

# Course Syllabus

## Basic Electricity for HVAC

### HART 1301

<b>Semester with Course Reference Number (CRN)</b>	SPRING 2015 CRN 45309
<b>Instructor contact information (phone number and email address)</b>	CHERYL PLEASANT 713.718.2373 CHERYL.PLEASANT@HCCS.EDU
<b>Office Location and Hours</b>	SOUTHEAST COLLEGE – EASTSIDE CAMPUS WORKFORCE BUILDING – 2 <sup>ND</sup> FLOOR MONDAY 8:00AM – 9:00AM; 1:00PM – 2:00PM TUESDAY – WEDNESDAY 8:00AM – 9:00AM
<b>Course Location/Times</b>	SOUTHEAST PARKING GARAGE HVAC CLASSROOM 118 M T W 11:00AM – 12:50AM
<b>Course Semester Credit Hours (SCH) (lecture, lab) If applicable</b>	Credit Hours: 3 Lecture Hours: 2 Laboratory Hours: 3 External Hours:
<b>Total Course Contact Hours</b>	80.00
<b>Course Length (number of weeks)</b>	8 WEEKS
<b>Type of Instruction</b>	Lecture/Lab
<b>Course Description:</b>	Principles of electricity as required by HVAC, including proper use of test equipment, electrical circuits, and component theory and operation.
<b>Course Prerequisite(s)</b>	<b>PREREQUISITE(S):</b> <ul style="list-style-type: none"><li>TECM 1301 with a minimum grade of D or better</li></ul> <b>CO-REQUISITE(S):</b> <ul style="list-style-type: none"><li>TECM 1301 with a minimum grade of D or better</li></ul> <b>FREQUENT REQUISITES</b> <ul style="list-style-type: none"><li>MATH 0306 (Basic Math Pre-Algebra)</li><li>GUST 0339 (5th -7th Grade Reading)</li><li>ENGL 0300 or 0347</li></ul>
<b>Academic Discipline/CTE Program Learning Outcomes</b>	<ol style="list-style-type: none"><li>1. Demonstrate knowledge of safety rules and regulations.</li><li>2. Demonstrate the proper selection, use, and maintenance of hand and power tools and measuring instruments used in A/C and Refrigeration.</li><li>3. Maintain A/C and Refrigeration equipment.</li><li>4. Service/repair A/C and Refrigeration equipment.</li><li>5. Troubleshoot A/C and Refrigeration equipment.</li></ol>

<b>Course Student Learning Outcomes (SLO): 4 to 7</b>	<ol style="list-style-type: none"> <li>1. Demonstrate knowledge of basic principles of electricity, electrical current, circuitry, and air conditioning devices;</li> <li>2. Apply Ohm's law to electrical calculations;</li> <li>3. Demonstrate electrical safety.</li> <li>4. Perform electrical continuity, voltage, and current tests with appropriate meters;</li> </ol>
<b>Learning Objectives (Numbering system should be linked to SLO - e.g., 1.1, 1.2, 1.3, etc.)</b>	<p><b>Demonstrate knowledge of basic principles of electricity, electrical current, circuitry, and air conditioning devices;</b>  <b>Apply Ohm's law to electrical calculations;</b>  <b>Demonstrate electrical safety.</b>  <b>Perform electrical continuity, voltage, and current tests with appropriate meters;</b></p>
<b>SCANS and/or Core Curriculum Competencies: If applicable</b>	<p><b>SCANS</b>  <b>Demonstrate knowledge of basic principles of electricity, electrical current, circuitry, and air conditioning devices;</b>  <b>Apply Ohm's law to electrical calculations;</b>  <b>Demonstrate electrical safety.</b>  <b>Perform electrical continuity, voltage, and current tests with appropriate meters;</b></p>
<b>Instructional Methods</b>	Web-enhanced (49% or less)
<b>Student Assignments</b>	<p><b>Demonstrate knowledge of basic principles of electricity, electrical current, circuitry, and air conditioning devices;</b>  Various assigned readings from textbooks, peer-rev  Discussions  Projects</p> <p><b>Apply Ohm's law to electrical calculations;</b>  Various assigned readings from textbooks, peer-rev  Discussions  Projects</p> <p><b>Demonstrate electrical safety.</b>  Various assigned readings from textbooks, peer-rev  Discussions  Projects</p> <p><b>Perform electrical continuity, voltage, and current tests with appropriate meters;</b>  Various assigned readings from textbooks, peer-rev  Discussions  Projects</p>
<b>Student Assessment(s)</b>	<p>Assessments will be administered to determine understanding and comprehension of the course and to determine an appropriate grade.</p> <p><b>Demonstrate knowledge of basic principles of electricity, electrical current, circuitry, and air conditioning devices;</b>  Various assigned readings from textbooks  In-class discussions  Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay</p> <p><b>Apply Ohm's law to electrical calculations;</b>  Various assigned readings from textbooks  In-class discussions  Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay</p>

