SAN DIEGO COMMUNITY COLLEGE DISTRICT
CONTINUING EDUCATION
COURSE OUTLINE

SECTION I

SUBJECT AREA AND COURSE NUMBER

ELRN 452

COURSE TITLE

ELECTRONIC TECHNICIAN II

TYPE COURSE

NON FEE VOCATIONAL

CATALOG COURSE DESCRIPTION

This is an open-entry/exit course that is designed to teach skills required for entry-level employment as an electronic technician. Students will learn the fundamentals of Digital, DC and AC systems, digital technology and basic communications electronics. Instruction includes the operation of test instruments, problem solving, and safety practices and procedures. Instruction will take place in a simulated workplace enabling students to gain the necessary workplace skills. (FT)

LECTURE/LABORATORY HOURS

450

ADVISORY

Satisfactory completion of Electronic Technician I; basic computer knowledge and internet search skills.

RECOMMENDED SKILL LEVEL

An eighth grade reading and math level, ability to communicate effectively in the English language and a working knowledge of math.

COURSE GOALS

1. Introduce the principles and practices of Digital, RF and ATE Systems that the electronic technician will use in the electronic component fabrication industry today.

COURSE GOALS (CONT)

2. Provide the student with instruction and practical experience necessary to safely perform electronic component identification and basic troubleshooting.
3. Introduce electronic testing and troubleshooting techniques and practices to assist in identification and repair of electronic components to identified acceptable standards.
4. Enhance the student's workplace skills including soft skills, math, communications, business ethics, etc., necessary to succeed in the electronics industry.

INSTITUTIONAL STUDENT LEARNING OUTCOMES

1. Social Responsibility
   SDCE students demonstrate interpersonal skills by leaning and working cooperatively in a diverse environment.
2. Effective Communication
   SDCE students demonstrate effective communication skills.
3. Critical Thinking
   SDCE students critically process information, make decisions, and solve problems independently or cooperatively.
4. Personal and Professional Development
   SDCE students pursue short term and life-long learning goals, mastering necessary skills and using resource management and self advocacy skills to cope with changing situations in their lives.

COURSE OBJECTIVES

1. Demonstrate the safety requirements and practices utilized in electronics industry.
2. Understand and utilize the terminology of electronic components and test equipment when communicating with instructors, staff and students.
3. Identify Digital, RF and ATE systems, DC and AC circuits, and components in an electronic item.
4. Perform troubleshooting techniques to identify issues and repair electronic components to industry acceptable standards.

SECTION II

COURSE CONTENT AND SCOPE

MODULE I – DIGITAL **100 hrs**

1. Numeration Systems
   1.1. Numbers and symbols
   1.2. Systems of numeration
   1.3. Decimal versus binary numeration
   1.4. Octal and hexadecimal numeration

1.5. Octal and hexadecimal to decimal conversion
1.6. Conversion from decimal numeration

COURSE CONTENT AND SCOPE (CONT)

2. Binary Arithmetic
   - 2.1. Numbers versus numeration
   - 2.2. Binary addition
   - 2.3. Negative binary numbers
   - 2.4. Subtraction
   - 2.5. Overflow
   - 2.6. Bit groupings
3. Logic Gates
   - 3.1. Digital signals and gates
   - 3.2. The NOT gate
   - 3.3. The "buffer" gate
   - 3.4. Multiple-input gates
   - 3.5. TTL NAND and AND gates
   - 3.6. TTL NOR and OR gates
   - 3.7. CMOS gate circuitry
   - 3.8. Special-output gates
   - 3.9. Gate universality
   - 3.10. Logic signal voltage levels
   - 3.11. DIP gate packaging
4. Switches
   - 4.1. Switch types
   - 4.2. Switch contact design
   - 4.3. Contact "normal" state and make/break sequence
   - 4.4. Contact "bounce"
5. Electromechanical Relays
   - 5.1. Relay construction
   - 5.2. Contactors
   - 5.3. Time-delay relays
   - 5.4. Protective relays
   - 5.5. Solid-state relays
6. Boolean Algebra
   - 6.1. Introduction
   - 6.2. Boolean arithmetic
   - 6.3. Boolean algebraic identities
   - 6.4. Boolean algebraic properties
   - 6.5. Boolean rules for simplification
   - 6.6. Circuit simplification examples
   - 6.7. The Exclusive-OR function
   - 6.8. Converting truth tables into Boolean expressions
7. Karnaugh Mapping
   - 7.1. Introduction
   - 7.2. Venn diagrams and sets
   - 7.3. Boolean Relationships on Venn Diagrams
   - 7.4. Making a Venn diagram look like a Karnaugh map
   - 7.5. Karnaugh maps, truth tables, and Boolean expressions
   - 7.6. Logic simplification with Karnaugh maps

COURSE CONTENT AND SCOPE (CONT)

