[](http://www.udc.edu/)

**Syllabus**

**Electronics I**

**Fall 2014 Class**

Tuesdays, Wednesdays, and Thursdays; 3-6pm; UDC Fort Totten, Room TBD; September 9 to December 18, 2014.

**Textbook**

*Primary:*

Electricity; Principles and Applications,7th Edition; Fowler; ISBN 978-0073106991; Glencoe/McGraw Hill, 2008.

*Supplementary (other books recommended by ETA):*

The Associate CET Study Guide, 6th Edition; ETA International; ISBN 1-891749-07-2; 2012.

Electronics; Principles and Applications,7th Edition; Schuler; ISBN 978-0073316512; Glencoe/McGraw Hill, Career Education; 2002.

Introduction to Electricity, Electronics, and Electromagnetics, 5th Edition; Boylestad, Nashelsky; ISBN 978-0130105738; Prentice Hall; 2001.

Mastering Technical Mathematics, 3rd Edition; Gibilisco, Crowhurst; ISBN 978-0071494489; McGraw-Hill / TAB Electronics; 2007.

Electronics Principles, 7th Edition; Malvino, Bates; ISBN 978-0073222776; McGraw-Hill Higher Education; 2007.

Introductory DC / AC Electronics, 6th Edition; Cook; ISBN 978-0131139848; Prentice Hall; 2004.

Electronic Communications, 6th Edition; Shrader; ISBN 978-0070571570; McGraw-Hill Co; 1990.

How to Test Almost Everything Electronic; Horn; ISBN 978-0830641277; McGraw-Hill/TAB Elec. 1993.

Basic Electronics Theory With Projects & Experiments, 4th Edition; Horn; ISBN 978-0830642007; McGraw-Hill/TAB Elec. 1993.

The Soldering Handbook, 3rd E; Vianco; ISBN 978-0871716187; American Welding Society; 2000.

Introduction to Electronics; Crozier; ISBN 978-0534012434; Breton Pub.; 1983.

There Are No Electrons: Electronics for Earthlings; Amdahl; ISBN 978-0962781599; Clearwater Pub.; 1991.

Becoming An Electronics Technician, 4th E; Reis; ISBN 978-0130932198; Prentice Hall; 2001.

*Of interest (other books recommended by me):*

Make: Electronics (Learning by Discovery), 1st E; Platt; ISBN 978-0596153748; Make; 2009.

Electronics All-In-One For Dummies, UK E; Ross and Lowe; ISBN 978-1118589731; For Dummies; 2013.

*Online resources:*

Navy Electrical Engineering Training Series (NEETS): www.tpub.com/neets/index.htm

**Software**

CircuitLab [www.circuitlab.com](http://www.circuitlab.com)

DoCircuits [www.docircuits.com](http://www.docircuits.com)

**Course Description**

This course will give students a good grounding in elementary electronics and prepare them to take the SET (Student Electronic Technician) exam of the Electronic Technicians Association.

**Related Courses**

This class has no prerequisites. There will be some arithmetic, and simple algebra, but no difficult mathematics.

**Teaching Methods**

The class will be primarily in traditional lecture format for the first two hours on each class day (with appropriate breaks!). In the third hour we will either have special activities (work with simulations, guest presentations, etc.) or the time will be available for one-on-one discussion (office hours).

**Learning Objectives**

Students will understand basic electronic theory.

In addition they will be able to:

**(1.0 Electrical Theory)**

1.1(1) Describe atomic structure, the components of the atom, their charges and importance to electronics technology

1.2(2) List ten uses for magnetism in electronics technology

1.3(3) Explain basic uses for electricity

1.4(4) Describe the basic methods of using electricity to operate a motor and how mechanical motion

causes a generator to produce electrical current

1.5(5) Explain the differences between current, voltage and resistance

1.6(6) List different types of resistive materials and how resistors are used in electronics

1.7(7) Describe the purposes of capacitors. List common types and construction designs

1.8(8) Explain how inductance relates to magnetism and describe coil construction, cores and usages

1.9(9) Show a comparison between reactance and resistance and describe current/voltage

relationships

1.10(10) Compare impedance with reactance and resistance and explain the causes and effects of

impedance

1.11(11) List voltage sources, AC and DC, batteries and natural generation

1.12(12) List Ohms law formulas for current, voltage, resistance and power. Solve math problems utilizing each

1.13(13) Calculate power consumption and requirements

**(2.0 Electronic Components)**

2.1(14) Identify resistor values from color code or other marks and list composition and reasons for different usages

2.2(15) Identify capacitor types; list common usages; methods of varying capacitance and explain the terms *charge* and *coulomb*

2.3(16) Identify inductor types and reasons for various core materials; how diameter and wire size affects the values

2.4(17) Identify common types of transformers and list uses for each; explain step up/down voltage methods; explain why laminations are used

2.5(18) Identify transistors as to type and usage, such as unijunction, FETs and MOSFETS; explain beta and alpha and provide common DC and bias voltage ranges; list common usage

2.6(19) Identify other semiconductors and explain their uses: Darlington pairs; unijunction transistors and Gunn diodes

2.7(20) Compare thyristors with other semiconductors; Identify diacs, triacs and SCRs and explain their operation.

