

ILLINOIS VALLEY COMMUNITY COLLEGE



COURSE OUTLINE

DIVISION: Workforce Development

COURSE: ATO 1220; Basic Automotive Electricity

Date: Spring 2014

Credit Hours: 3

Prerequisite(s): None

Delivery Method:

<input checked="" type="checkbox"/> Lecture	2 Contact Hours (1 contact = 1 credit hour)
<input type="checkbox"/> Seminar	0 Contact Hours (1 contact = 1 credit hour)
<input checked="" type="checkbox"/> Lab	2 Contact Hours (2 contact = 1 credit hour)
<input type="checkbox"/> Clinical	0 Contact Hours (3 contact = 1 credit hour)
<input type="checkbox"/> Online	
<input type="checkbox"/> Blended	

Offered: Fall Spring Summer

IAI Equivalent –**Only for Transfer Courses**–go to <http://www.itransfer.org>.

CATALOG DESCRIPTION:

This is a basic automotive electricity course dealing with voltage, current, resistance, series and parallel circuits, digital multimeter, digital storage oscilloscope, basic electronics, wiring diagrams, batteries, starting systems, and charging systems.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page of this form for more information.]

Upon completion of the course, the student will be able:

[Choose those goals that apply to this course.]

- To apply analytical and problem solving skills to personal, social and professional issues and situations.
- To communicate orally and in writing, socially and interpersonally.
- To develop an awareness of the contributions made to civilization by the diverse cultures of the world.
- To understand and use contemporary technology effectively and to understand its impact on the individual and society.
- To work and study effectively both individually and in collaboration with others.
- To understand what it means to act ethically and responsibly as an individual in one's career and as a member of society.
- To develop and maintain a healthy lifestyle physically, mentally, and spiritually.
- To appreciate the ongoing values of learning, self-improvement, and career planning.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals.]

Upon completion of the course, the student will be able to:

VI. Electrical/Electronic Systems Tasks (NATEF)

A. General Electrical System Diagnosis

VI.A.1 Identify and interpret electrical/ electronic system concern; determine necessary action.

VI.A.2 Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.

VI.A.3 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).

VI.A.4 Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).

VI.A.5 Use wiring diagrams during diagnosis of electrical circuit problems.

VI.A.6 Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.

VI.A.7 Check electrical circuits with a test light; determine necessary action.

VI.A.8 Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.

VI.A.9 Measure current flow in electrical/ electronic circuits and components using an ammeter; determine necessary action.

VI.A.10. Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.

VI.A.11 Check electrical circuits using jumper wires; determine necessary action.

VI.A.12 Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.

- VI.A.13 Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
- VI.A.14 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
- VI.A.15 Inspect and test switches, connectors, relays, and wires of electrical/electronic circuits; perform necessary action.
- VI.A.16 Repair wiring harnesses and connectors.
- VI.A.17 Perform solder repair of electrical wiring.
- B. Battery Diagnosis and Service
 - VI.B.1 Perform battery state of charge test; determine necessary action.
 - VI.B.2 Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
 - VI.B.3 Maintain or restore electronic memory functions.
 - VI.B.4 Inspect, clean, fill and replace battery.
 - VI.B.5 Perform slow/fast battery charge.
 - VI.B.6 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.
 - VI.B.7 Start a vehicle using jumper cables and a battery or auxiliary power supply.
- C. Starting System Diagnosis and Repair
 - VI.C.1 Perform starter current draw tests; determine necessary action.
 - VI.C.2 Perform starter circuit voltage drop tests; determine necessary action.
 - VI.C.3 Inspect and test starter relays and solenoids; determine necessary action.
 - VI.C.4 Remove and install starter in a vehicle.
 - VI.C.5 Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
 - VI.C.6 Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.
- D. Charging System Diagnosis and Repair
 - VI.D.1 Perform charging system output test; determine necessary action.
 - VI.D.2 Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
 - VI.D.3 Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.
 - VI.D.4 Inspect and test voltage regulator/ regulating circuit; perform necessary action.
 - VI.D.5 Remove, inspect, and install generator (alternator).
 - VI.D.6 Perform charging circuit voltage drop tests; determine necessary action.
- E. Lighting Systems Diagnosis and Repair
 - VI.E.1 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action

COURSE TOPICS AND CONTENT REQUIREMENTS:

- I. Basic Shop Safety
 - A. Explain basic shop safety
 - B. Identify hazardous waste products in the shop
 - C. Explain the use of material safety data sheets (MSDS)
 - D. Define the purpose of OSHA and EPA
 - E. Explain the different types of fires and fire extinguishers
 - F. Explain basic eye, ear, static, shop and electrical safety
- II. Basic Automotive Electricity Theory
 - A. Electron Theory
 - B. Electrical Terms and Principles
 - 1. Direct Current
 - 2. Alternating Current
 - 3. Current Flow
 - 4. Voltage
 - 5. Resistance
 - C. Factors of Electricity
 - 1. Magnetism
 - 2. Electromagnetism
 - 3. Electromagnetic Induction (EMI)
 - D. Electrical Rules
 - 1. Ohm's Law
 - 2. Watt's Law
 - E. Types of Electrical Circuits
 - 1. Series
 - 2. Parallel
- III. Measurement System
 - A. Metric prefix system
 - B. Scientific Calculator
- IV. Components of an Electrical Circuit
 - A. Automotive Wiring
 - 1. Primary Wire
 - 2. Secondary Wire
 - 3. Stranded Wire
 - 4. Metric/AWG Wire
 - B. Electrical Connectors
 - C. Soldering
 - 1. Design and Types
 - 2. Technique
 - D. Resistive Devices
 - 1. Fixed
 - 2. Variable
 - 3. Stepped
 - E. Circuit Protection Devices
 - 1. Fuse Design
 - a. Glass, ceramic, Pacific Element, and Blade
 - 2. Fuse Ratings
 - 3. Fusible Link
 - 4. Circuit Breakers

- a. Manual and Automatic Design
 - F. Electrical Switches
 - 1. SPST/SPDT
 - 2. Ganged
 - 3. Mercury
 - 4. Electromagnetic
 - G. Capacitors
 - 1. Application and Rating
- V. Meters and Measuring Devices
 - A. Analog Meters
 - B. Polarity
 - C. Impedance
 - D. Digital Multimeter
 - 1. Electrical test Equipment (Digital Multimeter)
Voltmeter (dc and ac), ammeter, ohmmeter, diode checker, frequency, temperature, duty cycle, dwell, millivolts, milliamps, 10 megaohm impedance, minimum/maximum feature, and sleep mode
 - 2. Measurements: Voltage, Amperage, Resistance, and Diode voltage
 - E. Test Lights
 - 1. Low and High Current Types
 - 2. Troubleshooting
 - 3. Self-Powered
 - F. Wiring Diagrams
 - 1. How to Read
 - 2. How to Use to Service Vehicles
 - G. Automotive Oscilloscopes
 - 1. Digital Storage Oscilloscope
 - a. Amplitude, Time Divisions, Single and Dual Trace
 - 2. Analog and Digital Signals
 - 3. Buffer Circuits
- VI. Circuits
 - A. Series Circuit and Laws
 - B. Parallel Circuit and Laws
 - C. Series-Parallel Circuit and Laws
 - D. Exercises
- VII. Troubleshooting Techniques and Specifications For
 - A. Open Circuits
 - B. Short Circuits
 - C. Voltage Drops
 - D. Parasitic Drains
 - E. Feedback Circuits
- VIII. Basics of Electronics and Computers
 - A. Semiconductors
 - 1. P and N Type Materials
 - 2. Diodes
 - 3. Transistors
 - 4. Testing
 - B. Binary Code

- IX. Batteries
 - A. Basic Theory
 - B. Conventional Battery Construction
 - C. Maintenance Free Construction
 - D. Deep Cycle Battery Construction
 - E. Recombination Battery Construction
 - F. Battery Load Ratings
 - G. Battery Testing
 - 1. Terminal Voltage Drop
 - 2. State-of-Charge
 - 3. Open Circuit Voltage Test
 - 4. Load Testing Equipment
 - 5. Electronic Tester
 - 6. Specific Gravity
 - H. Battery Charging Procedures and Safety
 - I. Battery Jump Starting
 - J. Battery Removal and Cleaning
 - K. Care and Servicing
 - L. Sales and Purchasing
 - M. Storage
- X. Starting System
 - A. Magnetism and Motor Principles
 - B. Starting Circuit Components
 - 1. Starter Pinion Drives
 - 2. Starter Solenoid
 - 3. Starter Relay
 - C. Starter Motor Designs
 - 1. Direct Drive
 - 2. Positive Engagement
 - 3. Gear Reduction
 - 4. Permanent Magnet
 - D. Neutral Safety Switch
 - E. Starter System Testing
 - 1. Starter Current Draw Test
 - 2. Starter Voltage Drop Test
 - 3. Starter Open Circuit Test
 - 4. Starter Pinion Gear Clearance
 - F. Starter Motor Service
 - 1. Disassembly Procedures
 - 2. Growler Tests
 - 3. Reassembly Procedures
- XI. Charging System
 - A. Charging System Principles
 - 1. Direct Current Generators
 - 2. Alternating Current Generators
 - B. Charging System Components and Operation
 - 1. Stator Assembly Designs
 - 2. Rotor Assembly Design
 - C. Alternating Current Rectification

- D. Charging System Regulation
 - 1. Field Current Control
 - a. A-Circuit, B-Circuit, or PCM
 - 2. Mechanical
 - 3. Transistorized
 - 4. Diode Testing
- E. Charging System Testing
 - 1. Visual Inspection
 - 2. State of Charge
 - 3. Drive Belt Inspection
 - 4. AC Ripple Test

INSTRUCTIONAL METHODS:

- 1. Lecture
- 2. Demonstrations
- 3. Practical (Lab)
- 4. Transparencies
- 5. Power Point
- 6. Alldata and Mitchell On-Demand
- 7. Internet
- 8. Class Discussion
- 9. Handouts
- 10. Quizzes and Tests

INSTRUCTIONAL MATERIALS:

TEXTBOOK:

Chapman, Norm. Principles of Electricity & Electronics for the Automotive Technician. Delmar Thomson Learning Company, 2000.

