describe types of transformers
2. Determine transformer requirements
3. Determine rectifier (diode) specifications for specific installations
4. Select components for complete power supply
5. Identify and describe use of series regulators
6. Identify and describe use of shunt regulators
7. Identify and describe use of switching regulators
8. Install power supply components
9. Test power supply and correct defects

D. Semiconductor Devices

1. Identify schematic design symbols for semiconductor devices
2. Describe the operation of junction diodes
3. Describe the operation of bipolar transistors
4. Construct circuits using bipolar transistors
5. Describe the basic operation of a JFET
6. Describe the basic operation of a MOSFET
7. Describe the basic operation of a UJT
8. Describe the basic operation of a PUT
9. Describe the basic operation of a DIAC
10. Describe the basic operation of a SCR
11. Describe the basic operation of a TRIAC
12. Describe the basic operation of a VDR
13. Test diodes
14. Test transistors
15. Test thyristors
16. Select transistors for specific purposes using specification sheets and substitution guides
17. Demonstrate the proper replacement techniques for semiconductor devices

E. Amplifiers

1. Describe the operation of a bipolar amplifier
2. Describe the operation of a FET amplifier
3. Describe the operation of an operational amplifier
4. Test and repair bipolar amplifier
5. Test and repair FET amplifier
6. Test and repair operational amplifier
7. Describe amplifier coupling techniques
8. Measure frequency response of amplifiers

F. Frequency Generation

1. Describe the basic operation of oscillators
2. Describe the basic operation of a crystal oscillator
3. Describe operation of phase lock loop (PLL)
4. Describe operation of waveform generators
5. Test and repair oscillators
6. Test and repair phase lock loop (PLL)
7. Test and repair waveform generators
G. Receivers and Transmitters
1. Identify and describe the stages of a radio receiver, AM/FM
2. Identify and describe the stages of a radio transmitter, AM/FM
3. Describe the basic operation of microwave and satellite transmitter/receiver systems
4. Describe the operation of transmitter/receiver antennas

H. Test Equipment
1. Describe the operation and demonstrate the use of an oscilloscope
2. Describe the operation and demonstrate the use of multimeters; i.e., VOM, EVM or DVM
3. Describe the operation and demonstrate the use of signal generators; i.e., audio, RF or function
4. Describe the operation and demonstrate the use of a frequency counter
5. Describe the function and application of analyzers; i.e., Signature, Data, LOGS, Spectrum or Components
6. Describe the operation and demonstrate the use of logic probes
7. Describe the operation and demonstrate the use of digital breakout boxes
8. Describe the operation and demonstrate the use of analog breakout boxes

I. Microprocessor and Computer Systems
1. Identify and describe computer architecture
2. Identify the levels of computer languages
3. Describe the purpose of operating systems
4. Analyze simple programs using computer instruction sets
5. Write simple computer programs
6. Debug software
7. Describe interfacing techniques
8. Explain control and data transfer techniques to and from peripheral devices
9. Troubleshoot hardware problems

J. Optical Electronics
1. Describe physical aspects of light
2. Identify types of photodetectors and emitters
3. Construct a circuit using a photodetector and emitter
4. Describe optically coupled electronic systems
5. Describe optoelectronic methods of communication
6. Test and repair optical displays
7. Describe operating principals of lasers and masers
8. Describe operation principles of optical encoders

K. Digital Logic Application
1. Identify and convert number systems and codes for binary, hex, octal and BCD
2. Identify and describe the operation of basic logic gates
3. Develop truth tables defining circuit design
4. Test and repair logic circuits
5. List advantages and disadvantages of SSI, MSI, LSI and VLSI
6. Describe the characteristics of ROM's and PLA's
7. Construct combination logic circuits for a given application
8. Describe digital counter operating modes and their function
9. Construct counter and controller circuits for sequential logic applications
10. Describe the advantages of test instruments that use digital techniques
11. Use data sheets
12. Describe the operation of A/D and D/A converters

L. Electromechanical Devices and Controllers
1. Test and repair a DC motor
2. Test and repair an AC motor (single and polyphase)
3. Test and repair a stepper motor
4. Test and repair electromechanical control devices
5. Test and repair analog electronic control devices
6. Test and repair digital electronic control devices
7. Explain the proper connection of Delta and Wye motor connections
8. Describe the operation of motor speed control
9. Describe the operation of programmable controllers

M. Circuit Construction Techniques
1. Breadboard circuits
2. Wirewrap circuits
3. Solder/desolder circuits
4. Select and install proper components for specific use
5. Repair printed circuit boards

N. Logical Steps of Troubleshooting
1. Describe system operation using block diagram
2. Identify problem area by symptom
3. Diagnose by signal tracing and/or injecting
4. Isolate defective unit, circuit and components
5. Test for proper operation after repair

Leadership
1. Demonstrate an understanding of VICA, its structure and activities
2. Demonstrate an understanding of one's personal values
3. Perform tasks related to effective personal management skills
4. Demonstrate interpersonal skills
5. Demonstrate etiquette and courtesy
6. Demonstrate effectiveness in oral and written communication
7. Develop and maintain a code of professional ethics
8. Maintain a good professional appearance
9. Perform basic tasks related to securing and terminating employment
10. Perform basic parliamentary procedures in a group meeting
Figure B17.1

Figure B17.2

Figure B19.1

Load

Figure D1.1
a.        b.        c.        d.

Figure D1.2
a.        b.        c.        d.

Figure D1.3
a.        b.        c.        d.

Figure D1.4
a.        b.        c.        d.
Figure N1.2

Figure N3.1
**190**

**54/74190**

**54LS/74LS190**

**UP/DOWN DECADE COUNTER**

(With Preset and Ripple Clock)

**DESCRIPTION** — The '190 is a reversible BCD 8421 decade counter featuring synchronous counting and asynchronous presetting. The preset feature allows the '190 to be used in programmable dividers. The Count Enable input, the Terminal Count output and the Ripple Clock output make possible a variety of methods of implementing multi-stage counters. In the counting modes, state changes are initiated by the rising edge of the clock.

- **HIGH SPEED — 30 MHz TYPICAL COUNT FREQUENCY**
- **SYNCHRONOUS COUNTING**
- **ASYNCRONOUS PARALLEL LOAD**
- **CASCADEABLE**

**MODE SELECT TABLE**

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>MODE</th>
<th>COUNT UP</th>
<th>COUNT DOWN</th>
<th>PRESET (ASYN)</th>
<th>NO CHANGE/HOLD</th>
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<tr>
<td>PL</td>
<td>CE</td>
<td>L</td>
<td>H</td>
<td>X</td>
<td>X</td>
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<tr>
<td>H</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>L</td>
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<td>L</td>
<td>H</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>H</td>
<td>H</td>
<td>X</td>
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**RC TRUTH TABLE**

<table>
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<tr>
<td>CE</td>
<td>TC*</td>
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<tr>
<td>L</td>
<td>H</td>
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<td>H</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
<td>L</td>
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</table>

'TC is generated internally.

**INPUT LOADING/FAN-OUT:** See Section 3 for U.L definitions.

<table>
<thead>
<tr>
<th>PIN NAMES</th>
<th>DESCRIPTION</th>
<th>54/74 (U.L.)</th>
<th>54/74LS (U.L.)</th>
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<tbody>
<tr>
<td>CE</td>
<td>Count Enable Input 'Active LOW'</td>
<td>3 0/3 0</td>
<td>1 5/0 75</td>
</tr>
<tr>
<td>CP</td>
<td>Clock Pulse Input 'Active Rising Edge'</td>
<td>1 0/1 0</td>
<td>0 5/0 25</td>
</tr>
<tr>
<td>P0 — P3</td>
<td>Parallel Data Inputs</td>
<td>1 0/1 0</td>
<td>0 5/0 25</td>
</tr>
<tr>
<td>PL</td>
<td>Asynchronous Parallel Load Input 'Active LOW'</td>
<td>1 0/1 0</td>
<td>0 5/0 25</td>
</tr>
<tr>
<td>U - D</td>
<td>Up/Down Count Control Input</td>
<td>1 0/1 0</td>
<td>0 5/0 25</td>
</tr>
<tr>
<td>Q0 — Q3</td>
<td>Flip-flop Outputs</td>
<td>20/10</td>
<td>10/5 0</td>
</tr>
<tr>
<td>RC</td>
<td>Ripple Clock Output 'Active LOW'</td>
<td>20/10</td>
<td>10/5 0</td>
</tr>
<tr>
<td>TC</td>
<td>Terminal Count Output 'Active HIGH'</td>
<td>20/10</td>
<td>10/5 0</td>
</tr>
</tbody>
</table>

**VCC = Pin 16**

**GROUND = Pin 8**
INPUT LOADING/FAN-OUT: See Section 3 for U.L. definitions

<table>
<thead>
<tr>
<th>PIN NAMES</th>
<th>DESCRIPTION</th>
<th>54/74 (U.L.)</th>
<th>54/74LS (U.L.)</th>
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</thead>
<tbody>
<tr>
<td>CE</td>
<td>Count Enable Input (Active LOW)</td>
<td>3.0/3.0</td>
<td>1.5/0.75</td>
</tr>
<tr>
<td>CP</td>
<td>Clock Pulse Input (Active Rising Edge)</td>
<td>1.0/1.0</td>
<td>0.5/0.25</td>
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<tr>
<td>P0 - P3</td>
<td>Parallel Data Inputs</td>
<td>1.0/1.0</td>
<td>0.5/0.25</td>
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<td>FL</td>
<td>Asynchronous Parallel Load Input (Active LOW)</td>
<td>1.0/1.0</td>
<td>0.5/0.25</td>
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<tr>
<td>U/D</td>
<td>Up/Down Count Control Input</td>
<td>1.0/1.0</td>
<td>0.5/0.25</td>
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<tr>
<td>Q0 - Q3</td>
<td>Flip-flop Outputs</td>
<td>20/10</td>
<td>10/5.0</td>
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<td>RC</td>
<td>Ripple Clock Output (Active LOW)</td>
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<td>10/5.0</td>
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<tr>
<td>TC</td>
<td>Terminal Count Output (Active HIGH)</td>
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TRUTH TABLE

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<thead>
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<tr>
<td>MR</td>
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<td>H</td>
<td>L</td>
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<td>H</td>
<td>L</td>
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<td>L</td>
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<td>L</td>
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When either I1 or I2 are HIGH, the output is in the OFF state-high impedance; however, this does not affect the contents or sequential operating of the register.

HIGH Voltage Level
LOW Voltage Level
X: immaterial

AC OPERATING REQUIREMENTS: \( V_{CC} = +5.0 \, \text{V}, \, T_A = \pm 25^\circ \text{C} \)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>54/74</th>
<th>54/74S</th>
<th>54/74LS</th>
<th>UNITS</th>
<th>CONDITIONS</th>
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<td>t\text{_}{\text{_}}{H}{\text{_}}</td>
<td>Setup Time HIGH or LOW</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
<td>Max</td>
<td>Min</td>
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<tr>
<td>t\text{_}{\text{_}}{\text{_}}{L}{\text{_}}</td>
<td>Dn to CP</td>
<td>20</td>
<td>50</td>
<td>10</td>
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<tr>
<td>t\text{_}{\text{_}}{H}{\text{_}}</td>
<td>Hold Time HIGH or LOW</td>
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<td>30</td>
<td>5.0</td>
<td></td>
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<td>t\text{_}{\text{_}}{H}{\text{_}}</td>
<td>Dn to CP</td>
<td>5.0</td>
<td>30</td>
<td>5.0</td>
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<tr>
<td>t\text{_}{\text{_}}{L}{\text{_}}</td>
<td>CP Pulse Width HIGH</td>
<td>20</td>
<td>7.0</td>
<td>18</td>
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<tr>
<td>t\text{_}{\text{_}}{L}{\text{_}}</td>
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<td>Recovery Time MR to CP</td>
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<td>5.0</td>
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</table>
There are four classes types of fires.

a. True
b. False

On which type of fire should a Class D fire extinguisher be used?

a. Wood
b. Flammable liquids
c. Electrical
d. Combustible metals

On which type of fire should a Class A fire extinguisher be used?

a. Electrical
b. Wood
c. Grease
d. Combustible metal
On which type of fire should a Class C fire extinguisher be used?

a. Electrical
b. Gasoline
c. Oil
d. Metal
5. What is an outlet with many cables attached to it called?
   a. Switched outlet
   b. Six-way outlet
   c. Ground-fault interrupt outlet
   d. Octopus outlet

6. Current is usually considered less serious than voltage.
   a. True
   b. False

7. At about what level of current will a slight shock be felt?
   a. .1 mA
   b. 1 mA
   c. 10 mA
   d. 15 mA

8. What is the correct procedure for removing a victim of electrical shock from a source of electricity?
   a. Grab and quickly pull him or her away from the source.
   b. Use your feet to kick the victim away from the source.
   c. Use a nonconductive item to separate the victim and source.
   d. Call 911.
9. A3 b IML Mod. 1 0890 C R.M.