**Demonstrate electrical safety.**

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

**Perform electrical continuity, voltage, and current tests with appropriate meters;**

Various assigned readings from textbooks

In-class discussions

Quizzes/Tests which may include: definitions, matching, multiple choice, true/false, short answer, brief essay

## **COURSE OUTLINE, CONTENT GOALS AND ACTIVITIES**

**Week 1**

*Reading Assignment:*

*(NCCER CORE-Employability, NCCER CORE-Communications; HCC Learning Web)*

Review syllabus and course procedures, requirements and assignments

Course description and learning outcomes

Required textbooks and tools

Class attendance and grading scales

Provide overview of HVAC careers, training and regulations

Electricity safety basics

Electrical safety procedures

Electrical safety devices

***Quiz***

***Lab***

**Week 2**

Introduction to electricity

Define principals of direct current

Discuss basic electron theory

Understand the basic physical properties of elements

List the three principal parts of an atom

State the law of charges

Discuss centripetal force

Discuss the difference between conductors and insulators

Differentiate different types of wire and insulation

Use the NEC chart

List factors that determine ampacity

Select a conductor from the proper wire table

Use correction factor to determine proper wire

Determine the proper wire size, the circular mil, K factor and conductor materials

Determine the resistance of long lengths of conductors

***Quiz***

***Lab***

**Week 3**

*Reading Assignment:*

*(NCCER CORE-Construction Drawings HCC Learning Web)*

Identify and understand construction documents and drawings  
Read and understand electrical circuitry  
Identify electrical components, diagram types and electrical symbols  
Recall an electrical circuit and define it  
Identify different types of diagrams: pictorial, ladder and installation diagram  
Recognize standard electrical symbols  
Read schematic diagram  
Interpret the sequence of operation  
Learn rules of how to read a schematic  
Recognize principles and application of magnetism  
Discuss the properties of permanent magnets  
Discuss the difference between the axis poles of the earth and the magnetic poles of the earth  
Discuss the operation of electromagnets  
Determine the polarity of an electromagnet when the direction of the current is known  
Discuss the different systems used to measure magnetism  
List magnetic devices used in the HVAC field

***Quiz***

***Lab***

#### **Week 4**

Define a coulomb  
Define an ampere, a volt, an ohm and a watt  
Apply Ohm's Law  
Compute electrical values using Ohm's law  
Select the proper Ohm's law formula from a chart  
Practice principles of Voltage, Resistance, and Amperage by using Ohm's law  
Define an electric circuit: controller, path, load and power supply  
Calculate total voltage, total resistance and total amperage  
Calculate voltage drop, current for each load  
Calculate total wattage and wattage for individual load

***Quiz***

***Lab***

#### ***Mid Term***

#### **Week 5**

*(Reading Assignment: HART 1301 Unit 6, Learning Web)*

Practice application of electrical Laws – series circuits  
Identify a series circuit  
State three rules for solving electrical values of series circuit  
Use Ohm's law  
Calculate the value of total voltage, total current and total resistance  
Calculate the voltage drop and current flow for each load  
Calculate the wattage for each load and total wattage  
Practice application of electrical laws – parallel circuits  
Identify a parallel circuit  
State three rules for solving electrical values of parallel circuit  
Use Ohm's law  
Calculate the value of total voltage, total current and total resistance  
Calculate the voltage drop and current flow for each load

