Electronics - Principles and Applications 9th edition Schuler Solutions Manual

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Instructor Manual

to accompany

Electronics

Principles and Applications

Ninth Edition

Charles A.Schuler

Mc Graw Hill Education

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Preface

The *Instructor Manual for Electronics: Principles and Applications,* ninth edition, is designed to save you time. Part 1 contains materials related to the student textbook and Experiments Manual. In Section 1, you will find a listing of the off-the-shelf components needed to perform all the lab experiments and most of the design and troubleshooting problems in the Experiments Manual. Section 2 contains a chapter-by-chapter listing of specific learning objectives for the textbook and the Experiments Manual. Section 3 provides answers to the Chapter Review Questions and Problems, as well as the Critical Thinking Questions, found at the end of each chapter in the student textbook. Section 4 supplies the answers to the Experiments Manual exercises. It contains waveforms, graphs, completed tables, and answers to the questions that follow each experiment.

Circuit files for the simulation experiments are on the Online Learning Center. Open the appropriate chapter folder and look for the figure number of interest.

One of the most time-consuming tasks in wiring many of the experiments in the Experiments Manual is to mount and wire the many components. An alternative to loose components is the ETS-900A Electronics Activities System shown on the next page. The ETS-900A consists of four experiment circuit boards: EB-914A, EB-915A, EB-916A, and EB-919. The components are soldered to the boards and divided into circuit areas that are directly correlated to the experiments in the manual. For more information about these products, contact:

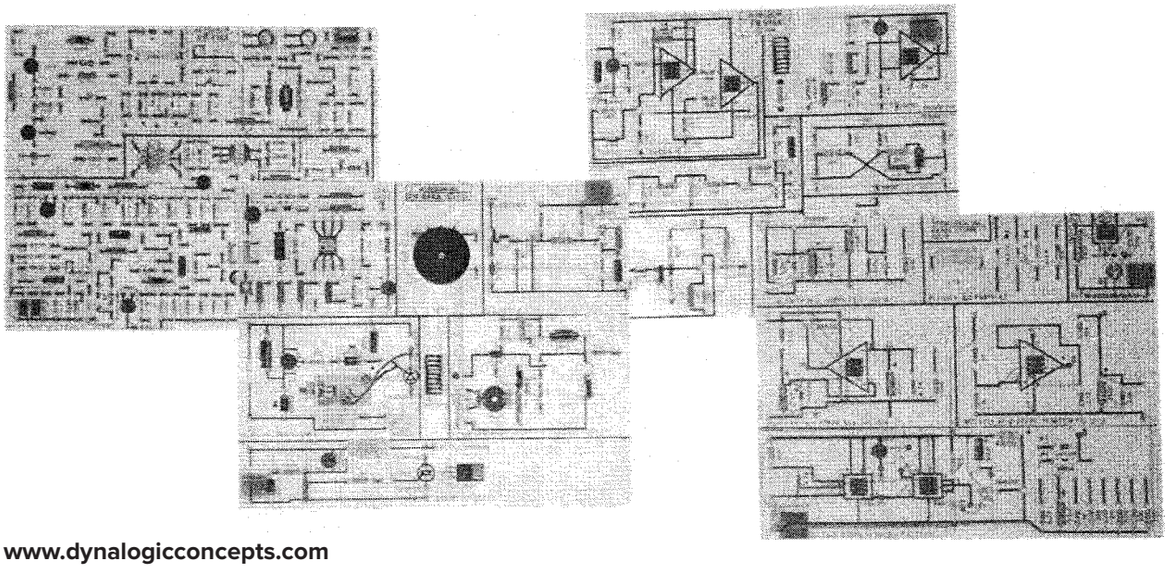
Dynalogic Concepts, Inc.
10200 Wales Loop
Bonita Springs, Florida 34135
1-800-246-4907
239-949-1326

With the Dynalogic system, students learn to build a circuit from a schematic diagram. Components are connected by using No. 22 AWG solid wire that plugs into miniature spring sockets; this helps students learn basic breadboarding techniques. As students progress through the experiments, the circuits are prewired, allowing more time to study the circuits.

The results of each experiment and problem in the Experiments Manual have been thoroughly tested and verified. I would be interested in hearing about your experiences with these materials.

Part 2 contains ancillary materials. Section 1 contains parts lists and descriptions for construction projects. These projects are suggestions for circuits relevant to the learning of analog electronics.

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www.dynalogicconcepts.com

Section 2 of Part 2 contains instrumentation masters for simulated experiments covering key concepts in basic instrumentation. The software files necessary for these experiments are available on the Instructor Side of the Online Learning Center. They are Multisim files for learning the concepts of electronic instrumentation. Again, feel free to copy this material for distribution to your students.