Solvents can be safely used and stored in any environment.

a. True
b. False

10. A3 a IML Mod. 1 0890 C R.M.

All equipment and tools showing signs of wear should be reported to the supervisor immediately.

a. True
b. False

d. Turn off all power before leaving test equipment.

11. A3 d IML Mod. 1 0890 C R.M.

What is the proper lab/shop procedure for leaving test equipment or circuits being worked on?

a. Cover the items so dust won't build up on them.
b. Instruct others to leave your work site undisturbed.
c. Leave a reference point so as to begin where you left off.
d. Turn off all power before leaving test equipment.

12. A3 b IML Mod. 1 0890 C R.M.

The third prong of a three-prong plug may be removed if only two-hole outlet plugs are available.

a. True
b. False
13. Which soldering tool would be used to make a large electrical connection safely when heat control is required?
   a. 70 watt iron
   b. 100-250 watt gun
   c. 150 watt iron
   d. 200 watt iron

14. Which must be done to make a solder connection safely without burning the printed circuit board or destroying a component?
   a. Spray coolant on the device while soldering.
   b. Turn the soldering iron down to prevent damage.
   c. Use a heat sink to draw heat away from the board or device.
   d. Apply the iron intermittently to the device being soldered.

15. To remove excess solder from the iron, give it a quick flip in a direction where no one is standing.
   a. True
   b. False

16. A soldering iron properly placed in its holder is considered completely safe.
   a. True
   b. False
17. What factor should be considered when purchasing a hand tool?
   a. Knowledge of specifications
   b. Cost of the tool in comparison to profit of the job
   c. Proper tool use
   d. Ability of operator to use the tool

18. Tools should be specifically designed for electronics use.
   a. True
   b. False

19. What function can combination slip-joint pliers perform safely?
   a. Cutting cable
   b. Holding and turning
   c. Stripping wire
   d. Crimping solderless connections

20. What function can long-nose pliers perform safely?
   a. Tightening and loosening nuts
   b. Cutting wire
   c. Heat sinking
   d. Stripping insulation
21. The hazard of microwave exposure depends upon frequency, power and signal exposure duration.
   a. True
   b. False

22. What symptom can result from excessive exposure to RF radiation?
   a. High blood pressure
   b. Headaches
   c. Rashes
   d. Blindness

23. What precaution should be taken with microwave equipment?
   a. Do not operate equipment without proper shielding in place.
   b. Always wear a microwave detection meter.
   c. Wear protective glasses that filter out microwaves.
   d. Check microwave power levels and keep at a minimum.

24. Just as for visible light, laser absorption by the human body is selective.
   a. True
   b. False
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1. | B1 | a | Floyd E.C. | 0890 | C | R.M. |

What is the outermost shell of an atom called?

- a. Valence
- b. Current
- c. Proton
- d. Neutron

2. | B1 | b | Floyd E.C. | 0890 | C | R.M. |

How much charge does one coulomb have?

- a. $6.25 \times 10^{10}$ (or $6.25 \times 10^{10}$ electrons)
- b. $6.25 \times 10^{18}$ (or $6.25 \times 10^{18}$ electrons)
- c. $6.25 \times 10^{25}$ (or $6.25 \times 10^{25}$ electrons)
- d. $6.25 \times 10^{28}$ (or $6.25 \times 10^{28}$ electrons)

3. | B1 | c | Floyd E.C. | 0890 | C | R.M. |

A single electron has how much charge in coulombs?

- a. $1.6 \times 10^{-10}$ (or $1.6 \times 10^{-10}$)
- b. $1.6 \times 10^{-15}$ (or $1.6 \times 10^{-15}$)
- c. $1.6 \times 10^{-19}$ (or $1.6 \times 10^{-19}$)
- d. $1.6 \times 10^{-25}$ (or $1.6 \times 10^{-25}$)
The charge of an electron is negative.

a. True
b. False
5. What is the most common type of semiconductor in use?
   a. Silicon
   b. Germanium
   c. Quartz
   d. Gallium arsenide

6. What is the merging of a free electron and a hole called?
   a. Reconstitution
   b. Recombination
   c. Relevant bonding
   d. Relational excitation

7. What change occurs when a semiconductor is doped (as compared to pure silicon)?
   a. Decreased conductivity
   b. Removes pentavalent atoms
   c. Increased conductivity
   d. Forms a crystalline lattice
What is the area in a diode called where positive and negative regions meet?

a. Barrier potential
b. Barrier gap
c. Unbiased zone
d. Depletion region
9. What is the group of lines surrounding a magnet called?
   a. Magnetic flux
   b. Magnetic attraction
   c. Magnetic repulsion
   d. Magnetic induction

10. In an electromagnetic circuit, what is the opposition to the ability to establish a magnetic field called?
    a. Magnetomotive force
    b. Reluctance
    c. Permeability
    d. Magnetic charge

11. "The direction of the current induced in a coil is always such that it opposes the change in the magnetic field that produced it." Who discovered this law?
    a. Faraday
    b. Geissler
    c. Lenz
    d. Maxwell
What is the ability of a coil to establish an induced voltage as a result of a change in its current called?

a. Mutual inductance  
b. Apparent inductance  
c. Pulsing inductance  
d. Self inductance
13. What does current flowing through a conductor produce?
   a. Electromagnetic field
   b. Magnetomotive force
   c. Electro-reluctant force
   d. Electro-permeable field

14. When nonmagnetic material is placed in a magnetic field, the lines of force will be altered.
   a. True
   b. False

15. Like poles of a magnet repel; unlike poles attract.
   a. True
   b. False

16. How many time constants does it take to fully charge an inductor in a DC circuit?
   a. 1
   b. 3
   c. 5
   d. 7
17. What name is given to electromagnetic signals above 300 GHz?
   a. Infrared
   b. Microwave
   c. HF
   d. RF

18. When used as a sensor, a light-sensitive device uses the photoelectric effect.
   a. True
   b. False

19. What is the name of a discrete device that amplifies current in relationship to the amount of light striking the receiver?
   a. Photoresistor
   b. Photodiode
   c. Phototransistor
   d. Photocapacitor

20. Light travels at the speed of 186,000 miles per second.
   a. True
   b. False
21. A device that converts thermal energy to electrical energy takes advantage of the thermocouple effect.

a. True  
b. False

22. When the temperature increases, what happens to the resistance in a conductor with a negative temperature coefficient?

a. Increases  
b. Alternates up and down  
c. Remains the same  
d. Decreases
23. What is a charged atom called?
   a. Ion
   b. Proton
   c. Neutron
   d. Electron

24. What is the study of electricity at rest called?
   a. Electrophysics
   b. Electrostatics
   c. Electronics
   d. Electrolytics

25. According to Coulomb's law, the electrical force between two charged objects is proportional to the product of the charges and inversely proportional to the square of the distance between them.
   a. True
   b. False

26. The nucleus of an atom is composed of electrons and protons.
   a. True
   b. False
27. If resistance is held constant and voltage is increased, what happens to current?
   a. Increases
   b. Decreases
   c. Stays the same

28. If a circuit has a power source of 27 volts and a total resistance of 63 ohms, what is total current?
   a. 428 microamps
   b. 428 milliamps
   c. 428 picoamps
   d. 428 nanoamps

29. If a circuit has a resistance of 70 kilohms and total current of .9 milliamps, what is the power source?
   a. .63 volts
   b. 6.3 volts
   c. 63 volts
   d. 630 volts
If a circuit has a power source of 88 volts and current of 2.3 amps, how much total resistance does the circuit contain?

a. 38.26 kilohms
b. 3.826 kilohms
c. 382.6 ohms
d. 38.26 ohms
31. How many time constants does it take to fully charge a capacitor in a DC circuit?
   a. 1
   b. 3
   c. 5
   d. 7

32. When fully charged, a capacitor blocks current in a DC circuit.
   a. True
   b. False

33. In a capacitor, by how many degrees does current lead voltage?
   a. 90
   b. 180
   c. 270
   d. 360

34. Ideally, the average power of a capacitor is always zero.
   a. True
   b. False
35. By how many degrees does the alternating voltage lead the current in a pure inductive current?
   a. 90
   b. 100
   c. 120
   d. 180

36. What is the base unit of measurement for inductance?
   a. Ohm
   b. Ampere
   c. Farad
   d. Henry

37. Inductance opposes any change in voltage.
   a. True
   b. False
Which describes the counter EMF induced in a coil that opposes a change in current?

a. Mutual induction

b. Self induction

c. Flyback effect

d. Transient response
What is the formula to find the reactance of an inductor?

a. \( X_L = 2\pi fL \)

b. \( X_L = 2\pi V \)

c. \( L = V / I \)

d. \( L = L_1 + L_2 \), etc.

What is the reactance of a four-Henry coil at 100 Hertz?

a. 1,512 ohms

b. 2,025 ohms

c. 2,512 ohms

d. 3,515 ohms

What is the unit of measurement for inductive reactance?

a. Hertz

b. Voltage

c. Ampere

d. Ohm
42. What formula is used to find the amount of mutual inductance between two coils?
   a. \( X_L = 2\pi fL \)
   b. \( L_T = L_1 + L_2 \)
   c. \( M = \frac{K}{\sqrt{L_1 + L_2}} \)
   d. \( M = \sqrt{2\pi fL} \)

43. What is the capacitive reactance if the capacitor voltage is 125 volts AC and the capacitor current is 0.7 amps AC?
   a. 0.0056 ohm
   b. 87.5 ohm
   c. 179 ohm
   d. 508 ohm
   e. 875 ohm

44. What is the applied frequency to a series RL circuit when \( X_L = 100 \) ohms, \( L = 0.025 \) henry, and \( R = 1,200 \) ohms?
   a. 0.00636 Hertz
   b. 0.0637 Hertz
   c. 6.37 Hertz
   d. 63.7 Hertz
   e. 637 Hertz
45. What is the frequency of a waveform that has a period of 0.279 microseconds?
   a. 3.58 KHz
   b. 35.8 KHz
   c. 358 KHz
   d. 3.58 MHz
   e. Depends on the applied voltage

46. Calculate the inductive reactance of a 15 mH coil at 500 Hertz (cycles per second).
   a. 0.021 ohms
   b. 47 ohms
   c. 210 ohms
   d. 471 ohms
   e. 680 ohms

47. What is the capacitive reactance when C = 330 microfarad and frequency is 60 Hz?
   a. 0.008 ohms
   b. 0.124 ohms
   c. 0.995 ohms
   d. 8 ohms
   e. 124 ohms
What is the inductive reactance when \( L = 20 \text{ millihenrys} \) and frequency is 60 Hz?

a. 0.133 ohms
b. 0.754 ohms
c. 7.54 ohms
d. 133 ohms
e. 1,200 ohms
What is the color code for a 2.2 ohm resistor?

a. Red, red, gold
b. Red, red, black
c. Red, black, black
d. Orange, brown, red

In a four-band resistor, what does the fourth color-code band represent?

a. Multiplier
b. Tolerance
c. First digit
d. Reliability level

What is the resistance of a 20-ohm and a 40-ohm resistor connected in series?

a. 13.3 ohms
b. 20 ohms
c. 60 ohms
d. 80 ohms
What is the equivalent resistance of a circuit with a 20-ohm and 60-ohm resistor connected in parallel?

a. 15 ohms
b. 20 ohms
c. 60 ohms
d. 80 ohms
53. | B13 | d | E&E | 0890 | C | P.M. |