2.8(21) Explain zeners diode ratings; describe usage in regulator circuits

2.9(22) List common optical devices (LEDs, LCDs, etc.) and describe how photovoltaic cells are activated. Draw symbols for photo resistors, photodiodes and phototransistors; list materials

from which these devices are made

2.10(23) Describe MOS, CMOS, FET applications

(**3.0 Soldering-Desoldering and Tools)**

3.1(24) Describe solder safety as it pertains to burns and potential fires or damage to facilities or customer products

3.2(25) Explain the cause of solder fumes and the effects of lead poisoning

3.3(26) List causes and precautions to prevent or reduce solder splatter

3.4(27) Explain the reasons for flux usage and describe types

3.5(28) List types of solder and reasons for choosing each

3.6(29) Explain heat shunts, why and how they are used

3.7(30) Identify cold solder joints and explain causes

3.8(31) Describe the differences between good and bad mechanical and electrical solder connections

3.9(32) Demonstrate proper care of solder-desolder equipment and aids

3.10(33) Explain desoldering principles

3.11(34) Describe various types of desoldering equipment and how it is used

3.12(35) Demonstrate the use of braid-wick solder removers

(**4.0 Block Diagrams—Schematics-Wiring Diagrams)**

4.1(36) Draw common electrical/electronic symbols

4.2(37) Explain how block diagrams are used for troubleshooting and maintenance of electronics

products

4.3(38) Explain the differences between wiring prints, schematics and block diagrams

4.4(39) Describe the purpose and use of test points. Indicate their likely placement on schematics

4.5(40) Explain how schematics are used to locate component and wiring failures in electronics products

4.6(41) Explain the methods of using flow diagrams/charts

**(5.0 Cabling)**

5.1(42) List wire types and construction

5.2(43) List American wire gauges used for various purposes

5.3(44) Explain construction of coaxial cable and the impedance characteristics

5.4(45) List common identifications for copper cables, such as #18 and #24, and UTP telephone cable

5.5(46) Explain major differences between copper, coaxial and fiber optic cables

5.6(47) Describe impedance and its causes; explain reasons for maintaining a cable’s characteristics

5.7(48) Explain the effects of proper and improper termination

5.8(49) Explain the purposes of grounding and common conventions used in electrical and electronics

5.9(50) Demonstrate splicing knowledge and ability for coaxial and copper cable; explain two types of fiber splices

5.10(51) Demonstrate testing methods for all three types of cables and compare dB loss measurements and techniques

5.11(52) Compare the fittings and connectors used in cabling and list potential defects a technician may encounter

5.12(53) Describe proper crimping of communications wiring connectors

5.13(54) Explain how cable prep tools are used and demonstrate proper and improper crimping

**(6.0 Power Supplies)**

6.1(55) Explain shock hazards when servicing power supplies in electronic equipment

6.2(56) Describe the differences between transformer powered supplies and line connected supplies

6.3(57) Describe battery supplies and list common usages; also explain recharging principles

6.4(58) Explain the reasons for filtering, describe hum, identify common filter types (pi, t, l, etc.)

6.5(59) Explain the reasons for power supply regulation and list common components used in regulated

supplies

6.6(60) Explain where fuses and circuit breakers are commonly and electrically located in circuits; approximate sizes for common circuits; house service box common fuses and circuit breaker configuration and precautions for replacement

**(7.0 Test Equipment and Measurements)**

7.1(61) Describe how volt-ohm-current meters operate

7.2(62) Identify meter protection, safety and usage

7.3(63) Explain care of equipment and test leads

7.4(64) List the purposes and types of signal generators

7.5(65) Describe meter loading and precautions

7.6(66) Explain what R-C-L substitution equipment is and its purposes; explain ESR Capacitance- measurement equipment

7.7(67) List the uses and precautions for logic test probes

7.8(68) Explain how logic pulsers are used

7.9(69) Describe oscilloscope usage; explain the purposes of each front panel control