The Online Learning Center contains instructional PowerPoint presentations for each chapter; a Test Bank with questions for each chapter; presentations on breadboarding, soldering, and circuit interrupters; plus many Multisim circuit files. I hope that you find these additional teaching aids helpful.

Charles A. Schuler

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SECTION 2

Learning Objectives

FINAL OBJECTIVES

Upon successful completion of the text and Experiments Manual, the student will be able to:

1. Work safely with basic tools, test equipment, and circuitry.
2. Use schematic diagrams to construct basic electronic circuits.
3. Use block diagrams to coordinate electronic system analysis.
4. Use common electronic test equipment to verify and document electronic circuit operation.
5. Troubleshoot basic electronic circuits at both the system level and the component level.
6. Use data sheets, catalogs, substitution guides, and other reference materials to properly choose replacement parts.
7. Analyze and troubleshoot both nonregulated and regulated power supplies, small- and large-signal amplifiers, differential amplifiers, operational amplifiers, oscillators, simple radio circuitry, circuits utilizing ICs, basic electronic control circuits, and DSP systems.
8. Use computer simulations for electronic circuits.

CHAPTER OBJECTIVES

CHAPTER 1 INTRODUCTION

1-1. *Identify* some major events in the history of electronics.
1-2. *Classify* circuit operation as digital or analog.
1-3. *Name* major analog circuit functions.
1-4. *Begin* developing a system viewpoint for troubleshooting.
1-5. *Analyze* circuits with both dc and ac sources.
1-6. *List* the current trends in electronics.

CHAPTER 2 SEMICONDUCTORS

2-1. *Identify* some common electronic materials as conductors or semiconductors.
2-2. *Predict* the effect of temperature on conductors.
2-3. *Predict* the effect of temperature on semiconductors.
2-4. *Show* the directions of electron and hole currents in semiconductors.
2-5. *Identify* the majority and minority carriers in N-type semiconductors.
2-6. *Identify* the majority and minority carriers in P-type semiconductors.
2-7. *Explain* the term band gap.

CHAPTER 3 DIODES

3-1. *Predict* the conductivity of diodes under the conditions of forward and reverse bias.
3-2. *Interpret* volt-ampere characteristic curves for diodes.

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3-3. *Identify* the cathode and anode leads of some diodes by visual inspection.
3-4. *Identify* the cathode and anode leads of diodes by ohmmeter testing.
3-5. *Identify* diode schematic symbols.
3-6. *List* several diode types and applications.
3-7. *Describe* the structure and characteristics of photovoltaic devices.

CHAPTER 4 POWER SUPPLIES

4-1. *View* power supplies as systems.
4-2. *Identify* and *explain* common rectifier circuits.
4-3. *Predict* and *measure* dc output voltage for unfiltered and filtered power supplies.
4-4. *Explain* how voltage multipliers work.
4-5. *Measure* and *calculate* ripple and voltage regulation.
4-6. *Explain* and *make* basic calculations for zener voltage regulators.
4-7. *Troubleshoot* power supplies.
4-8. *Select* replacement parts.

CHAPTER 5 TRANSISTORS

5-1. *Define* amplification and power gain.
5-2. *Identify* transistor schematic symbols and leads.
5-3. *Calculate* current gain.
5-4. *Identify* power-supply polarity and current flow for NPN and PNP transistors.
5-5. *Interpret* characteristic curves and *determine* current gain and power dissipation.
5-6. *Discuss* package styles and data sheets.
5-7. *Test* bipolar junction transistors using an ohmmeter.
5-8. *Explain* junction field-effect transistors and metal oxide semiconductor field-effect transistors and *identify* their schematic symbols.
5-9. *Compare* the types of transistors.
5-10. *Explain* how power transistors differ from small signal transistors.
5-11. *Discuss* power packages and the need for heat transfer.
5-12. *Explain* transistor switching and hard saturation.
5-13. *Explain* analog switching.

CHAPTER 6 INTRODUCTION TO SMALL-SIGNAL AMPLIFIERS

6-1. *Calculate* decibel gain and loss.
6-2. *Draw* a load line for a basic common-emitter amplifier.
6-3. *Define* clipping in a linear amplifier.
6-4. *Find* the operating point for a basic common-emitter amplifier.
6-5. *Determine* common-emitter amplifier voltage gain.
6-6. *Identify* common-base and common-collector amplifiers.
6-7. *Explain* the importance of impedance matching.
6-8. *Discuss* SPICE and explain the importance of models.
6-9. *Define* THD (total harmonic distortion).

CHAPTER 7 MORE ABOUT SMALL-SIGNAL AMPLIFIERS

7-1. *Identify* the standard methods of signal coupling and list their characteristics.
7-2. *Calculate* the input impedance of common-emitter amplifiers.
7-3. *Find* voltage gain in cascade amplifiers.