What component in a circuit opposes a change in voltage?

a. Diode
b. Resistor
c. Inductor
d. Capacitor

54. | B13 | a | E&E | 0890 | C | P.M. |

What is the insulator called between the two plates of a capacitor?

a. Dielectric
b. Conductor
c. Stator
d. Buffer

55. | B13 | b | E&E | 0890 | C | P.M. |

What formula is used to calculate the capacitance of capacitors in parallel?

a. \( C_T = \frac{C_1 \cdot C_2}{C_1 \times C_2} \)
b. \( C_T = C_1 + C_2 + C_3, \text{ etc.} \)
c. \( C_T = C_1 \times C_2 \times C_3, \text{ etc.} \)
d. \( C_T = \sqrt{C_1 + C_2} \)
What determines the capacitance of a capacitor?

a. Voltage applied
b. Current applied
c. Area of the plates
d. Leads of the capacitor
What does the inductance of a coil oppose in an electrical circuit?

a. Voltage
b. Wattage
c. Resistance
d. Current

What is measured when testing an inductor with an ohmmeter?

a. Inductance
b. Resistance
c. Frequency
d. Wattage

What is the formula to calculate the time constant of an RL circuit?

a. \( T = RL \)
b. \( L = RT \)
c. \( T = \frac{R}{L} \)
d. \( T = \frac{L}{R} \)
What is the unit of measurement for inductance?

a. Ampere
b. Volt
c. Henry
d. Farad
61. What is a parallel resonant circuit called?
   a. Acceptor circuit
   b. Capacitive circuit
   c. Tank circuit
   d. Resistive circuit

62. What is the total impedance of a series resonant circuit if \( R = 200 \, \text{ohms} \), \( X_C = 400 \, \text{ohms} \) and \( X_L = 600 \, \text{ohms} \)?
   a. 400 ohms
   b. 382.8 ohms
   c. 282.8 ohms
   d. 182.4 ohms

63. What is the total current in a parallel RCL circuit if \( R = 20 \, \text{ohms} \), \( X_C = 80 \, \text{ohms} \), \( X_L = 40 \, \text{ohms} \) with 40 volts applied?
   a. 3.5 amperes
   b. 2.5 amperes
   c. 2.06 amperes
   d. 0.5 amperes
What is the formula for calculating resonance frequency of a tank circuit?

a. \( Z = \sqrt{R^2 \left( X_l - X_c \right)^2} \)

b. \( f_r = \frac{1}{2\pi\sqrt{LC}} \)

c. \( BW = \frac{f_r}{Q} \)

d. \( Q = \frac{XL}{R} \)

A series RCL circuit has the following values: \( C = 120 \) microfarads, \( L = 15 \) millihenrys, \( R = 0.01 \) ohms. What is the resonant frequency?

a. 11.1 Hertz

b. 119 Hertz

c. 890 Hertz

d. 11,900 Hertz

e. 89,900 Hertz

A series RCL circuit has the following values: \( C = 47 \) picofarads, \( L = 22 \) microhenrys and \( R = 0.5 \) ohms. What is the resonant frequency?

a. 1.97 MHz

b. 4.95 MHz

c. 12.4 MHz

d. 80.6 MHz

e. 202 MHz
If the bandwidth of a circuit is 140 KHz and the resonant frequency is 10 MHz, what is the lower half-power frequency?

a. 4,930 KHz
b. 5,000 KHz
c. 5,070 KHz
d. 9,930 KHz
e. 9,860 KHz
When measuring resistance in a circuit, what must be done?
a. Check for leakage.
b. Turn off power.
c. Make sure the meter is grounded.
d. Stand on insulating pad.

When soldering replacement transistors on a circuit board, what must be done?
a. Observe voltage
b. Test bias voltage
c. Use heat sink
d. Use a current meter

When replacing electrolytic capacitors, what must be checked?
a. Static electricity
b. Leakage current
c. Temperature coefficient
d. Polarity
Match each of the symbols with its definition.

71. \[ \text{Inductor} \]
72. \[ \text{Battery} \]
73. \[ \text{Resistor} \]
74. \[ \text{Connector} \]
75. \[ \text{Capacitor} \]
76. \[ \text{Transistor} \]

Symbols for transformers indicate whether the core is a magnetic or nonmagnetic material.

a. True
b. False

What is the symbol shown in Figure B17.1?

a. P-channel MOSFET
b. NPN transistor
c. N-channel FET
d. NAND gate
What is the symbol shown in Figure B17.2?

a. NOR gate
b. NAND gate
c. AND gate
d. OR gate
What is the RC time constant of a 500 microfarad capacitor and 2500-ohm resistor?

a. 125 sec.
b. 12.5 sec.
c. 1.25 sec.
d. .125 sec.

What is the RC time constant of a 225 microfarad capacitor and 3200-ohm resistor?

a. .072 sec.
b. .72 sec.
c. .816 sec.
d. 7.2 sec.

What is the RC time constant of a 2K ohm resistor and .2 microfarad capacitor?

a. .4 ms
b. .004 sec.
c. .04 sec.
d. 4 sec.
What is the RC time constant of a 67 microfarad capacitor and 180-ohm resistor after five time constants?

a. 600 ms
b. 120 ms
c. 60 ms
d. 12 ms
82. | B19 | a | E&E | 0890 | C | P.M. |

What is a common type of filter used in a low-voltage power supply?

a. Band-pass
b. High-pass
c. T-type
d. Low-pass

83. | B19 | b | E&E | 0890 | C | P.M. | ART

What type of filter is shown in Figure B19.1?

a. High-pass
b. Low-pass
c. T-type
d. Pi-type

84. | B19 | c | E&E | 0890 | C | P.M. |

What type of filter would be used for a car radio to block out motor noise on 12 volts input?

a. High-pass
b. T-type
c. Low-pass
d. Band reject
What type of filter network is used to improve selectivity of an FM radio receiver?

a. High-pass
b. Pi-type
c. Band reject
d. Band-pass
What type of test equipment is used to test a filter in a radio?

- a. Ammeter
- b. Wattmeter
- c. Frequency counter
- d. Signal generator

An oscilloscope can be used to test the performance of a band reject filter.

- a. True
- b. False

What type of signal is used as an input for a 4.5 megahertz band-pass filter?

- a. Audio
- b. RF
- c. FM
- d. Modulated carrier
At what point on the slope of a signal is the half-power point measured?

a. Zero
b. .637 x peak
c. .707 x peak
d. 90 degrees on slope
1. What type of core does the power transformer require?
   a. Air
   b. Powdered iron
   c. Laminated iron
   d. Laminated steel

2. What type of transformer has a secondary voltage larger than the primary voltage?
   a. Auto
   b. Step-down
   c. Isolation
   d. Step-up

3. What type of transformer uses the same winding as the primary and secondary?
   a. Auto
   b. Step-down
   c. Isolation
   d. Step-up
In a step-up transformer, the voltage in the primary is less than in the secondary.

a. True

b. False
5. What is the current requirement of the secondary of a 12 volt transformer at 48 watts?
   a. 2
   b. 4
   c. 50
   d. 570

6. What turns ratio in a transformer is required to produce 6 volts from a 120-volt line?
   a. 2:1
   b. 10:1
   c. 20:1
   d. 40:1

7. When used within specifications, the winding of a step-up transformer designated as the primary can be used as the secondary.
   a. True
   b. False
What is the primary current of a 12 volt, 12 watt transformer?

a. 100 milliamperes
b. 1 ampere
c. 2 amperes
d. 4 amperes
9. What is the PIV requirement of a diode used with 12 volts RMS?
   a. 12 volts
   b. 20 volts
   c. 34 volts
   d. 40 volts

10. What determines the PIV requirement of a diode in a power supply?
    a. Input voltage
    b. Input current
    c. Input wattage
    d. RMS voltage across the diode

11. What is the purpose of connecting diodes in series in a power supply?
    a. Increase the ripple frequency
    b. Increase the output current
    c. Increase the output voltage
    d. Increase the PIV rating of the rectifier
What is the ripple frequency of a bridge rectifier output voltage if the input frequency is 60 Hz?

a. 30
b. 60
c. 80
d. 120
What is the purpose of a capacitor in parallel with a diode in a power supply?

a. Protect the diode  
b. Increase the output voltage  
c. Protect the filter capacitor  
d. Regulate the output voltage

Why are electrolytic capacitors used in power supplies?

a. Provide a large amount of capacitance in a small space  
b. Provide very low working voltage rating  
c. Obtain a higher voltage output  
d. Increase ripple frequency of the output voltage

What is the purpose of a bleeder resistor in a power supply?

a. Protect the diode  
b. Increase the output voltage  
c. Improve current regulation  
d. Discharge the filter capacitor
What component is used as the reference voltage in a regulated power supply?

a. Resistor
b. Transistor
c. Zener diode
d. Capacitor
17. What component is used as the voltage divider in a series regulator?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. Capacitor

18. What component is used to adjust the output voltage in a series regulated power supply?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. Capacitor

19. A series regulator is more accurate than a shunt regulator.
   a. True
   b. False
What voltage zener diode would be used to produce an output of 12 volts in a series regulator?

a. 2
b. 6.3
c. 11.3
d. 12.7
21. What component is used as the voltage divider in a shunt regulator?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. Capacitor

22. What component is used to adjust the output voltage in a shunt regulated power supply?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. Capacitor

23. A shunt regulator is more efficient than a series regulator.
   a. True
   b. False
What voltage zener diode would be used to produce a output of 12 volts in a shunt regulator?

a. 2
b. 11.3
c. 12
d. 12.7
25. What part is used as the voltage divider in a switching regulator?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. None

26. What component is used to control the output voltage in a switching regulated power supply?
   a. Resistor
   b. Transistor
   c. Zener diode
   d. Capacitor

27. A switching regulated power supply uses a feedback loop.
   a. True
   b. False

28. What is the advantage of a switching regulated power supply?
   a. Size
   b. Accuracy
   c. Cost
   d. Ease of repair
29. Which is correct when changing a rectifier diode?
   a. Use a signal diode.
   b. Replace with a resistor.
   c. Increase the PIV.
   d. Observe polarity.

30. What must be done before changing components in a power supply?
   a. Test replacement parts.
   b. Disconnect the transformer.
   c. Discharge the capacitor.
   d. Remove the diodes.

31. When an electrolytic capacitor in a power supply is replaced, polarity must be observed.
   a. True
   b. False

32. Which statement is true?
   a. Replace component with lower values.
   b. Replace component with the same value or higher voltage rating.
   c. Replace component with the same value or lower voltage rating.
   d. Replace component with lower current rating.
33. What type of voltage should be measured at the output filter network of a power supply?
   a. AC
   b. DC
   c. Pulsing DC
   d. Square wave

34. What would the output voltage be if one of the diodes were to open in a full-wave power supply?
   a. One-fourth of the supply voltage
   b. One-half of the supply voltage
   c. Three-fourths of the supply voltage
   d. Full supply voltage

35. Which type of power supply has an output identical to the output of a full-wave power supply with one diode open?
   a. Half-wave
   b. Full-wave
   c. Full-wave bridge
   d. Switching
In a positive half-wave power supply, what type of voltage will be measured at the cathode of a power supply diode?

a. AC  
b. DC  
c. Pulse DC  
d. None
In Figure D1.1, which is a schematic diagram for a PN-junction diode?

a. b. c. d.

In Figure D1.2, which is a schematic diagram for an NPN-bipolar transistor?

a. b. c. d.

In Figure D1.3, which is a schematic diagram for an N-channel enhancement MOSFET?

a. b. c. d.