7.10(70) List the uses for pattern generators

7.11(71) Define dummy load; show where and why used

7.12(72) Explain reasons for using rheostats, isolation transformers and variacs and why size matters

**(8.0 Safety Precautions)**

8.1(73) Describe the physiological reactions electrical shock causes; list various degrees of current the human body can tolerate

8.2(74) Explain the concept of First Aid and its particular importance to workers in electric and electronics fields; explain precautions for untrained people

8.3(75) Explain what the National Electrical Code (NEC®) is and describe various rules technicians must abide by

8.4(76) Explain NFPA® rules and describe how technicians comply and may violate them

8.5(77) Describe fusing and circuit breaker rules and reasons for different types of fuses

8.6(78) Explain static causes and CMOS damage prevention straps, mats and grounding

8.7(79) List tools hazards that are associated with technician activities in the workplace and in the field.

8.8(80) Describe lockout and tagging rules for potentially unsafe electrical or mechanical hazards

8.9(81) Explain eye and ear protection needed by technicians

8.10(82) List ladder handling and usage and OSHA® heights safety rules

8.11(83) List service vehicle safety concerns such as ladder or transporting security and flying objects, driver screens inside the vehicle

8.12(84) Describe the types and usage of fire extinguishers

**(9.0 Mathematics and Formulas)**

9.1(85) Quote Ohms law power, voltage, current and resistance formulas and solve for circuit values

9.2(86) List other common basic electronic formulas

**(10.0 Electronic Circuits: Series and Parallel)**

10.1(87) Identify and describe the operation of common DC circuits

10.2(88) Identify and describe the operation of common AC circuits

10.3(89) Explain how series circuits, R, L, C are used in electronics equipment

10.4(90) Explain the purpose of oscillators

10.5(91) Show how oscillators and multivibrators are similar and how they differ

10.6(92) Describe filter circuits, why and how they are used

**(11.0 Amplifiers)**

11.1(93) List common amplifier devices

11.2(94) Describe the purpose of each component in an amplifier circuit

11.3(95) List the usages and classes of amplifiers

11.4(96) Describe biasing and gain characteristics

11.5(97) Explain frequency response of an amplifier circuit and why it is important

11.6(98) Explain the uses of operational amplifiers and how they differ from other amplifiers

11.7(99) Show causes of distortion in amplifiers and list ways to reduce or eliminate it

11.8(100) Explain how inaccurate measurements can be experienced due to meter or scope loading. List ways to overcome loading problems

**(12.0 Interfacing of Electronics Products)**

12.1(101) List input circuit signal levels that may be expected for various common electronics products or test equipment

12.2(102) List anticipated signal or voltage levels for output circuits in audio and video equipment

12.3(103) Explain the importance of impedance matching; list causes of mismatches

12.4(104) Explain the purposes of plugs and connectors and why it is necessary to use the proper ones

12.5(105) Explain grounding, proper and improper methods, and the results of power source mismatch

**(13.0 Digital Concepts and Circuitry)**

13.1(106) Describe ASCII code

13.2(107) Identify each basic digital gate

13.3(108) Construct truth tables for common gates

13.4(109) Explain how counters operate

13.5(110) Explain the purpose of flip-flops and list common types

13.6(111) Explain the purpose of a digital bus and show how it is connected to various sections of a product

13.7(112) List types of display circuitry and describe how numbers and letters are activated digitally

13.8(113) Explain the purpose of computer clocks

13.9(114) Show how pulsers are used for digital signal tracing and how logic probes are used to verify states in digital equipment

13.10(115) Describe digital clock usage and circuitry

13.11(116) Describe how microprocessors function and identify the basic components and pinouts

**(14.0 Computer Electronics)**

14.1(117) Describe the major sections of a computer

14.2(118) Demonstrate how the computer block diagram and flow charts are utilized

14.3(119) Describe different types of computer memory and how storage is accomplished

14.4(120) Define the word peripheral and list various types

**(15.0 Computer Applications)**

15.1(121) Demonstrate knowledge of basic computer operation

15.2(122) List ways to backup data and the importance of doing so

15.3(123) Explain the causes of line surges and viruses and protection procedures against each

15.4(124) Explain major components of the Internet, how it is accessed and common applications

15.5(125) Demonstrate how to download a service or application, data or programs

15.6(126) Explain how to use the Internet to locate parts and service literature

**(16.0 Audio and Video Systems)**

16.1(127) Explain major components of the most common home entertainment products

16.2(128) Describe microphone technology and usage

16.3(129) Explain speaker construction and precautions

16.4(130) Describe the differences between good quality and distorted sound and electronic/acoustical reasons for each

16.5(131) Explain how signals may conflict and the symptoms the conflict may produce

16.6(132) Explain how to isolate troubles between discrete equipment units

**(17.0 Optical Electronics)**

17.1(133) List common electronics display devices

17.2(134) Explain the operation of a kinescope

17.3(135) Explain how LCD displays operate, their advantages and disadvantages

17.4(136) Describe how LED remote hand units work

17.5(137) Explain why and list some locations or circuits in which opto isolators are used

17.6(138) List uses for light activated controls and how photo devices are incorporated

**(18.0 Telecommunications Basics)**

18.1(139) Describe major types of two-way radio communications (avionics, land mobile and maritime, etc.)

