PASSAIC COUNTY TECHNICAL INSTITUTE

ELECTRONICS II

CURRICULUM GUIDE

JANUARY 2012

I. Course Description – Electronics Technology II

Electronics II is designed to provide the student with enhanced skills and understanding of the electronics industry and changing career opportunities. Course goals are to provide the student with an augmented comprehension of advanced digital circuits and applications based on sound electrical fundamentals. Lab applications and projects are combined with theory based learning to provide the learner with a program which emulates industry standards and practices.

II. Course Outline and Objectives

UNIT 1: ELECTRONICS SHOP SAFETY
(5.1.12.C.1, 5.1.4.D.3, 5.1.P.B.3)

Students will:

1. develop a clear understanding of things that conduct electricity
2. understand lab and electrical hazards
3. know the dangers of electricity and how it affects the human body
4. learn how to report lab hazards to school personnel
5. develop a positive attitude about safe environments
6. learn proper use of tools in a safe manner
7. operate test equipment safely and effectively
8. avoid and report obstructions in the lab which can lead to injury
9. identify elements in the lab which can potentially cause injury
10. create and document a personal safety plan
11. know where to access safety standards posted in the lab
12. learn to ask appropriate questions when concerned about safety
13. operate and maintain all lab computers and peripherals efficiently
14. wear hand and eye protection as instructed
15. pass the program safety test with a 100% score

UNIT 2: WORK ENVIRONMNETS IN ELECTRONICS (9.2.8.A.1, 9.4.12.O. (2).2)

Students will:

1. explore different lab and research environments
2. understand field service expectations
3. identify hazardous work environments
4. plan for safe work practices
5. research industrial and quality control facilities

UNIT 3: LAB PRACTICES (5.1.12.C.1, 5.1.4.D.3)

Students will:

1. use lab cleaning fluids properly
2. identify potential fire hazards
3. keep away from live circuits
4. avoid wearing jewelry and loose clothing
5. document safety actions taken in lab

UNIT 4: DIGITAL MATHEMATICS (4.4.12 C, 4.5 A, 4.5 C, 4.5 F, 9.4.12.O. (2).1)

Students will:

1. understand the binary number system
2. identify place values in the binary system
3. comprehend binary mathematics in digital applications
4. apply binary and decimal conversions
5. learn scientific notation
6. expand their knowledge of Ohm's Law

Advanced Analog and Digital Electronics

UNIT 1: DIGITAL CIRCUITS (4.5 F, 5.2.12.B.3, 8.2.2.A.1, 9.4.12.O. (2).6)
Students will:

1. research the history of digital electronics
2. learn to measure digital signals
3. comprehend the differences between digital and analog electronics
4. utilize soldering techniques in digital circuits
5. populate printed circuit boards with components
6. read schematic diagrams effectively
7. ensure proper grounding of equipment
8. understand combination circuits
9. construct digital circuits using breadboards
10. analyze analog and digital circuits

UNIT 2: BASIC DIGITAL LOGIC GATES (4.5 F, 5.2.12.B.3, 9.4.12.O. (2).2)
Students will:

1. identify and explain the basic function of logic gates
2. draw the symbols for basic logic gates
3. develop truth tables for basic logic gates
4. realize that all digital circuits are constructed of a few basic logic gates
5. comprehend that digital circuits are also referred to as logic elements

UNIT 3: ANALOG RECTIFIERS (5.3.12.A.1, 5.4.12.A.1, 9.4.12.O. (2).6)

Students will:

1. realize that rectifiers are the heart of power supplies
2. learn that rectifiers change incoming ac voltage to dc voltage
3. understand the three types of rectifiers
4. analyze bridge rectifiers
5. comprehend how rectifiers impact our daily lives

UNIT 4: DIGITAL AND ANALOG AMPLIFIERS (5.3.12.A.1, 9.4.12.O. (2).6)

Students will:

1. describe the purpose of an amplifier
2. learn how amplifiers boost electronic signals
3. identify the three basic configurations of transistor amplifier circuits
4. recognize the classes of amplifiers
5. describe the operation of direct coupled amplifiers

Manufacturing Techniques in Electronics

UNIT 1: PRINTED CIRCUIT BOARDS (5.3.12.A.1, 5.4.12.A.1, 5.4.12.C.1)

Students will:

1. learn the theory of printed circuit boards
2. research the history of printed circuit boards
3. understand electrical connections on printed circuit boards
4. comprehend methods of manufacturing
5. research testing and quality control

UNIT 2: CIRCUIT BOARD FABRICATION (5.3.12.A.1, 5.4.12.A.1, 5.4.12.C.1)

Students will:

1. research the manufacturing process of printed circuit boards
2. comprehend methods used to mechanically support and electrically connect electronic components using conductive pathways
3. understand tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate
4. solder electronic components on printed circuit boards
5. troubleshoot printed circuit boards

UNIT 3: ELECTRONIC ASSEMBLY (5.4.12.A.1, 5.4.12.C.1, 9.4.12.O. (2).6)

Students will:

1. learn quality control initiatives in assembly procedures
2. know the skills needed to construct printed circuit boards
3. practice mounting components
4. document testing procedures
5. practice quality control procedures

UNIT 4: QUALITY CONTROL IN ELECTRONICS (5.3.12.A.1, 5.4.12.C.1)

Students will:

1. learn visual inspections of components and circuit boards
2. implement digital testing procedures
3. practice documenting testing results
4. research industry standards
5. implement troubleshooting techniques

Industrial Applications in Electronics

UNIT 1: MOTORS (5.4.12.A.1, 5.4.12.C.1, 9.4.12.O. (2).1, 9.4.12.O. (2).2)

Students will:

1. research industrial applications of motors
2. learn the structure of motors, armatures, and brushes
3. understand magnetic fields and motors
4. comprehend armature reaction
5. practice troubleshooting techniques

UNIT 2: AC and DC GENERATORS (5.4.12.A.1, 9.4.12.O. (2).1, 9.4.12.O. (2).2)

Students will:

1. research types of alternators
2. analyze magnetic fields created by ac generators
3. understand ac wave forms
4. identify coils and magnetic fields
5. comprehend single, two phase, and three phase alternators

UNIT 3: POWER SUPPLIES (5.4.12.A.1, 5.4.12.C.1, 9.4.12.O. (2).1, 9.4.12.O. (2).2)

Students will:

1. interpret the theory of transformers
2. understand rectifiers and changes in electricity
3. know the role of filter circuits
4. comprehend voltage regulators
5. analyze circuit protection devices

UNIT 4: TRANSFORMERS (5.3.12.A.1, 5.4.12.A.1, 5.4.12.C.1, 9.4.12.O. (2).3)

Students will:

1. understand couplings and windings
2. learn the function of primary and secondary windings
3. comprehend alternating magnetic fields
4. analyze how a transformer transfers electrical power between coils
5. know transformer construction

Career Preparation

UNIT 1: EMPLOYABILITY SKILLS (9.2.12.A.1, 9.2.12.A.2)

Students will:

1. know career expectations of the industry
2. refine strategies for researching job opportunities
3. prepare for entry level electronics exams
4. know technical interviewing techniques
5. organize portfolios and other academic credentials

UNIT 2: TECHNICAL COMMUNICATION SKILLS (3.2.12.A.1, 3.2.12.A.4)

Students will:

1. learn fundamentals of technical writing
2. develop accurate data entry skills
3. produce precise customer estimates
4. learn common warranty practices and parts replacement
5. implement means of documenting service reports

UNIT 3: CUSTOMER RELATIONS (3.2.12.A.1, 3.3.12.B.6, 3.4.12.A.1)

Students will:

1. learn effective verbal skills
2. master telephone communications
3. develop information gathering techniques
4. produce clear and concise writing
5. utilize technology and develop new skills

UNIT 4: CAREERS IN ELECTRONICS (9.2.12.A.1, 9.2.12.A.2)

Students will research:

1. quality control specialists
2. biomedical field technicians
3. telecommunication analysts
4. project managers
5. pc repair opportunities
6. computer network administrators
7. component level troubleshooting specialists
8. specific career initiatives

III. Evaluation

Students are evaluated using the following criteria:

1. Class participation
2. Attendance
3. Lab reports
4. Technical projects
5. Class assignments

IV. Textbooks

REQUIRED TEXTBOOKS, EQUIPMENT and MATERIALS:

Electricity & Electronics Gerrish/Dugger/Roberts 2004
PAD-234 Digital/Analog Trainer Kit
Dual Trace Oscilloscope
VOM/DMM

V. Instructional Strategies

Instructional methods for the course combine a traditional text, lecture, and theory based approach with hands on learning modules designed to create a self paced laboratory approach for the student. A strong emphasis is placed on research and problem solving techniques, where the learner is guided by the instructor and challenged to investigate solutions and draw reasonable conclusions. This translates into transferable skills used for troubleshooting, an important component for success in the industry. Student reasoning skills are developed in an effort to help students think logically and find innovative solutions. Handouts, class discussions, and group projects will be used to integrate Science and Mathematics which is deeply ingrained in electronic technology.