In Figure D1.4, which is a schematic diagram for a silicon-controlled rectifier (SCR)?

a. b. c. d.
5. | D2 | c | Floyd E.D. | 0890 | C | R.B. |

What is the approximate voltage across a forward-biased silicon diode after conduction occurs?

a. .1V  
b. .4V  
c. .7V  
d. 1.0V

6. | D2 | a | Floyd E.D. | 0890 | C | R.B. |

The depletion region of a reverse-biased PN-junction diode increases as the voltage increases.

a. True  
b. False

7. | D2 | c | Malvino | 0890 | C | R.B. |

Which diode approximation includes the barrier potential voltage and the bulk resistance of the device?

a. First  
b. Second  
c. Third  
d. None of the above
Refer to Figure 2.1. Using the second approximation, what is the voltage across the silicon diode?

a. 0.3V
b. 0.7V
c. 5V
d. 10V
9. | D3 | a | Floyd E.D. | 0890 | C | R.B. |

How is the base-emitter junction of a bipolar transistor biased in order to properly operate as an amplifier?

a. Forward biased
b. Reverse biased
c. Zero biased
d. None of the above

10. | D3 | b | Floyd E.D. | 0890 | C | R.B. |

What is the ratio of collector current to base current in a bipolar junction transistor called?

a. Alpha
b. Beta
c. Efficiency
d. Q factor

11. | D3 | a | Floyd E.D. | 0890 | C | R.B. |

What is the ratio of collector current to emitter current in a bipolar junction transistor called?

a. Alpha
b. Beta
c. Efficiency
d. Q factor
What is the state called when the collector current of a BJT has reached a maximum value and is independent of the base current?

a. Inversion
b. Saturation
c. Cutoff
d. Breakdown
13. In Figure D4.1, what is the primary function of the circuit?
   a. Switch
   b. Current source
   c. Oscillator
   d. Amplifier

14. In Figure D4.2, which biasing technique is classified as voltage divider biasing?
   a. 
   b. 
   c. 
   d. 

15. When calculating the saturation point of a transistor during the development of a load line, how is the transistor viewed?
   a. As an open circuit
   b. As a resistive circuit
   c. As a short circuit
   d. None of the above

16. Which bipolar biasing technique is most widely used in order to maintain a stable operating point using only one power supply?
   a. Voltage divider bias
   b. Emitter bias
   c. Base bias
   d. Collector feedback bias
17. What is the correct gate-source biasing technique used for proper JFET operation?
   a. Forward bias
   b. Reverse bias
   c. Base bias
   d. Feedback bias

18. Which voltage applied to a JFET controls the drain current ($I_D$) through the device?
   a. Source
   b. Drain
   c. Gate
   d. Channel

19. When the gate-source voltage ($V_{gs}$) of an N-channel JFET is equal to zero volts, what is the drain current?
   a. Zero
   b. Minimum
   c. Maximum
   d. Does not change
What is the approximate input impedance of a JFET?

a. Zero ohms  
b. Low ohms  
c. High ohms  
d. Infinite ohms
21. **True**

22. **b.**

23. **b.**

24. **b.**
25. What are the names for the three leads of a UJT?
   a. Emitter, base, collector
   b. Emitter, base 1, base 2
   c. Source, gate, drain
   d. Anode, cathode, gate

26. Which three-terminal semiconductor device is used as a switching device in oscillators and circuits, and has a firing point controlled by a fixed voltage ratio inside the component?
   a. BJT
   b. FET
   c. VDR
   d. UJT

27. In Figure D7.1, which schematic symbol represents a UJT?
   a. b. c. d.

28. Refer to Figure D7.2. If this transistor has an efficiency of 0.82, what is the ideal emitter current?
   a. 40mA
   b. 44mA
   c. 50mA
   d. 54mA
What are the names for the three leads of a PUT?

a. Emitter, base, collector
b. Emitter, base 1, base 2
c. Source, gate, drain
d. Anode, cathode, gate

What must the polarity of the biasing voltage be at the gate of a PUT in order for the device to operate properly?

a. Positive
b. Negative
c. Neutral

Which programmable switching device has a voltage ratio that controls the firing point?

a. UJT
b. PUT
c. FET
d. JFET

Which schematic symbol in Figure D8.1 represents a PUT?

a. b. c. d.
33. Which schematic diagram in Figure D9.1 represents a DIAC?
   a.    b.    c.    d.

34. Which device is defined as a bidirectional trigger diode?
   a. DIAC  b. SCR  c. FET  d. UJT

35. Having only two leads, which device is classified in the thyristor family of bilateral devices?
   a. BJT  b. FET  c. DIAC  d. TRIAC

36. A DIAC can be used at the input of an AC circuit as a surge protection device.
   a. True  b. False
Which thyristor is defined as a three-terminal device that can be made to conduct current from its anode terminal to its cathode terminal by application of a short-duration positive voltage at its gate terminal?

a. Rectifier diode  
b. DIAC  
c. FET  
d. SCR

Which schematic symbol in Figure D10.1 represent an SCR?

a.  
b.  
c.  
d.

Which SCR part requires a positive voltage to turn on the device?

a. Anode  
b. Cathode  
c. Gate  
d. Base
What is the minimum anode current called that keeps an SCR in the conduction mode?

a. Forward current
b. Reverse current
c. Gate current
d. Holding current
Which schematic diagram in Figure D11.1 represent a TRIAC?

a.  

b.  

c.  

d.  

A TRIAC acts as three SCRs in parallel.

a. True

b. False

Which type of semiconductor device is a TRIAC?

a. Thermistor

b. Varistor

c. Transistor

d. Thyristor

A TRIAC can be controlled by applying a voltage pulse at the anode.

a. True

b. False
Which component is classified as a VDR?

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<td>Hazen</td>
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a. Transistor  
b. Varistor  
c. Thermistor  
d. Varactor

What does the resistance of a varistor do as voltage increases across it?

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a. Decreases  
b. Increases  
c. Remains the same

What does the acronym VDR stand for?

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a. Voltage dependent resistor  
b. Variable degaussing resistor  
c. Voltage dependent r  
d. Variable diode release
What is wrong with a VDR if, after applying a large voltage, the resistance remains the same as before the voltage was applied?

a. Open

b. Shorted

c. Leaking
49. To check the forward direction of current flow through a diode, the positive lead of an ohmmeter should be placed on the cathode side, and the negative lead of the meter should be placed on the anode side.
   a. True
   b. False

50. To check the reverse direction of current flow through a diode, the negative lead of an ohmmeter should be placed on the anode side, and the positive lead of the meter should be placed on the cathode side.
   a. True
   b. False

51. When measuring the forward direction of a good diode, what resistance reading should be obtained?
   a. Zero ohms
   b. Low ohms
   c. High ohms
   d. Infinite ohms
When measuring the reverse direction of a good diode, what resistance reading should be obtained?

a. Zero ohms
b. Low ohms
c. High ohms
d. Infinite ohms
An ohmmeter can be used to provide a simple test for open or shorted junctions in a bipolar transistor.

a. True
b. False

Which instrument can be used to display transistor characteristics such as a family of collector curves?

a. DMM
b. Oscilloscope
c. VTVM
d. Curve tracer

What resistance reading for a base-emitter junction should be obtained when a bipolar transistor is checked in the forward direction with an ohmmeter?

a. Zero ohms
b. Low ohms
c. High ohms
d. Infinite ohms

Current leakage of a transistor can be checked with an ohmmeter.

a. True
b. False
When checking an SCR with an ohmmeter, what should the resistance reading be when the negative lead is placed at the cathode and the positive lead is placed at the anode?

a. Zero ohms
b. Low ohms
c. High ohms
d. Infinite ohms

When checking an SCR with an ohmmeter, what should the resistance reading be when the negative lead is placed at the anode and the positive lead is placed at the cathode?

a. Zero ohms
b. Low ohms
c. High ohms
d. Infinite ohms

When checking an SCR with an ohmmeter, what should the resistance reading be when the negative lead is placed at the cathode and the positive lead is placed at the anode after the anode has been shorted to the gate momentarily?

a. Zero ohms
b. Low ohms
c. High ohms
d. Infinite ohms
When using an ohmmeter, what is wrong with the SCR if zero resistance is measured between its anode and cathode before a pulse is applied at the gate?

a. Open
b. Shorted
c. Leaking
61. The typical maximum ratings that are given for bipolar transistors on data sheets are: collector-to-base voltage, collector-to-emitter voltage, emitter-to-base voltage, collector current, and power dissipation.

a. True
b. False

62. A transistor is to be operated with $V_{ce} = 8V$ if its maximum power rating is .4W. What is the most collector current that it can withstand?

a. 20mA
b. 32mA
c. 50mA
d. 80mA

63. A transistor has a PD maximum of 1.5W at 25 degrees Celsius. The derating factor is 7mW per Celsius. What is the PD maximum at a temperature at 75 degrees Celsius?

a. 1W
b. 1.15W
c. 1.25W
d. 1.5W
A transistor has a PD maximum of 2W, the \( I_c = 50\)mA and the \( V_{CE} = 50\)V DC. Will this transistor work without exceeding the power dissipation?

a. No

b. Yes

c. Sometimes
What is the common name for a mass of metal that is connected to a device to draw heat away from that device?

a. Heater
b. Heat seeker
c. Heat sink
d. Heat absorber

When replacing a semiconductor device in a circuit, the power to the circuit should be left on.

a. True
b. False

What should the length of leads be on semiconductor devices that are being installed into high-frequency instruments?

a. Long
b. Medium
c. Short as possible
d. Doesn't matter

Polarity needs to be observed when replacing a diode in a circuit.

a. True
b. False
What standard connections would be used on a phototransistor when it is to be used as a photodiode?

a. Emitter and base leads, leaving collector lead open
b. Collector and base leads, leaving emitter lead open
c. Emitter and collector leads, leaving base lead open
d. None of the above
1. Which is the main advantage of the common collector configuration?
   a. Low power loss with high gain
   b. High power loss with high gain
   c. Low input impedance with high output impedance
   d. High input impedance with low output impedance

2. What is the DC voltage at the emitter in Figure E1.1?
   a. 0.7
   b. 3.1
   c. 3.8
   d. 4.5

3. What is the approximate voltage gain of the circuit in Figure E1.1? 
   \( A = \frac{r_l}{25} \)
   a. 60
   b. 120
   c. 180
   d. 7,200
4. | El | d | Malvino | 0890 | C | B.C. | ART

Which describes the transistor circuit configuration in Figure E1.1?

a. Common ground  
b. Common collector  
c. Common base  
d. Common emitter

5. | El | b | Malvino | 0890 | C | B.C. | ART

What is the DC voltage at the base in Figure E1.1?

a. 0.7  
b. 3.8  
c. 6.7  
d. 31.2
Which electronic device is similar in operating principles to the FET?

a. Triode vacuum tube
b. TRIAC
c. DIAC
d. LED

Which term describes the ability of a FET to control its output signal current?

a. Transmutation
b. Transconductance
c. Siemens
d. None of the above

Which is a purpose of a JFET device?

a. Voltage control
b. Current control
c. Low input resistance
d. Emits light
What is the input impedance of a JFET amplifier?

a. Nearly zero
b. Close to unity (one)
c. Approaches infinity
d. Impossible to predict
10. Which two points are connected by the feedback resistor in an operational amplifier circuit?
   a. Output to inverting input
   b. Output to noninverting input
   c. Inverting input to noninverting input
   d. Output to ground

11. Which characteristic of an operational amplifier circuit describes its ability to output exactly 0V with 0V input?
   a. DC ripple
   b. Input resistance
   c. Slew rate
   d. Offset voltage

12. Which term describes the increase of voltage in an operational amplifier circuit over a period of time?
   a. Slew rate
   b. Frequency
   c. Offset voltage
   d. Power
13. What is the gain of an operational amplifier if the input signal is 2.5 microvolts and the output voltage is .5 millivolts?
   a. 200
   b. 2,000
   c. 20,000
   d. 200,000

14. Identify the formula for calculating the output voltage of the inverting summing amplifier in Figure E3.1.
   a. \[ \frac{(R_{3E1})}{R_1} + \frac{(R_{3E2})}{R_2} \]
   b. \[ \frac{(E_1 + E_2)}{(R_1 + R_2)} \]
   c. \[ \frac{R_1 + 1}{R_2 + 1} \]
   d. \[ \frac{(E_1}{R_1 + E_2/R_2)} R_3 \]

15. Which is true when changes of the load resistance at the output of an operational amplifier have little or no effect on the signal voltage at the load?
   a. Amplifier gain is low.
   b. Open-circuit gain of the op amp increases when \( R_1 \) is decreased.
   c. Output impedance of the op amp is well matched to \( R_L \).
   d. Output impedance of the op amp is low.
16. Which symptom indicates that the bypass capacitor is open in Figure E1.1?
   a. No DC or signal at the collector
   b. No DC or signal at the emitter
   c. Distorted signal at the collector
   d. Distorted signal at the source