**(19.0 Technician Work Procedures)**

19.1(140) Explain major invoice and billing concepts for service businesses

19.2(141) Describe ways to procure service literature

19.3(142) Demonstrate location/cross referencing of parts and product in catalogs

19.4(143) Explain the purposes and requirements for proper record keeping

19.5(144) Explain estimate concepts for service work

19.6(145) Describe field technician work procedures that may differ from in-shop routines

**Grading Criteria**

There will be two exams as indicated on the schedule below, worth 80% of the class score. There will also be at least four quizzes, worth 10% of the class score. There will be homework assignments every week, for the remaining 10%. After rounding your score down (i.e. truncating it, by deleting the fractional part) it will translate to a letter grade on this scheme: 0-59=F, 60-62=D-, 63-66=D, 67-69=D+, ... 90-92=A-, 93up=A.

**Attendance Policy**

Students will be expected to attend class. Examination questions may be set on any material either in the textbook or covered in class.

**Methods of Achieving Success**

The material in this class is often not easy. It is vital that you do the assigned reading, try to attend and actively participate in every class, and complete all in-class activities and homework assignments. Don’t get overwhelmed or discouraged. I will help you as much as I can. Please help your classmates too.

**Feedback**

Always feel free to make comments, criticisms and suggestions. In addition to email, a suggestion box will be available to permit anonymous communication. If you have any difficulties, let me know immediately, and I will do all I can to help you.

**Electronics I**

**Fall 2014**

**Schedule**

**week.day.hour activities**

[mostly using Fowler, Ch1]

1.1.1 Sep 9 Syllabus, objectives, expectations, introductions

1.1.2 Fowler 1.1,2

1.1.3 office hours, lab work, simulations, guest presentations, etc.

1.2.1 Sep 10 Fowler 1.3,4,5

1.2.2 Fowler 1.6,7

1.2.3 office hours, lab work, simulations, guest presentations, etc.

1.3.1 Sep 11 Fowler 1.8,9,10

1.3.2 Fowler 1.11,12

1.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Ch2]

2.1.1 Sep 16 Fowler 2.1,2,3,4,5

2.1.2 Fowler 2.6,7,8,9

2.1.3 office hours, lab work, simulations, guest presentations, etc.

2.2.1 Sep 17 Fowler 2.10,11,12,13

2.2.2 Fowler 2.14,15,16,17

2.2.3 office hours, lab work, simulations, guest presentations, etc.

2.3.1 Sep 18 Fowler 2.18,19,20,21

2.3.2 Fowler 2.22,23,24,25

2.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Ch3]

3.1.1 Sep 23 Fowler 3.1

3.1.2 Fowler 3.2

3.1.3 office hours, lab work, simulations, guest presentations, etc.

3.2.1 Sep 24 Fowler 3.3

3.2.2 cont.

3.2.3 office hours, lab work, simulations, guest presentations, etc.

3.3.1 Sep 25 Fowler 3.4

3.3.2 cont.

3.3.3

[mostly using Fowler, Ch4]

4.1.1 Sep 30 Fowler 4.1,2,3

4.1.2 Fowler 4.4,5

4.1.3 office hours, lab work, simulations, guest presentations, etc.

4.2.1 Oct 1 Fowler 4.6,7,8

4.2.2 Fowler 4.9,10

4.2.3 office hours, lab work, simulations, guest presentations, etc.

4.3.1 Oct 2 Fowler 4.11,12,13

4.3.2 Fowler 4.14,15

4.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Ch5]

5.1.1 Oct 7 Fowler 5.1,2

5.1.2 Fowler 5.3

5.1.3 office hours, lab work, simulations, guest presentations, etc.

5.2.1 Oct 8 Fowler 5.4,5

5.2.2 Fowler 5.6

5.2.3 office hours, lab work, simulations, guest presentations, etc.

5.3.1 Oct 9 Fowler 5.7,8

5.3.2 Fowler 5.8

5.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Ch6]

6.1.1 Oct 14 Exam 1

6.1.2 cont.