- 7.7. Larger 4-variable Karnaugh maps
- 7.8. Minterm vs maxterm solution
- 7.9. (sum) and (product) notation
- 7.10. Don't care cells in the Karnaugh map
- 7.11. Larger 5 & 6-variable Karnaugh maps

8. Combinational Logic Functions
   - 8.1. Introduction
   - 8.2. A Half-Adder
   - 8.3. A Full-Adder
   - 8.4. Decoder
   - 8.5. Encoder
   - 8.6. Demultiplexers
   - 8.7. Multiplexers
   - 8.8. Using multiple combinational circuits
9. Multivibrators
   - 9.1. Digital logic with feedback
   - 9.2. The S-R latch
   - 9.3. The gated S-R latch
   - 9.4. The D latch
   - 9.5. Edge-triggered latches: Flip-Flops
   - 9.6. The J-K flip-flop
   - 9.7. Asynchronous flip-flop inputs
   - 9.8. Monostable multivibrators
10. Sequential Circuitscounters
    - 10.1. Binary count sequence
    - 10.2. Asynchronous counters
    - 10.3. Synchronous counters
    - 10.4. Counter modulus
    - 10.5. Finite State Machines
11. Shift Registers
    - 11.1. Introduction
    - 11.2. Serial-in/serial-out shift register
    - 11.3. Parallel-in, serial-out shift register
    - 11.4. Serial-in, parallel-out shift register
    - 11.5. Parallel-in, parallel-out, universal shift register
    - 11.6. Ring counters
12. Digital-Analog Conversion
    - 12.1. Introduction
    - 12.2. The R/2nR DAC
    - 12.3. The R/2R DAC
    - 12.4. Flash ADC
    - 12.5. Digital ramp ADC
    - 12.6. Successive approximation ADC
    - 12.7. Tracking ADC
    - 12.8. Slope (integrating) ADC
    - 12.9. Delta-Sigma () ADC

COURSE CONTENT AND SCOPE (CONT)

- 12.10. Practical considerations of ADC circuits
- 12.11. Digital Communication
- 12.12. Introduction
- 12.13. Networks and busses
- 12.14. Data flow
- 12.15. Electrical signal types
- 12.16. Optical data communication
- 12.17. Network topology
- 12.18. Network protocols
- 12.19. Practical considerations

13. Digital Storage (Memory)
    - 13.1. Digital memory terms and concepts
    - 13.2. Read-only memory
    - 13.3. Memory with moving parts: "Drives"
14. Principles Of Digital Computing
    - 14.1. A binary adder
    - 14.2. Look-up tables
    - 14.3. Finite-state machines
    - 14.4. Microprocessors
    - 14.5. Microprocessor programming

MODULE II – RF AND COMMUNICATIONS **100 hrs**

1. Introduction To Communication
    - 1.1. Significance of Human Communication
    - 1.2. Communication Systems
    - 1.3. Types of Electronic Communication
    - 1.4. Modulation and Multiplexing
    - 1.5. The Electromagnetic Spectrum
    - 1.6. Bandwidth
2. Electronic Communication
    - 2.1. Gain, Attenuation, and Decibels
    - 2.2. Tuned Circuits
    - 2.3. Filters
3. Amplitude Modulation Fundamentals
    - 3.1. AM Concepts
    - 3.2. Modulation Index and Percentage of Modulation
    - 3.3. Sidebands and the Frequency Domain
    - 3.4. AM Power
    - 3.5. Single-Sideband Modulation
    - 3.6. Classification of Radio Emissions
4. Amplitude Modulator And Demodulator Circuits
    - 4.1. Basic Principles of Amplitude Modulation
    - 4.2. Amplitude Modulators
    - 4.3. Amplitude Demodulators
    - 4.4. Balanced Modulators

COURSE CONTENT AND SCOPE (CONT)

- 4.5. SSB Circuits
5. Fundamentals Of Frequency Modulation
   - 5.1. Basic Principles of Frequency Modulation
   - 5.2. Principles of Phase Modulation
   - 5.3. Modulation Index and Sidebands
   - 5.4. Noise-Suppression Effects of FM
   - 5.5. Frequency Modulation Versus Amplitude Modulation
6. Fm Circuits
   - 6.1. Frequency Modulators
   - 6.2. Phase Modulators
   - 6.3. Frequency Demodulators
7. Digital Communication Techniques
   - 7.1. Digital Transmission of Data
   - 7.2. Parallel and Serial Transmission
   - 7.3. Data Conversion
   - 7.4. Pulse Modulation
   - 7.5. Digital Signal Processing
8. Radio Transmitters
   - 8.1. Transmitter Fundamentals
   - 8.2. Carrier Generators
   - 8.3. Power Amplifiers
   - 8.4. Impedance-Matching Networks
   - 8.5. Typical Transmitter Circuits
9. Communication Receivers
   - 9.1. Basic Principles of Signal Reproduction
   - 9.2. Superheterodyne Receivers
   - 9.3. Frequency Conversion
   - 9.4. Intermediate Frequency and Images
   - 9.5. Noise
   - 9.6. Typical Receiver Circuits
   - 9.7. Receivers and Transceivers
10. Multiplexing And Demultiplexing
    - 10.1. Multiplexing Principles
    - 10.2. Frequency-Division Multiplexing
    - 10.3. Time-Division Multiplexing
    - 10.4. Pulse-Code Modulation
    - 10.5. Duplexing
11. The Transmission Of Binary Data In Communication Systems
    - 11.1. Digital Codes
    - 11.2. Principles of Digital Transmission
    - 11.3. Transmission Efficiency
    - 11.4. Basic Modem Concepts
    - 11.5. Wideband Modulation
    - 11.6. Broadband Modem Techniques
    - 11.7. Error Detection and Correction
    - 11.8. Protocols