17. What will happen to the signal voltage at the collector of the transistor circuit in Figure E1.1 if the load resistor becomes open?
   a. Increase
   b. Decrease
   c. Remain the same
   d. Go to zero

18. What would happen to the signal voltage at the collector if the $V_{cc}$ goes to 0 in the circuit in Figure E1.1?
   a. Increase
   b. Decrease
   c. Remain the same
   d. Go to zero
Which symptom indicates an open collector resistor in Figure E1.1?

a. No DC or signal at the collector
b. No DC or signal at the emitter
c. Distorted signal at the collector
d. Distorted signal at the base
Which problem will cause $V_{out}$ in Figure E6.1 to become clipped?

a. $+V_{cc}$ and $-V_{cc}$ increase
b. $+V_{cc}$ and $-V_{cc}$ decrease
c. $R_f$ decreases in value
d. $R_i$ increases in value

Which problem will cause $V_{out}$ in Figure E6.1 to be zero?

a. $+V_{cc}$ and $-V_{cc}$ increase
b. Power supply failure
c. $R_f$ decreases in value
d. $R_i$ increases in value

What kind of operating voltage is required for most operational amplifier circuits, such as in Figure E6.1?

a. High supply voltage (usually 32 volts)
b. A supply providing +12.6 volts
c. Dual voltage (with equal positive and negative voltages)
d. Solar cell connected in parallel with a D size battery
23. When would a circuit similar to that in Figure E6.2 be used?
   a. Never
   b. To match high impedance source and low impedance load
   c. To decrease frequency range
   d. To increase the open loop gain

24. Which problem will cause no output voltage in Figure E6.3?
   a. Inverting input shorted to ground
   b. Operational amplifier with greater than normal open loop gain
   c. Input current source producing 5 mA instead of 1 mA
   d. An open in the noninverting input
25. When a coupling capacitor is used in the input circuit, what does a low audio frequency produce?

a. Lower input impedance
b. Lower output impedance
c. Lower mid-band voltage gain
d. None of the above

26. Broad frequency response and DC isolation are two reasons why resistance-capacitance coupling is used.

a. True
b. False

27. Impedance coupling is used when a narrow band of frequencies or a single frequency is to be amplified.

a. True
b. False

28. Transformer coupling is the preferred method of interstage coupling when DC or low frequency is involved.

a. True
b. False
29. Direct coupling is the preferred method of interstage coupling when DC or low frequency is involved.

a. True
b. False

30. Direct coupling usually requires more space than other methods of interstage coupling.

a. True
b. False

31. Transformer coupling provides excellent DC isolation between amplifier stages.

a. True
b. False
32. | E8 | d | E&E | 0890 | C | B.C. |

Which test equipment is used to check amplifier frequency response?

a. Curve tracer and digital multimeter
b. Curve tracer and oscilloscope
c. Curve tracer and sweep-frequency generator
d. Sweep-frequency generator and oscilloscope

33. | E8 | b | E&E | 0890 | C | B.C. |

When checking the frequency response of high-frequency amplifiers, it is important to use low impedance test equipment.

a. True
b. False
1. What will cause an oscillator to amplify?
   a. Regenerative feedback
   b. Bias voltage
   c. Degenerative feedback
   d. Output load

2. What will cause an amplifier to oscillate?
   a. Regenerative feedback
   b. Bias voltage
   c. Degenerative feedback
   d. Output load

3. What type of oscillator has a tapped coil?
   a. Armstrong
   b. Hartley
   c. Colpitts
   d. Crystal
What are oscillators used for in electronics?

a. Amplification
b. Frequency generation
c. Impedance matching
d. Selection
What results from the distortion of a crystal?

a. Magnetic effect
b. Electrostatic effect
c. Thermoelectric effect
d. Piezoelectric effect

What type of oscillator is stable at high frequencies?

a. Armstrong
b. Hartley
c. Colpitts
d. Crystal

What determines the frequency of a crystal oscillator?

a. Tank circuit
b. Crystal
c. Transistor
d. Load resistor

The crystal-controlled oscillator is also called the Pearce oscillator.

a. True
b. False
9. | F3 | b | E&E | 0890 | C | D.W. |

What component determines the stabilization of a phase-lock loop?

a. Tank circuit
b. Crystal
c. Transistor
d. Load resistor

10. | F3 | c | E&E | 0890 | C | D.W. |

Which type of circuit uses a phase-lock loop?

a. Amplifier
b. Digital
c. Frequency generator
d. Detector

11. | F3 | a | E&E | 0890 | C | D.W. |

How is frequency determined in a phase-lock loop?

a. Division
b. Addition
c. Reduction
d. Subtraction
How is frequency controlled in a phase-lock loop?

a. Tank circuit

b. Crystal

c. Transistor

d. Feedback
What are the two main requirements of a waveform generator?

a. Frequency and amplitude
b. Amplitude and shape
c. Frequency and shape
d. Stability and shape

What type of circuitry is best suited as a square wave generator?

a. Analog
b. Digital
c. Linear
d. Nonlinear

What is the output of a relaxation oscillator?

a. Square wave
b. Sine wave
c. Triangle wave
d. Sawtooth wave
What type of circuit will produce multiple waveforms?

a. Analog
b. Digital
c. Linear
d. Nonlinear
17. What symptom is indicated if there is a bad crystal in an oscillator?
   a. Acts as an amplifier
   b. Acts as a sawtooth oscillator
   c. Incorrect frequency
   d. Incorrect voltages

18. What test equipment is used to test the frequency of an oscillator?
   a. Signal generator
   b. Oscilloscope
   c. Voltmeter
   d. Ohmmeter

19. What is the result of loading down an oscillator?
   a. Normal operation
   b. Incorrect voltages
   c. Acts as an amplifier
   d. Increased frequency
What component will cause frequency drift in a phase-lock loop?

a. Tank circuit
b. Crystal
c. Transistor
d. Load resistor

What should be done if a defect is suspected in a phase-lock loop?

a. Check the voltages.
b. Check with a digital probe.
c. Check the frequency.
d. Check the detectors.

What type of test equipment is used to test a phase-lock loop?

a. Frequency counter
b. Oscilloscope
c. Voltmeter
d. Ohmmeter
What code is used to control a phase-lock loop?

a. Gray

b. PLL

c. BCD

d. Control
24. What test equipment should be used to check a waveform generator?
   a. Signal generator
   b. Oscilloscope
   c. Voltmeter
   d. Ohmmeter

25. What is a possible defect if the output of a square wave generator is distorted?
   a. Input loaded
   b. Output loaded
   c. Input open
   d. Output open

26. What component is possibly defective if the output of a relaxation oscillator is a constant DC voltage?
   a. Static device
   b. Control device
   c. Passive device
   d. Active device
What is possibly defective if only one waveform can be obtained from a multiple waveform generator?

a. Oscillator
b. Selector
c. Power supply
d. All of the above
Match the following stages of a typical AM receiver to definitions.

1. Output section of the receiver which drives the speakers
   a. RF amplifier

2. Part of a receiver's tuning section; mixes the incoming signal with the oscillator signal to develop the IF signal
   b. Oscillator
c. Mixer
d. IF amplifier

e. Variable frequency divider

3. Separates audio information from the IF carrier

4. Adjusted to a fixed frequency regardless of input (Most radios have two stages.)
   ab. Detector
   ac. AF amplifier

5. In the tuning part of the receiver, provides signal to be mixed with incoming signal to develop IF

6. Usually the first stage of a receiver; provides amplification of incoming signal

Which stage of an FM receiver is NOT normally found in an AM receiver?

a. Mixer
b. IF amp
c. Limiter
d. AF amp
8. Which function is NOT normally found in a radio transmitter?
   a. Signal generation
   b. Modulation
   c. Detection
   d. Power amplification

9. Frequency modulated transmitters generally require the use of frequency multiplier stages to achieve the desired output frequency.
   a. True
   b. False

10. In what class of operation can an FM power amplifier operate that is NOT permissible for an AM amplifier?
    a. A
    b. AB
    c. B
    d. C

11. The final amplifier stages in FM broadcast transmitters typically use large vacuum tubes as opposed to transistors.
    a. True
    b. False
12. What band of frequencies make up the microwave frequency band?
   a. 1-30 KHz
   b. 1-30 MHz
   c. 1-30 GHz
   d. 1-30 THz

13. Which is NOT an advantage of microwave transmission?
   a. Minimum atmospheric disturbance
   b. Some degree of privacy
   c. No transmission line maintenance
   d. Line of sight communications

14. Microwave frequencies are used primarily for telephone communications, radar and satellite communications.
   a. True
   b. False

15. What is the preferred transmission line used for microwaves?
   a. Coaxial
   b. Waveguide
   c. Balanced
   d. Twin lead cable
16. | G4 | b | IML Mod. 6 | 0890 | C | D.M. |

What type of antenna is used by two-way radios?

a. Hertz
b. Marconi
c. Yagi
d. Hyperbolic

17. | G4 | c | IML Mod. 6 | 0890 | C | D.M. |

Approximately how long is a Hertz antenna for a radio station broadcasting at 150 MHz?

a. 1.64 ft.
b. 2 ft.
c. 3.28 ft.
d. 6.54 ft.

18. | G4 | c | Frenzel | 0890 | C | D.M. |

What is the most commonly used antenna for microwave transmission?

a. Hertz
b. Marconi
c. Parabolic
d. Yagi
What antenna is one-half wavelength long (also called half-wave and dipole antenna)?

a. Hertz
b. Marconi
c. Parabolic
d. Yagi
Which instrument allows the technician to view a waveform as measurements are being taken?

a. DVM  
b. VOM  
c. DMM  
d. Oscilloscope

What is the minimum number of cycles that has to be shown on an oscilloscope display to correctly measure a signal's frequency?

a. 1  
b. 2  
c. 3  
d. 4

What would the peak-to-peak voltage be of a signal displayed on an oscilloscope screen if the distance from the positive peak to the negative peak covers four vertical divisions and the volt/division control is set at 5V/div.? 

a. 10V  
b. 15V  
c. 20V  
d. 25V
4. What would the frequency of a signal be where one complete cycle covered six horizontal divisions and the time/division control is set at 1ms/div.?

a. 100 Hz  
b. 167 Hz  
c. 600 Hz  
d. 1000 Hz

5. The display on an oscilloscope shows a waveform that is 5.4 cm horizontally and 3.6 cm vertically. What is the peak-to-peak voltage? (The settings are 0.2V/div. and 0.5 microseconds/div.)

a. 0.72  
b. 1.02  
c. 1.08  
d. 7.2  
e. 10.8

6. The display on an oscilloscope is 6.9 cm horizontally and 5.5 cm vertically. The settings of the 'scope are 10V/div. and 20 microseconds/div. What is the peak-to-peak voltage?

a. 55  
b. 69  
c. 488  
d. 550  
e. 690
7. What type of meter is connected in parallel when measuring voltage across a component?
   a. Ohmmeter
   b. Ammeter
   c. Voltmeter
   d. Wattmeter

8. What multimeter switches a multiplier resistor in series with the meter movement?
   a. Ammeter
   b. Wattmeter
   c. Ohmmeter
   d. Voltmeter

9. What multimeter uses a shunt resistor in parallel with the meter movement?
   a. Ammeter
   b. Ohmmeter
   c. Voltmeter
   d. Wattmeter
10. What type of test equipment converts the formula \( P = I \times E \) into a readout?
   a. Voltmeter
   b. Wattmeter
   c. Ammeter
   d. Frequency counter

11. What function on a multimeter uses its own power source?
   a. Ohmmeter
   b. Voltmeter
   c. Ammeter
   d. Wattmeter

12. A typical bench-type AC voltmeter indicates 35 volts AC. What is the RMS value?
   a. 24.7
   b. 35
   c. 49.5
   d. 70
   e. 99
A typical bench-type AC voltmeter indicates 12 volts across a 1200-ohm resistor. What is the peak-to-peak current?