6.1.3 office hours, lab work, simulations, guest presentations, etc.

6.2.1 Oct 15 Review of Exam1

6.2.2 cont.

6.2.3 office hours, lab work, simulations, guest presentations, etc.

.3.1 Oct 16 Fowler 6

6.3.2 cont.

6.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Chs7-12]

7.1.1 Oct 21 Fowler 7

7.1.2 Fowler 8

7.1.3 office hours, lab work, simulations, guest presentations, etc.

7.2.1 Oct 22 Fowler 9

7.2.2 Fowler 10

7.2.3 office hours, lab work, simulations, guest presentations, etc.

7.3.1 Oct 23 Fowler 11

7.3.2 Fowler 12

7.3.3 office hours, lab work, simulations, guest presentations, etc.

[mostly using Fowler, Chs13-end]

8.1.1 Oct 28 Fowler 13

8.1.2 Fowler 14

8.1.3 office hours, lab work, simulations, guest presentations, etc.

8.2.1 Oct 29 Fowler 15

8.2.2 Fowler 16

8.2.3 office hours, lab work, simulations, guest presentations, etc.

8.3.1 Oct 30 Fowler Appendices

8.3.2 Fowler review

8.3.3 office hours, lab work, simulations, guest presentations, etc.

[other other sources]

9.1.1 Nov 4 TBD

9.1.2 TBD

9.1.3 office hours, lab work, simulations, guest presentations, etc.

9.2.1 Nov 5 TBD

9.2.2 TBD

9.2.3 office hours, lab work, simulations, guest presentations, etc.

9.3.1 Nov 6 TBD

9.3.2 TBD

9.3.3 office hours, lab work, simulations, guest presentations, etc.

[using other sources]

10.1.1 Nov 11 TBD

10.1.2 TBD

10.1.3 office hours, lab work, simulations, guest presentations, etc.

10.2.1 Nov 12 TBD

10.2.2 TBD

10.2.3 office hours, lab work, simulations, guest presentations, etc.

10.3.1 Nov 13 Exam 2

10.3.2 cont.

10.3.3 office hours, lab work, simulations, guest presentations, etc.

[SET certification competencies]

11.1.1 Nov 18 Exam 2

11.1.2 cont.

11.1.3 office hours, lab work, simulations, guest presentations, etc.

11.2.1 Nov 19 Review of Exam2

11.2.2 cont.

11.2.3 office hours, lab work, simulations, guest presentations, etc.

11.3.1 Nov 20 competencies 1-10

11.3.2 competencies 11-20

11.3.3 office hours, lab work, simulations, guest presentations, etc.

[SET certification competencies]

12.1.1 Nov 25 competencies 21-30

12.1.2 competencies 31-40

12.1.3 office hours, lab work, simulations, guest presentations, etc.

12.2.1 Nov 26 competencies 41-50

12.2.2 competencies 51-60

12.2.3 office hours, lab work, simulations, guest presentations, etc.

12.3.1 Nov 27 Thanksgiving (NO CLASS)

12.3.2 Thanksgiving (NO CLASS)

12.3.3 Thanksgiving (NO CLASS)

[SET certification competencies]

13.1.1 Dec 2 competencies 61-70

13.1.2 competencies 71-80

13.1.3 office hours, lab work, simulations, guest presentations, etc.

13.2.1 Dec 3 competencies 81-90

13.2.2 competencies 91-100

13.2.3 office hours, lab work, simulations, guest presentations, etc.

13.3.1 Dec 4 competencies 101-110

13.3.2 competencies 111-120

13.3.3 office hours, lab work, simulations, guest presentations, etc.

[SET certification competencies]

14.1.1 Dec 9 competencies 121-130

14.1.2 competencies 131-140

14.1.3 office hours, lab work, simulations, guest presentations, etc.

14.2.1 Dec 10 competencies 141-145

14.2.2 competencies review

14.2.3 office hours, lab work, simulations, guest presentations, etc.

14.3.1 Dec 11 SET practice test

14.3.2 cont.

14.3.3 office hours, lab work, simulations, guest presentations, etc.

[remedial]

15.1.1 Dec 16 Remedial work

15.1.2 Remedial work

15.1.3 office hours, lab work, simulations, guest presentations, etc.

15.2.1 Dec 17 Remedial work

15.2.2 Remedial work

15.2.3 office hours, lab work, simulations, guest presentations, etc.

15.3.1 Dec 18 Remedial work and farewells

15.3.2 Remedial work and farewells

15.3.3 office hours, lab work, simulations, guest presentations, etc.