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7-4. *Draw* a signal load line for a common-emitter amplifier.
7-5. *Solve* FET amplifier circuits.
7-6. *Identify* negative feedback and list its effects.
7-7. *Determine* the frequency response of a common-emitter amplifier.
7-8. *Identify* positive feedback and list its effects.
7-9. *Define* hysteresis.

CHAPTER 8 LARGE-SIGNAL AMPLIFIERS

8-1. *Calculate* amplifier efficiency.
8-2. *Identify* the class of amplifier operation.
8-3. *Recognize* crossover distortion in push-pull amplifiers.
8-4. *Explain* the operation of complementary symmetry amplifiers.
8-5. *Describe* tank circuit action in class C amplifiers.
8-6. *Explain* how class D amplifiers work.

CHAPTER 9 OPERATIONAL AMPLIFIERS

9-1. *Predict* the phase relationships in differential amplifiers.
9-2. *Determine* the CMRR for differential amplifiers.
9-3. *Calculate* the power bandwidth for operational amplifiers.
9-4. *Find* voltage gain for operational amplifiers.
9-5. *Determine* the small-signal bandwidth for operational amplifiers.
9-6. *Identify* various applications for operational amplifiers.
9-7. *Discuss* the operation and application of comparators.

CHAPTER 10 TROUBLESHOOTING

10-1. *Save* troubleshooting time by performing preliminary checks.
10-2. *Develop* and *use* a system view.
10-3. *Use* procedures that prevent electrostatic discharge.
10-4. *Troubleshoot* for the symptom of no output.
10-5. *Troubleshoot* for reduced output.
10-6. *Correct* distortion and noise problems.
10-7. *Deal* with intermittent problems.
10-8. *Troubleshoot* op-amp circuits.
10-9. *Explain* how boundary scan can be used to troubleshoot circuits.
10-10. *Explain* how thermal issues relate to the troubleshooting process.

CHAPTER 11 OSCILLATORS

11-1. *Identify* oscillator circuits.
11-2. *Apply* the concepts of gain and feedback to oscillators.
11-3. *Predict* the frequency of operation for oscillators.
11-4. *List* causes of undesired oscillations.
11-5. *Discuss* how op-amp loading can cause instability and ringing.
11-6. *Identify* techniques used to prevent undesired oscillation.
11-7. *Troubleshoot* oscillators.
11-8. *Explain* and *troubleshoot* direct digital synthesizers.

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CHAPTER 12 COMMUNICATIONS

12-1. *Define* modulation and demodulation.
12-2. *List* the characteristics of AM, SSB, and FM.
12-3. *Explain* the operation of basic radio receivers.
12-4. *Predict* the bandwidth of AM signals.
12-5. *Calculate* the oscillator frequency for superheterodyne receivers.
12-6. *Calculate* the image frequency for superheterodyne receivers.
12-7. *List* some methods of digital modulation and discuss where they are used.
12-8. *Describe* wireless data systems.
12-9. *Troubleshoot* receivers.
12-10. *Troubleshoot* wireless data systems.

CHAPTER 13 INTEGRATED CIRCUITS

13-1. *Compare* integrated circuit (IC) technology with discrete technology.
13-2. *Explain* the photolithographic process used to make ICs.
13-3. *Make* calculations for 555 timer circuits.
13-4. *Identify* analog, digital, and mixed signal ICs.
13-5. *Troubleshoot* circuits with ICs.

CHAPTER 14 ELECTRONIC CONTROL DEVICES AND CIRCUITS

14-1. *Calculate* efficiency in control circuits.
14-2. *Identify* the schematic symbols for thyristors.
14-3. *Explain* the operation of thyristors.
14-4. *Define* conduction angle in thyristor circuits.
14-5. *Explain* commutation in thyristor circuits.
14-6. *Discuss* servomechanisms.
14-7. *Explain* the operation of photovoltaic and LED controllers.
14-8. *Troubleshoot* control circuits.

CHAPTER 15 REGULATED POWER SUPPLIES

15-1. *Perform* basic calculations for power-supply regulator circuits.
15-2. *Explain* the use of feedback in voltage regulator circuits.
15-3. *Identify* the types of current regulation.
15-4. *Identify* crowbar circuits.
15-5. *Identify* switch-mode regulators and their characteristics.
15-6. *Troubleshoot* regulated power supplies.

CHAPTER 16 DIGITAL SIGNAL PROCESSING

16-1. *Explain* the popularity of DSP.
16-2. *Discuss* the conversion of continuous signals to discrete form.
16-3. *Sketch* the block diagram for a typical DSP system.
16-4. *List* some advantages of DSP.
16-5. *Explain* how signals are represented in time and frequency.
16-6. *Explain* the operation and design of digital filters.
16-7. *Discuss* other applications.
16-8. *List* some limitations of DSP.
16-9. *Troubleshoot* DSP systems.

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