a. 7.07 mA
b. 10 mA
c. 14.1 mA
d. 19.9 mA
e. 28.3 mA
14. | H3 | b | Mfg. spec. | 0890 | C | B.C. |

How is the gain or amplitude control used on the signal generator?

a. Vary frequency output
b. Vary peak-to-peak output
c. Vary phase output
d. Vary frequency input

15. | H3 | a | Mfg. spec. | 0890 | C | B.C. |

How is the multiplier control used on the signal generator?

a. Vary frequency output
b. Vary peak-to-peak output
c. Vary phase output
d. Vary frequency input

16. | H3 | b | Owner/operator manual | 0890 | C | B.C. |

The duty control of a function generator adjusts the duty cycle only— not the frequency of the output.

a. True
b. False
Which function generator control is used to establish the DC level and polarity of the signal at the output?

a. Amplitude
b. DC main output
c. DC/frequency
d. DC offset
18. Which measurement is made when counting the number of seconds between events?
   a. Frequency
   b. Period
   c. Time interval
   d. Event

19. Which is used to give the electronic counter a stable time reference?
   a. Time-period oscillator
   b. Time-base oscillator
   c. External reference
   d. Decade oscillator

20. A frequency counter’s decade counting and display unit also contain the overrange circuit.
   a. True
   b. False
Which are time-base accuracy specifications for a frequency counter?

a. Frequency range, sensitivity, impedance
b. Sensitivity, temperature stability, aging rate
c. Impedance, temperature stability, set tolerance
d. Temperature stability, aging rate, set tolerance

Normally, the maximum input voltage is higher for a 1 megohm input than for a 50 ohm input.

a. True
b. False
23. A logic analyzer is especially useful when examining small transitions of a digital waveform.
   a. True
   b. False

24. When used as a timing analyzer, a logic analyzer is similar to an oscilloscope.
   a. True
   b. False

25. Using a timing analyzer is like using a digitizing oscilloscope with only one bit of vertical resolution.
   a. True
   b. False

26. A timing analyzer uses the system's clock, while a state analyzer has an internal clock.
   a. True
   b. False
27. A logic probe is used to troubleshoot what type of circuit?
   a. Digital
   b. Resistive
   c. Capacitive
   d. Inductive

28. When troubleshooting a digital circuit, the logic probe is applied to a test point on the I.C. that has a level of 5 volts. Which indicator will light?
   a. Low
   b. High
   c. Floating
   d. Pulse

29. When troubleshooting with a logic probe, it is applied to a circuit test point which has a voltage level of .3 volts. Which indicator on the probe will light?
   a. Pulse
   b. High
   c. Low
   d. Floating
An external power source must be used with a logic probe.

a. True

b. False
What is the purpose of an RS-232C breakout box?

a. Monitor the data bus inside a microcomputer system
b. Monitor the control bus inside a microcomputer system
c. Monitor the serial communications link between microcomputer and peripherals
d. Disconnect microcomputer peripherals

A logic clip can be used in place of a breakout box.

a. True
b. False

The breakout box effectively disconnects the peripheral so it will no longer function.

a. True
b. False

A powered breakout box will NOT affect the signal voltage.

a. True
b. False
For what type of troubleshooting is a breakout box useful?

a. Power supply failure
b. CPU failure
c. Memory failure
d. Data communications failure
Which is NOT a bus in a typical microcomputer system?

a. Instruction bus
b. Address bus
c. Data bus
d. Control bus

On which bus does the CPU place the enabled memory location?

a. Instruction bus
b. Address bus
c. Data bus
d. Control bus

What part of the CPU performs all arithmetic and logic operations?

a. Math unit
b. Instruction decoder
c. Memory
d. ALU
4. Which bus identifies data transfer direction between CPU and memory?
   a. Instruction bus
   b. Data bus
   c. Address bus
   d. Control bus

5. Which identifies the point at which data enters or exits a microcomputer system?
   a. Data bus
   b. Peripheral unit
   c. Port
   d. ALU

6. The Apple II computer uses a 6502 CPU.
   a. True
   b. False

7. What is another name for computer data?
   a. Operand
   b. Op code
   c. Mnemonic
   d. Instruction
What is a binary or hexadecimal instruction called?

a. Mnemonic  
b. Op code  
c. Operand  
d. Address
9. BASIC can be described as a high-level language.
   a. True
   b. False

10. Which can be described as a low-level language?
    a. BASIC
    b. PASCAL
    c. Assembly language
    d. FORTRAN

11. Which language is the lowest level language in which the CPU is programmed with ones and zeroes?
    a. Assembly language
    b. Machine language
    c. Digital language
    d. COBOL
In which low-level language does the programmer use mnemonics, which are later converted to binary with ones and zeroes?

- a. Assembly language
- b. Machine language
- c. Digital language
- d. COBOL
13. The basic input output system (BIOS) is stored in RAM.
   a. True
   b. False

14. DOS stands for Digital Operating System.
   a. True
   b. False

15. For which microcomputer system was MS-DOS made?
   a. Apple
   b. Commodore
   c. IBM
   d. All microcomputer systems

16. Internal DOS commands do NOT need to access the disk every time the command is used.
   a. True
   b. False
17. From the Debug – prompt, an operator enters the Debug hexadecimal calculator mode by typing H followed by two hex numbers, 3 and 7. What is the Debug response?

a. A4, the sum and difference in hex
b. 4A, the difference and sum in hex
c. 1010 1000, the sum and difference in binary
d. 1000 1010, the difference and sum in binary

18. Debug will display all of the internal registers on the screen at one time by typing R.

a. True
b. False

c. Which instructions will combine the contents of the AX register with the BX register?
   a. COM AX,BX
   b. COM BX,AX
   c. ADD AX,BX
   d. ADD BX,AX
Which instruction has a function similar to the BASIC GOSUB command?

a. GSB
b. INT
c. MOV
d. COM

Refer to the program listing below. What happens when the instruction at 0100 is implemented?

```
0100 MOV DL,[200]
0104 MOV AH,5
0106 INT 21
0108 MOV DL,[201]
100C MOV AH,5
010E INT 21
0110 MOV DL,[202]
```

a. Contents of memory 0200 are placed in DL.
b. Contents of DL are placed in memory 0200.
c. 0200 is placed in DL.
d. Contents of DL are added to memory 0200.
Using the program below, what would be the result if the instruction at 0200 had the brackets deleted?

0100 MOV DL,[200]
0104 MOV AH,5
0106 INT 21
0108 MOV DL,[201]
100C MOV AH,5
010E INT 21
0110 MOV DL,[202]

a. Contents of memory 0200\textsubscript{m} are placed in DL.
b. Contents of DL are placed in memory 0200\textsubscript{m}.
c. 0200\textsubscript{m} is placed in DL.
d. Contents of DL are placed in memory 0200\textsubscript{m}.

Examine the program below. Which line will place a "pointer" address into the BX register?

a. 0100 0100 MOV CX,xx
    0103 MOV BX,11A
b. 0103 0106 MOV DL,[BX]
    0108 MOV AH,5
c. 0106 010A INT 21
    010C INC BX
d. 010C 010D LOOP 106
    010F INT 20
    011A DB 'Electronics Technology' 0D,0A
Examine the program below. Which line is used to prepare the BX register to point to the next character to be printed?

a. 0100
   0100 MOV CX,xx
   0103 MOV BX,11A
b. 0103
   0106 MOV DL,[BX]
   0108 MOV AH,5
c. 0106
   010A INT 21
   010C INC BX
d. 010C
   010D LOOP 106
   010F INT 20
   011A DB 'Electronics Technology' 0D,0A
25. I7 d IML Mod. 8 0890 C B.C. 

Which three sets of signals are needed for interface experiments?

a. IREQ, MEMR and MEMW
b. Data, address and clock
c. Data, clock and control
d. Data, control and address

26. I7 a IML Mod. 8 0890 C B.C. 

Which is a support chip used to simplify interface design?

a. PPI
b. ALU
c. RS232
d. MPU

27. I7 a IML Mod. 8 0890 C B.C. 

Which are common interface standards used with data communications equipment?

a. RS232, Centronics, IEEE-488
b. PPI, PIA, CPU
c. PPI, RS232, Centronics
d. RS1844, RS248, RS232
Why do bus signals to the breadboard need to be buffered?

a. The PC must be physically close to the project.
b. The PC can only supply about two TTL fanouts per slot.
c. It prevents interconnection capacitance.
d. The PC must be able to distinguish different signals.
29. Which is a communications exchange that is accomplished with hardware?
   a. Handshake
   b. Interface
   c. Parity
   d. Protocol

30. Which describes keeping one thing equal to another?
   a. Handshake
   b. Interface
   c. Parity
   d. Protocol

31. Which is a communications exchange accomplished with software?
   a. Handshake
   b. Interface
   c. Parity
   d. Protocol
Which describes the point of connection between two components within a system and/or the connecting device?

a. Handshake
b. Interface
c. Defacto
d. Protocol
If a customer noted that the system would not run a certain program and a known good copy of the program did not work, which test would the technician run?

a. Motherboard ROM
b. Motherboard RAM
c. Keyboard
d. Disk drive

Which test should the technician run if the customer is having problems with a graphics tablet or pen?

a. Graphics tablet
b. Graphics display
c. Monitor
d. Keyboard

Which cleaner should be used to clean non-metallic parts?

a. High residue
b. Low residue
c. Soap and water
d. Strong degreaser
36. | 19 | c | MAVCC | 0890 | C | B.C. |

When troubleshooting hardware, which should be checked first?

a. Microprocessor
b. Clock
c. Power supply
d. Address and data busses

37. | 19 | b | MAVCC | 0890 | C | B.C. |

Diagnostic software is NOT a helpful troubleshooting tool even when the microprocessor or disk drive is operational enough to run the diagnostics.

a. True
b. False

38. | 19 | c | MAVCC | 0890 | C | B.C. |

Which troubleshooting method describes the mass replacement of components?

a. Diagnostics
b. Systematic troubleshooting
c. Shotgunning
d. Generic troubleshooting
1. | J1 | c | Frenzel | 0890 | C | D.M. |

What spectrum includes ultraviolet, infrared and visible light?

a. X-ray  
b. Sonic  
c. Optical  
d. Magnetic

2. | J1 | d | Frenzel | 0890 | C | D.M. |

When a light ray passes from one medium to another, it is bent. What is this called?

a. Absorption  
b. Diffraction  
c. Reflection  
d. Refraction

3. | J1 | a | Adamson | 0890 | C | D.M. |

What particles make up light?

a. Photons  
b. Protons  
c. Electrons  
d. Neutrons
What unit is used to measure the wavelength of visible light?

a. Meter
b. Centimeter
c. Nanometer
d. Picometer
Light-emitting diodes are used as main light sources for which systems?

a. Short distance, high speed
b. Short distance, low speed
c. Long distance, high speed
d. Long distance, low speed

Which is commonly used as a photodetector?

a. Silicon-controlled rectifier
b. TRIAC
c. Photodiode
d. Injection laser diode

Which photodetector is most commonly used in optical electronics?

a. Avalanche photodiode
b. Phototransistor
c. Light-emitting diode
d. Photodiode
What is the bias condition of an LED during normal operation?

a. Forward biased
b. Reverse biased
c. Self-biased
d. Undetermined
9. | J3 | a | Ala. | 0890 | C | D.M. |

For which application is a phototransistor preferred over a photodiode?

a. Higher output current is required and response speed is not critical.
b. High-speed response is required and current output is not critical.
c. Low sensitivity can be tolerated.
d. Dark current cannot be tolerated.