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

- 1. Complete all lab objectives (NATEF Tasks)
- 2. Practical Application
- 3. Attendance
- 4. Work Habits
- 5. Attitude
- 6. Safety Practices
- 7. Student Notebook
- 8. Ability to Work with Others
- 9. Written Exams and Quizzes
- 10. Class Participation

OTHER REFERENCES

- 1. Alldata and Mitchell On-Demand, DVD Information System (Both Labs, Office, and Classroom)
- 2. Automotive Electricity and Electronics – Santini, (Auto Office)
- 3. Auto Electricity and Electronics – Dubby, (Auto Office)
- 4. Automotive Electrical and Electronics – Chek-Chart, (Auto Office)

Course Competency/Assessment Methods Matrix

ATO 1220- Basic Automotive Electricity	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	Assessment of Student Learning	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment	
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D								
VI.A.1 Electrical/Electronic Systems Tasks - Identify and interpret electrical/electronic system concern; determine necessary action.				X																													
VI.A.2 Electrical/Electronic Systems Tasks - Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.				X																													
VI.A.3 Electrical/Electronic Systems Tasks - Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).				X		X	X																										

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Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D							
VI.A.4 Electrical/Electronic Systems Tasks - Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).					X			X	X																							
VI.A.5 Electrical/Electronic Systems Tasks - Use wiring diagrams during diagnosis of electrical circuit problems.				X			X	X																								
VI.A.6 Electrical/Electronic Systems Tasks - Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.				X			X	X																								
VI.A.7 Electrical/Electronic Systems Tasks - Check electrical circuits with a test light; determine necessary action.				X																												
VI.A.8 Electrical/Electronic Systems Tasks - Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.				X			X	X																								

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Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	Direct/ Indirect	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D							
VI.A.9 Electrical/Electronic Systems Tasks - Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.				X			X	X																								
VI.A.10 Electrical/Electronic Systems Tasks - Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.				X			X	X																								
VI.A.11 Electrical/Electronic Systems Tasks - Check electrical circuits using jumper wires; determine necessary action.				X																												
VI.A.12 Electrical/Electronic Systems Tasks - Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.			X					X																								

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VI.A.13 Electrical/Electronic Systems Tasks - Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.					X			X																								
VI.A.14 Electrical/Electronic Systems Tasks - Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.				X																												
VI.A.15 Electrical/Electronic Systems Tasks - Inspect and test switches, connectors, relays, and wires of electrical/electronic circuits; perform necessary action.				X																												
VI.A.16 Electrical/Electronic Systems Tasks - Repair wiring harnesses and connectors.				X																												
VI.A.17 Electrical/Electronic Systems Tasks - Perform solder repair of electrical wiring.				X																												

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VI.B.1 Electrical/Electronic Systems Tasks - Perform battery state of charge test; determine necessary action.					X																											
VI.B.2 Electrical/Electronic Systems Tasks - Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.					X																											
VI.B.3 Electrical/Electronic Systems Tasks - Maintain or restore electronic memory functions.					X																											
VI.B.4 Electrical/Electronic Systems Tasks - Inspect, clean, fill and replace battery.					X																											
VI.B.5 Electrical/Electronic Systems Tasks - Perform slow/fast battery charge					X																											
VI.B.6 Electrical/Electronic Systems Tasks - Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.					X																											

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VI.B.7 Electrical/Electronic Systems Tasks - Start a vehicle using jumper cables and a battery or auxiliary power supply.					X																											
VI.C.1 Electrical/Electronic Systems Tasks - Perform starter current draw tests; determine necessary action.				X																												
VI.C.2 Electrical/Electronic Systems Tasks - Perform starter circuit voltage drop tests; determine necessary action.				X			X	X																								
VI.C.3 Electrical/Electronic Systems Tasks - Inspect and test starter relays and solenoids; determine necessary action.				X			X																									
VI.C.4 Electrical/Electronic Systems Tasks - Remove and install starter in a vehicle.				X																												
VI.C.5 Electrical/Electronic Systems Tasks - Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.				X																												

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VI.C.6 Electrical/Electronic Systems Tasks - Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.					X																											
VI.D.1 Electrical/Electronic Systems Tasks - Perform charging system output test; determine necessary action.				X																												
VI.D.2 Electrical/Electronic Systems Tasks - Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.				X			X																									
VI.D.3 Electrical/Electronic Systems Tasks - Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.				X																												
VI.D.4 Electrical/Electronic Systems Tasks - Inspect and test voltage regulator/ regulating circuit; perform necessary action.				X																												

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VI.D.5 Electrical/Electronic Systems Tasks - Remove, inspect, and install generator (alternator).					X																											
VI.D.6 Electrical/Electronic Systems Tasks - Perform charging circuit voltage drop tests; determine necessary action.				X			X	X																								
VI.E.1 Electrical/Electronic Systems Tasks - Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.				X																												