VI. **Scope and Sequence Chart** *Key I = Introduced D = Developed R = Reinforced*

SKILLS TO BE LEARNED	**9**	**10**	**11**	**12**
Research in electronics work environments		IDR		
Options in the electronics industry		IDR		
Various types of specialty areas		IDR		
Advanced digital logic circuits		ID		
Installing digital devices		ID		
Digital troubleshooting		IDR		
Reading blueprints, wiring diagrams, schematic drawings		ID		
Follow engineering instructions for assembling electronics		ID		
Identifying and resolving equipment malfunctions		IDR		
Analysis of test trainer results to evaluate performance		IDR		
Constructing amplifiers		ID		
Troubleshooting techniques for amplifiers		ID		
Develop or perform operational, maintenance, or testing procedures for electronic products		IDR		
Ability to write reports or record data on testing techniques		IDR		
Analyze computer system requirements, capacity, cost, and customer needs		IDR		
Electronic assembly protocols and techniques		IDR		
Assembly of circuit rectifiers		I		
Fabrication of electronic filtering circuits		I		
Determine need for adjustments in projects		IDR		
Printed circuit board fabrication methods		IR		

SKILLS TO BE LEARNED	9	10	11	12
Populating circuit boards with digital and analog components		IDR		
Soldering circuit boards		IDR		
Electronic assembly protocols		IDR		
Maintain system logs or manuals to document testing		IDR		
Quality control inspections		IDR		
Adjust or replace defective or improperly functioning circuitry		ID		
Assemble, test, or maintain circuitry or electronic components		ID		
Apply knowledge of electronic theory and components		IDR		
Prepare engineering sketches or specifications for construction		ID		
Theory of AC and DC motors		I		
Creating electrical power with AC generators		I		
Perform preventative maintenance or calibration of equipment or systems		IDR		
Function of AC and DC power supplies		I		
Troubleshooting power supplies		IDR		
Exploration of careers in electronics		IDR		
Technical communication skills		IDR		
Employability skills needed in the electronics industry		IDR		
Methods of integrating electronics mathematics into practical applications		IDR		
Identification of specific electronics career paths		IDR		
Utilize lab software programs		IDR		
Ideas for additional avenues of technical education		IDR		

VII. Pacing Chart

	DAYS 1-45 WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**
MP 1	Technical work environments	Technical career opportunities	Review of analog electronics	Review of digital electronics	Digital logic circuits	Digital binary codes	Reading digital signals	Repair of digital circuits	Proficient digital lab practices
	DAYS 46-90 WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**
MP 2	Introduction to rectifiers	Changing AC current to DC current	Introduction to amplifiers	Boosting AC/DC signals	Circuit filters	Circuit board fabrication	Soldering circuit boards	Electronic assembly	Current industry standards
	DAYS 91-135 WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**
MP 3	Effective assembly methods	Quality control in electronics	Circuit board inspections	Populating circuit boards	Intro to motors	AC and DC motors	Industry use of motors	AC generators	Repair of motors and generators
	DAYS 136-180 WEEK 1	**WEEK 2**	**WEEK 3**	**WEEK 4**	**WEEK 5**	**WEEK 6**	**WEEK 7**	**WEEK 8**	**WEEK 9**
MP 4	Into to power supplies	AC/DC power supplies	Repair of AC/DC motors	Effective repair procedures	Technical writing	Technical research methods	Enhancing job skills	Customer relations	Careers in electronics

VI. Student Handout/Proficiencies

Electronics Technology II

Electronics II is designed to provide the student with enhanced skills and understanding of the electronics industry and changing career opportunities. Course goals are to provide the student with an augmented comprehension of advanced digital circuits and applications based on sound electrical fundamentals. Lab applications and projects are combined with theory based learning to provide the learner with a program which emulates industry standards and practices.

Proficiencies
Students will:

1. develop knowledge of work environments in electronics
2. accrue awareness of industry changes
3. demonstrate proficiency in circuit design and Ohm's Law
4. exhibit safe lab practices
5. learn how to avoid lab hazards
6. experiment with advanced digital circuit concepts
7. test logic gate functions in digital circuits
8. understand rectifiers and how they change electricity
9. comprehend how rectifiers convert ac current to dc current
10. explore amplifier circuits
11. learn how current is amplified in a circuit
12. implementation of logic circuits using discrete components
13. implementation of analog circuits using integrated circuits
14. phase measurements of input/output signals in analog circuits
15. differentiate between fuses and circuit breakers
16. understand Kirchhoff's law
17. learn how to identify component
18. understand how to design a printed circuit board
19. demonstrate respect for people and property
20. use time and other resources responsibly
21. monitor their own progress toward objectives
22. test diodes and transistors using an ohmmeter
23. describe how to construct electronic circuits using schematic diagrams
24. differentiate between inductors and capacitors
25. understand the difference between a shorted and open circuit
26. make sound career choices
27. research additional means of technical education
28. develop successful means of networking in the industry
29. implement workplace readiness skills
30. set productive career and technical goals