10. | J3, D17 | b | Ala. | 0890 | C | D.M. |

What connections would be used on a phototransistor when it is to be used as a photodiode?

a. Emitter and base leads, leaving collector lead open
b. Collector and base leads, leaving emitter lead open
c. Emitter and collector leads, leaving base lead open
d. None of the above

11. | J3 | a | Frenzel | 0890 | C | D.M. |

What composition of fiber optic cable core would cause the LEAST attenuation?

a. Wide glass
b. Narrow glass
c. Wide plastic
d. Narrow plastic
Compared to wire cable, one disadvantage of fiber optic cable is that it cannot be spliced.

a. True
b. False
13. Which device passes a narrow band of the optical spectrum?
   a. Filter
   b. Lens
   c. Beam splitter
   d. Reflector

14. What device bends light?
   a. Beam splitter
   b. Filter
   c. Lens
   d. Reflector

15. What effect does a convex lens have on the spreading of a light beam?
   a. Increases
   b. No affect
   c. Reduces
   d. Stops
Which PN junction is designed to detect light?

a. Light-emitting diode  
b. Photodiode  
c. Photoresistor  
d. Optocoupler
What is another term for the loss of information caused by propagation delays in an optical fiber transmission system?

a. Attenuation
b. Coupling loss
c. Numerical aperture loss
d. Dispersion

Figure J5.1 shows the basic elements of a fiber-optic communications system. Match the components to appropriate functions.

18. #1 a. Decoder
19. #2 b. Receiver
20. #3 c. Encoder
21. #4 d. Antenna
22. #5 e. Transmitter
 ab. Fiber-optic cable

One advantage of using fiber-optic cable for television systems is its wide bandwidths.

a. True
b. False
24. What is the typical voltage drop of a forward-biased light-emitting diode?
   a. .5-1
   b. 1-2
   c. 3-4
   d. 4-5

25. At least how many volts must the ohmmeter battery be to test an LED as a diode?
   a. .7
   b. 2.0
   c. 4.0
   d. 6.3

26. Which is the most appropriate reference to find the pin configuration of a seven-segment LED display?
   a. Underside of the display
   b. Manufacturer's literature
   c. Schematic diagram
   d. Marked at each pin
The "g" segment of a seven-segment LED display glows when the numbers 3, 5, 6, 8 or 9 are displayed but does not glow when the number 2 is displayed. What is the most likely problem?

a. Open "g" bar
b. Current-limiting resistor
c. No problem indicated
d. Decoder driver
28. Which is NOT a part of the ruby laser?
   a. Flash tube
   b. Mirrored end
   c. Partially mirrored end
   d. Transparent end

29. The laser and maser both operate using the concept of stimulated emission.
   a. True
   b. False

30. Which statement applies to the ruby laser?
   a. In 1990, operated at above 75% efficiency
   b. Contains an internal cathode and anode
   c. Excitation obtained using a powerful flash lamp
   d. Very high energy gain obtainable
Which statement applies to fiber optic cable?

a. Since fiber optics work with very high carrier frequencies, bandwidths are significantly reduced.

b. Length for length, optical fibers have higher attenuation than wire cable.

c. Attenuation in optical fibers is dependent on assigned frequencies.

d. Unlike wire, glass does not pick up or generate electromagnetic interference.
32. Add a gear train to limit the revolution to one.
   b. Keep track of the number of revolutions.
   c. Multiple revolution use is not permitted.
   d. Use multiple absolute encoders in parallel.

33. a. Computer compatibility
    b. Effects of power surge
    c. Retains original accuracy
    d. Long use life

34. a. 72
    b. 720
    c. 7,200
    d. 72,000
How many slots in an optical disk are required for a resolution of one degree per slot?

a. 36
b. 360
c. 3,600
d. 36,000
Which number system has a base or radix of 16?

a. Binary
b. Octal
c. Decimal
d. Hexadecimal

What is the decimal equivalent of the BCD number: 1001 1000 0101?

a. 965
b. 985
c. 986
d. 1085

What is the binary equivalent of decimal 199?

a. 11000111
b. 11000110
c. 11000011
d. 01100011
4. | K1 | c | IML Mod. 3 | 0890 | C | M.M. |

What is the binary equivalent of the hexadecimal number A7?

a. 00100111
b. 01010111
c. 10100111
d. 10101110
5. Which type of logic gate will produce a high at the output ONLY when all input bits are logic high?
   a. AND
   b. NAND
   c. OR
   d. NOR

6. Which type of logic gate will produce a high at the output any time one or more input bits are logic high?
   a. AND
   b. NAND
   c. OR
   d. NOR

7. Which type of logic gate will produce a low at the output when any or all input bits are logic high?
   a. AND
   b. NAND
   c. OR
   d. NOR
What is the primary function of logic gates?

a. Add
b. Make decisions
c. Amplify
d. Convert from decimal to binary
9. Which truth table in Figure K3.1 is correct for a NAND gate?
   a. A
   b. B
   c. C
   d. D

10. Which logic gate has a truth table identical to that of the logic circuit shown in Figure K3.2?
    a. AND
    b. NAND
    c. OR
    d. NOT

11. Which logic circuit has only two possible input combinations?
    a. Inverter
    b. AND gate
    c. NOR gate
    d. Exclusive OR gate
12. | K4 | a | IML Mod. 3 | 0890 | C | M.M. | ART

In Figure K4.1, what type of output should the NOR gate have if all gates are good?

- a. Logic low
- b. Logic high
- c. Floating output

13. | K4 | b | IML Mod. 3 | 0890 | C | M.M. | ART

In Figure K4.1, if test points 1 and 2 measure logic low and test point 3 measures logic high, which gate is faulty?

- a. AND
- b. OR
- c. NAND
- d. None

14. | K4 | a | IML Mod. 3 | 0890 | C | M.M. | ART

If the inverter in Figure K4.2 should fail and produce a logic high at its output, the output of the NOR would not change.

- a. True
- b. False

15. | K4 | b | IML Mod. 3 | 0890 | C | M.M. |

A 7400 series TTL I.C. can be substituted for a CMOS I.C. 400 series in the repair of logic circuits.

- a. True
- b. False
Which pin in Figure K4.2 is pin 1 of the I.C.?

a. A
b. B
c. C
d. D
17. One advantage of a digital system using SSI over LSI is the need for fewer integrated circuits.
   a. True
   b. False

18. Which I.C. classification contains a complete functional system typically found in microcomputers?
   a. SSI
   b. MSI
   c. LSI
   d. VLSI

19. In which classification does a 7490 counter fall?
   a. SSI
   b. MSI
   c. LSI
   d. VLSI

20. A Quad 4 input NAND gate is considered MSI.
   a. True
   b. False
21. Read-only memory is a non-volatile form of memory.
   a. True
   b. False

22. When power is removed from ROM, the contents of memory are lost.
   a. True
   b. False

23. Which type of ROM can be reprogrammed repeatedly?
   a. PLA
   b. ROM
   c. PROM
   d. EPROM

24. Which type of light is used to erase EPROMs?
   a. Visible
   b. Infrared
   c. Ultraviolet
A PLA is similar to a ROM in that a PLA contains both OR and AND matrices to perform a desired sum of the products logic equation.

a. True

b. False
26. What is the primary function of combinational logic circuits?
   a. Count events
   b. Decision making
   c. Memory
   d. Frequency division

27. Which type of gate would be used to create a decoder with an active low output?
   a. AND
   b. NAND
   c. OR
   d. None of the above

28. What type of combinational logic circuit is needed to convert BCD to decimal?
   a. Multiplexer
   b. Demultiplexer
   c. Encoder
   d. Decoder
29. How many inputs must a 1 of 32 decoder have?
   a. 4
   b. 5
   c. 6
   d. 32

30. A demultiplexer can be used to convert serial data to parallel data.
    a. True
    b. False

31. How many input combinations can a decoder with 20 inputs decode?
    a. 20
    b. 1,024
    c. 65,536
    d. 1,048,576

32. What decimal number is the decoder in Figure K7.1 decoding for?
    a. 5
    b. 10
    c. 12
    d. 14
A binary comparator can be constructed from exclusive OR gates.
a. True
b. False

A frequency counter is preferred to troubleshoot timing problems.
a. True
b. False

What is the odd parity bit for the binary word 10010001?
c. 0
b. 1
c. No parity bit needed
36. Which is the best test instrument to troubleshoot a frequency divider?
   a. Digital voltmeter
   b. Logic probe
   c. Current probe
   d. Frequency counter

37. A frequency counter placed in the event mode can measure frequency.
   a. True
   b. False
38. What is the output frequency on Q3 of a BCD counter?
   a. One-half the input frequency
   b. One-fifth the input frequency
   c. One-ninth the input frequency
   d. One-tenth the input frequency

39. If all the clock inputs of a digital circuit are connected, the circuit would be classified as asynchronous.
   a. True
   b. False

40. What is another name for an asynchronous counter?
   a. Trickle
   b. BCD
   c. Ripple
   d. Decade

41. What is another name for a BCD counter?
   a. Synchronous
   b. Asynchronous
   c. Pure binary
   d. Decade
42. What is the maximum number a six-bit counter will count to?
   a. 6
   b. 36
   c. 63
   d. 64

43. A trailing edge-triggered JK flip flop, with J high and K low, will change states on every high to low transition of the clock input.
   a. True
   b. False

44. How many clock pulses are required to load a 16-bit word into a 16-bit parallel load register?
   a. 1
   b. 2
   c. 8
   d. 16

45. Shift registers are capable of multiplication or division by powers of two simply by performing a shift left or right.
   a. True
   b. False
What is another name for a sequencer?

a. Modulo counter
b. Johnson counter
c. Ring counter
d. Scaler

Modulus refers to the maximum number a counter will count to.

a. True
b. False

A counter can also be used as a divider.

a. True
b. False
In general, the accuracy of a digital multimeter is far greater than that of an analog multimeter.

a. True
b. False

Which is a characteristic of digital equipment?

a. High cost
b. More complex design
c. Less accuracy than analog
d. None of the above
51. Using a TTL Data Manual, what is the logic level necessary on pin 5 of a 74190 to cause the counter to count down?
   a. Logic low
   b. Logic high
   c. Floating logic
   d. None of the above

52. Using a TTL Data Manual, what is the fan-out on the Q₀-Q₃ outputs on a 74191 when Q₀-Q₃ pins are producing logic lows?
   a. 1
   b. 3
   c. 5
   d. 10

53. Using a TTL Data Manual, what is the required pulse width to Master Reset a 74174?
   a. 7 ns
   b. 12 ns
   c. 18 ns
   d. 20 ns
Using a TTL Data Manual, what is the active level of the clock input on a 74190?

a. Leading edge triggered
b. Trailing edge triggered
c. Negative edge triggered
d. Level triggered

Using a TTL Data Manual, how many inverters are inside a 74LS04 I.C.?

a. 2
b. 4
c. 6
d. 8
What type of circuit does Figure K12.1 illustrate?

a. ADC  
b. DAC  
c. CAD  
d. BCD

What is a circuit called that converts light intensities into binary bits of data?

a. ADC  
b. DAC  
c. CAD  
d. BCD

What type of conversion is necessary inside a digital voltmeter (DVM)?

a. None  
b. Digital to analog  
c. Analog to digital  
d. Binary to digital
A five-bit DAC has an output of voltage of 0V with an input of 00000, and an output of 8V with an input of 11111. What is the approximate analog output with an input of 00111?

a. 2 volts  
b. 3 volts  
c. 4 volts  
d. 5 volts

What is the resolution of a 16-bit DAC?

a. 1/16  
b. 1/64  
c. 1/256  
d. 1/65536

The SAR type ADC includes a DAC as an integral part of the conversion process.

a. True  
b. False
Which ADC has the fastest conversion time?

a. Counter ramp
b. Ladder
c. SAR
d. Flash

Sample rate is a term frequently used when discussing what type of conversion?

a. ADC
b. DAC
c. CAD
d. BCD
1. | L1 | d | E&E | 0890 | C | D.W. |

What will cause a DC series motor to overspeed?

a. Excessive load
b. Open field
c. Open rotor
d. No load

2. | L1 | b | E&E | 0890 | C | D.W. |

What test results should be expected if a DC motor is running slow?

a. High voltage
b. Low voltage
c. No voltage
d. Constant voltage

3. | L1 | b | E&E | 0890 | C | D.W. |

What is the normal resistance of the armature of a DC motor?

a. High
b. Low
c. Open
b. Shorted
% of speed regulation = \frac{\text{Speed (no load)} - \text{Speed (full load)}}{\text{Speed full load}} \times 100

a. True
b. False
5. What will cause a single-phase induction motor to hum but not run?
   a. Defective starter capacitor
   b. Defective running winding
   c. Defective starting winding
   d. Defective field

6. What should be tested when a three-phase induction motor is overheating?
   a. Resistance of the stator
   b. Current of each phase
   c. Starter winding
   d. Fuse

7. What is the phase angle between the stator voltages of a three-phase motor?
   a. In phase
   b. 90 degrees
   c. 120 degrees
   d. 270 degrees
8. True

9. a. Voltmeter
   b. Ohmmeter
   c. Ammeter
   d. Oscilloscope
10. What will cause a stepper motor to overheat?
   a. Defective controller
   b. Incorrect feedback path
   c. Incorrect frequency
   d. Incorrect voltage

11. What should be done first if a stepper motor is hunting?
   a. Replace stepper motor.
   b. Test the fuse.
   c. Check for proper frequency.
   d. Test for proper stepping codes.