COURSE CONTENT AND SCOPE (CONT)

12. Antennas And Wave Propagation
    12.1. Antenna Fundamentals Communication Systems
    12.2. Common Antenna Types
    12.3. Radio-Wave Propagation

MODULE III – ATE SYSTEMS **100 hrs**

1. ATE In General
2. Power Supplies
    2.1. Stimulus devices
    2.2. Response Devices
    2.3. Create new folders
    2.4. Interface Device to the systems (ID)
    2.5. Self Test
    2.6. Confidence Tests
    2.7. Diagnostic Tests
3. Using Softwares
    3.1. Software/ hardware trade off

MODULE IV – TEST PROGRAMS **150 hrs**

1. Test Programs
    1.1. Develop test program to test the circuit using C++ programming
    1.2. Using power-point to draw flow-chart for diagnostic tests
    1.3. Debug test program software/hardware
    1.4. Gain more skill in troubleshooting
2. Laboratory Exercises
    2.1. Correctly operate the following test instruments:
    2.2. Analog Meters
    2.3. Digital Meters
    2.4. Oscilloscopes
    2.5. Oscillators
    2.6. Logic Analyzer
    2.7. Spectrum Analyzer
    2.8. Network Analyzer
    2.9. Automatic Tester
3. View and identify normal and abnormal functions in RF and Digital communication systems.
4. Troubleshooting RF and Digital malfunction devices.

APPROPRIATE READINGS

Students may be given reading assignments from the course text book, informational handouts, related trade magazines and internet articles.

WRITING ASSIGNMENTS

Typical writing assignments will include: completing assigned reports, providing written answers to assigned questions, performing arithmetic calculations as assigned and completing shop and/or job orders.

APPROPRIATE ASSIGNMENTS THAT DEMONSTRATE CRITICAL THINKING

Students will perform analysis and evaluation of reading and/or classroom materials and utilize this analysis in classroom discussions, writing assignments, and in performing laboratory activities. Students must select and use appropriate methods and materials needed to complete laboratory assignments.

OUTSIDE ASSIGNMENTS

Students are expected to spend a minimum of one hour per day outside of the class in practice and preparation for each day in class. Appropriate assignments may include, but are not limited to: appropriate internet research, readings, preparing research reports, preparing appropriate writing assignments and studying as needed to perform successfully in class.

EVALUATION

A student's grade will be based on multiple measures of performance related to the course objectives. The assessment will measure development of independent critical thinking skills and will include evaluation of the student's ability. Multiple measures may include, but are not limited to the following: quizzes, lab projects, classroom participation, and attendance.

Upon successful completion of the course a Certificate of Course Completion will be issued.

Upon successful completion of this course and Electronic Technician I a Certificate of Program Completion will be issued.

METHOD OF INSTRUCTION

Methods of instruction will include, but are not limited to; lectures, demonstrations, laboratory, audio-visual presentations and computer assisted instruction. Classroom lectures, demonstration, laboratory, computer assisted instruction, computer assisted in simulation analog and digital labs, computer assisted in semi-automatic testing and troubleshooting. Group and individual instructions, field trips, guess speakers, job shadowing and internships/externships may also be utilized.

This course, or sections of this course, may be offered through distance education.

TEXT AND SUPPLIES

Circuit Analysis Theories and Practice (2003), Robbins & Miller, Current Edition, Delmar
Basic Electronics (2010), Grob, Current Edition, McGraw-Hill
Grob's Basic Electronics (2006), Mitchel E. Schultz, Current Edition, McGraw-Hill
Digital Fundamentals (2005), Floyd, Current Edition, Prentice Hall
Electronic Communication Systems (1996), David L. Heiserman, Current Edition, McGraw-Hill
Principal of Electronic Communication Systems (2007), Frenzel, Current Edition, McGraw-Hill

PREPARED B: Hoai Pham / Bill Borinski DATE March 5, 2012

REVISED BY Tai Hong / Andrei Lucas DATE May 6, 2020

Instructors must meet all requirements stated in Policy 3100 (Student Rights, Responsibilities and Administration Due Process) and the attendance Policy set forth in the Continuing Education Catalog

References

San Diego Community College District Policy 3100
California Community College, Title 5, Section 55002
Continuing Education Catalog