12. A stepper motor is an analog device.
   a. True
   b. False
13. What is the resistance of a control solenoid winding?
   a. High
   b. Low
   c. Open
   d. Short

14. What item frequently fails in a contactor controller?
   a. Terminal
   b. Solenoid
   c. Contact
   d. SCR

15. Which item fails frequently in a solid-state controller?
   a. Terminal
   b. Solenoid
   c. Contact
   d. SCR

16. The SCR is the solid-state replacement for the relay.
   a. True
   b. False
17. Voltage regulation is a form of analog control.
   a. True
   b. False

18. Which term refers to an analog electronic control system that has no feedback?
   a. Closed loop
   b. Open loop
   c. Pneumatic
   d. Degenerative

19. What test equipment should be used to test an analog control device?
   a. Voltmeter
   b. Ohmmeter
   c. Ammeter
   d. Oscilloscope
20. What component is used as the input to a digital speed control?
   a. Digital-to-analog converter
   b. Comparator
   c. DIP switches
   d. Operational amplifier

21. What is the purpose of the error detection circuit?
   a. Compares digital to analog voltage
   b. Corrects errors from the DAC
   c. Compares DAC voltage to motor speed voltage
   d. Changes digital voltage to analog voltage

22. What is the purpose of the current-limiter resistor in a digital speed control?
   a. Increase motor speed
   b. Increase start-up current
   c. Decrease stall current
   d. Prevent overheating of the motor
What is the purpose of the motor speed measuring circuit?

a. Change frequency to voltage
b. Change voltage to frequency
c. Change digital to analog
d. Change analog to digital
24. What does Delta depict in circuit analysis?
   a. Wye arrangement
   b. Triangular arrangement
   c. Superposition arrangement
   d. Nodal voltage arrangement

25. What is the proper way to connect a motor using a Wye connection?
   a. The field windings are connected in series.
   b. The field windings are connected in parallel.
   c. The phase must be observed.
   d. The node must be observed.

26. What arrangement is being used to connect a motor when the power is applied in series with the field windings?
   a. Wye
   b. Triangular
   c. Superposition
   d. Nodal voltage
When converting a Wye-connected motor to a Delta connection, what must be done?

a. Reverse power wires.
b. Reverse field wires.
c. Change fields from series to parallel.
d. Change fields from parallel to series.
What is the purpose of the ADC in a motor speed control?

a. Frequency-to-voltage conversion
b. Generate an error signal
c. Change speed
d. Control speed

What is the purpose of the controller in a motor speed control?

a. Frequency-to-voltage conversion
b. Generate an error signal
c. Change speed
d. Control speed

What is the purpose of the comparator in a motor speed control?

a. Frequency-to-voltage conversion
b. Generate an error signal
c. Change speed
d. Control speed
What is the purpose of the speed control reference in a motor speed control?

a. Frequency-to-voltage conversion
b. Generate an error signal
c. Change speed
d. Control speed
In a programmable controller, the set-point module accepts input from an operator and controls the timing of the digital control.

a. True
b. False

Where is the binary signal from the input processed?

a. Transducer
b. Actuator
c. Output
d. Control

How is the set-point used in a programmable controller?

a. Output
b. Control
c. Reference
d. Input

What does the output module of a programmable controller drive?

a. Control
b. Set-point
c. Input
d. Actuator
When breadboarding circuits, what gage wire is usually used?

a. 14  
b. 16  
c. 18  
d. 22

What type of wire is used for breadboarding?

a. Coaxial  
b. Flat  
c. Solid  
d. Stranded

Wirewrapping is a method of breadboarding used where low cost, temporary connections are desirable.

a. True  
b. False
4. Which statement best describes the wirewrapping method of circuit construction?
   a. Easy to master
   b. Least expensive
   c. No special tools needed
   d. None of the above

5. Match the following terms and definitions.
   5. Wire or rows of holes used to carry power or ground for convenient connection to circuit components
   a. Spring connector
   b. Fahnestock clip
   c. Wirewrap
   d. Jack
   e. Bus
   6. Springy metal fastener with components soldered to clip and wires inserted through hole
   7. Round receptacle
   8. Plastic circuit board with holes typically laid out in rows of five
   9. Copper-coated fastener used for solderless connection of wires and components
   a. Solderless circuit board
What type of solder is most commonly used in electronics connections?

a. 60/40 acid core
b. 60/40 rosin core
c. 40/60 acid core
d. 40/60 rosin core

Which soldering device would be best suited for making soldered connections on a printed circuit board?

a. Soldering gun, 100 watt
b. Soldering iron, 100 watt
c. Soldering iron, 10-35 watts
d. Desoldering iron, 20 watt

What tool is used to prevent thermal damage to components when soldering/desoldering?

a. Component lead cleaner
b. Heat shrink tubing
c. Thermal wire stripper
d. Heat sink
Match terms on the right with definitions on the left.

13. Device that draws heat from soldered connection to prevent damage to component
   a. Crimping  
   b. Rosin

14. Liquid or solid which, when heated, cleans and protects surfaces to be soldered
   c. Wetting  
   d. Tinning

15. Material used during soldering to help ensure a good bond between the solder and metal surfaces
   e. Heat sink  
   ab. Flux

16. Ability of molten solder to flow over and fuse completely with metal surfaces to which it is applied

17. Mechanical pressure applied to ensure a good electrical connection

When replacing components on a printed circuit board, the length of the leads are NOT important.

a. True
b. False

An acceptable method of replacing discrete components on a printed circuit board is to clip the old leads and solder the new component leads to the ends attached to the board.

a. True
b. False
20. What is the proper action to take when a "run" has been damaged on a printed circuit board?
   a. Repair using "like-new" method
   b. Repair using "crushing" method
   c. Repair using "bridge" method
   d. Cannot be repaired

21. What is the name of the round, donut-shaped copper terminal connection point on a printed circuit board where component lead wires are attached?
   a. Run
   b. Pad
   c. Foil
   d. Wick
A block diagram shows a detailed schematic diagram of an electronics system.

a. True
b. False

In Figure N1.1, the audio level is controlled after one stage of amplification.

a. True
b. False

Figure N1.1 shows the complete block diagram for a stereo receiver.

a. True
b. False
Refer to Figure N1.2. A signal is injected at TP2 and heard at the speaker. No signal is heard when the signal is injected at TP3. Which stage is faulty?

a. Detector stage
b. Audio amplifier
c. Driver amplifier
d. None
5. What section of the radio should be checked first if no sound is heard from the speaker?
   a. Antenna
   b. RF section
   c. IF section
   d. Audio output section

6. What section of the equipment should be checked first if the equipment cannot be turned on?
   a. Power section
   b. Signal section
   c. Output section
   d. Meter circuits

7. What section of the equipment should be checked if the system has an AC hum?
   a. Middle section
   b. Output section
   c. Input power section
   d. Meter circuits
When the AC line fuse continues to blow, what should be checked first?

a. Signal path
b. Power supply
c. Output section
d. Amplifier section
9. When troubleshooting by signal injection, start near the output and work toward the input.
   a. True
   b. False

10. When troubleshooting by signal tracing, start near the input and work toward the output.
    a. True
    b. False

11. Which is an acceptable signal source when using the signal injection method of troubleshooting a stereo amplifier?
    a. RF oscillator
    b. Video pattern generator
    c. Function generator
    d. None of the above

12. See Figure N3.1. Using an oscilloscope to troubleshoot an AM radio with a problem of hum in the output, the technician finds no hum present at point L. What would be the next point to check?
    a. J
    b. K
    c. M
    d. N
The proper use of flowcharts is very helpful in troubleshooting equipment. Match the following terms with standard symbols.

13. [Blank rectangle]  
   a. Make decision

14. [Blank rectangle]  
   b. Adjust

15. [Diamond]  
   c. Connector

16. [Circle]  
   d. Terminate
   e. Process
   ab. Begin
1. | Leadership 1 | c | VICA | 0889 | C | Fred Smith |

Why should students NOT enroll in occupational training programs?

a. To work toward a career
b. To develop business and industry contacts
c. To avoid taking math, science, or English classes
d. To work toward financial independence

2. | Leadership 1 | a | VICA | 0889 | C | Fred Smith |

Only one VICA club per school is allowed.

a. True
b. False

c. 3
b. 5
c. 7
d. 9
In which national VICA region is Missouri located?

a. 3  
b. 4  
c. 5  
d. 6  

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5. | Leadership 2 | b | VICA | 0889 | C | Fred Smith |

Personal values rarely affect career choices.

a. True

b. False

6. | Leadership 2 | a | VICA | 0889 | C | Fred Smith |

A career should align with one's personal values, interests, and abilities.

a. True

b. False
7. Effective decision making can be broken down into six steps.
   a. True
   b. False

8. A new supervisor should be liked by all workers in order to be effective.
   a. True
   b. False

9. Which goal should a supervisor work toward in order to succeed and improve worker morale?
   a. Keep attention on getting work done
   b. Be as fair as possible
   c. Avoid taking a worker's negative feelings personally
   d. All the above

10. To be more productive, workers need ways to measure and use time more effectively.
    a. True
    b. False
11. Which trait or traits do employers expect from their employees?
   a. Cooperation and acceptance of evaluation
   b. Honesty
   c. Initiative
   d. All the above

12. Which characteristic should employees expect from their employers?
   a. Understanding of job requirements
   b. Fair payment for labor
   c. Equal treatment for all employees
   d. All of the above

13. Effective communication, care for people, flexibility, dependability, optimism, and perseverance are traits of good leaders.
   a. True
   b. False
14. Leadership 5 | a | VICA | 0889 | C | Fred Smith |

Good table manners include entering into table conversation.

a. True
b. False

15. Leadership 5 | b | VICA | 0889 | C | Fred Smith |

A coat room clerk at a restaurant is usually NOT tipped.

a. True
b. False

16. Leadership 5 | a | VICA | 0889 | C | Fred Smith |

Employees should stand when an authority figure (employer) joins them for a meal.

a. True
b. False
17. Leadership 6 | b | VICA | 0889 | C | Fred Smith |

It is a good idea to use big words when writing in order to impress people.

a. True

b. False

18. Leadership 6 | a | VICA | 0889 | C | Fred Smith |

Self-concept affects verbal communication.

a. True

b. False

19. Leadership 6 | a | VICA | 0889 | C | Fred Smith |

When speaking, always use a vocabulary that others can understand.

a. True

b. False
20. Professionals respect themselves and others.
   a. True
   b. False

21. A person's code of ethics defines his or her principles or standards of right and wrong.
   a. True
   b. False

22. A professional code of ethics includes both legal and moral standards.
   a. True
   b. False
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23. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Appropriate business dress for women would include a skirt.

a. True

b. False

24. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Appropriate business attire for men would include a traditional dark suit.

a. True

b. False

25. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Fashion accessories reflect the self-image of an individual.

a. True

b. False

26. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Getting plenty of sleep and avoiding junk food can improve personal appearance.

a. True

b. False
A resume is a well-organized overview of what one has to offer an employer.

a. True
b. False

A letter of application should ask an employer for an interview.

a. True
b. False

The local chamber of commerce can help people research employers.

a. True
b. False
When parliamentary procedures are used at a meeting, only one subject at a time should be discussed.

a. True
b. False

Parliamentary procedure calls for the finishing of old business before new business is started.

a. True
b. False

Parliamentary procedure calls for standing committee reports to be given before special committee reports.

a. True
b. False
Proper use of the gavel signals members to stand or sit.

a. True

b. False