Calculate the wattage for each load and total wattage  
Practice application of electrical laws – complex circuits  
Define a combination circuit or complex circuit  
List the rules for series and parallel circuits  
Solve combination circuits using the rules of series and parallel circuits  
State Kirchhoff's voltage and current law  
Apply Kirchhoff's law

**Quiz**

**Lab**

### **Week 6**

Define different types of meters  
Differentiate the analog and digital meters  
Discuss the operational principle of voltmeter  
Connect a voltmeter to an energized circuit to measure voltage  
Discuss the operational principle of ohmmeter  
Connect an ohmmeter to a de-energized circuit to measure resistance  
Discuss the operational principle of ammeter  
Connect an ammeter to an energized load to measure current  
Calibrate instruments  
Record Ohm, Voltage and Amperage Readings  
Connect the proper electrical instrument to measure ohm reading, voltage and amperage  
List the proper sequence how to use a specific instrument to record volt,ohm,amp  
Apply alternating current theory  
Discuss the difference between DC and AC  
Compute the instantaneous values of voltage and current for a sine wave  
Compute the peak voltage, RMS, and average values of voltage and current  
Discuss the phase relationship of voltage and current in a pure resistive circuit  
Discuss the properties of inductance in an AC circuit: resistance, inductance, capacitance  
Compute the values of inductive, reactive and inductance

**Quiz**

**Lab**

### **Week 7**

Identify and test HVAC electrical components  
Identify the high voltage and low voltage  
Identify a transformer  
Understand the principle and operation of the device  
Use ohmmeter to measure resistance or primary and secondary taps of transformer  
Use voltmeter to take reading on live circuit of a transformer  
Read the primary voltage and the secondary voltage  
Determine the term VA applied to a control transformer  
Calculate how much amperage can a 40/60 VA transformer put out  
List all electrical components in an air conditioning unit  
Categorize control devices in terms of temperature, pressure, electro-mechanical, etc.  
Identify a thermostat, pressure control devices, contactors, relays and overloads  
Understand the principle and operation of each device  
Use the proper meter to determine the condition of each component  
Record ohm reading, scale of meter and list the name of the component

Compare the actual reading to the recommended reading of a specific component

**Quiz**

**Lab**

**Week 8**

**Quiz**

**Lab**

Review

**Final**

THE END

### **Instructor's Requirements**

As your Instructor, it is my responsibility to:

- Provide the grading scale and detailed grading formula explaining how student grades are to be derived
- Facilitate an effective learning environment through class activities, discussions, and lectures
- Description of any special projects or assignments
- Inform students of policies such as attendance, withdrawal, tardiness and make up
- Provide the course outline and class calendar which will include a description of any special projects or assignments
- Arrange to meet with individual students before and after class as required

To be successful in this class, it is the student's responsibility to:

- Attend class and participate in class discussions and activities
- Read and comprehend the textbook
- Complete the required assignments and exams:
- Midterm Exam / Final Exam
- Ask for help when there is a question or problem
- Keep copies of all paperwork, including this syllabus, handouts and all assignments

### **Program/Discipline Requirements: If applicable**

Student is required to bring to class all necessary tools, and dress according to lab safety requirements. Student must bring textbooks, notebooks, and other required supplies.

### **HCC Grading Scale:**

A = 100- 90	4 points per semester hour
B = 89 - 80:	3 points per semester hour
C = 79 - 70:	2 points per semester hour
D = 69 - 60:	1 point per semester hour
59 and below = F	0 points per semester hour
FX (Failure due to non-attendance)	0 points per semester hour
IP (In Progress)	0 points per semester hour
W (Withdrawn)	0 points per semester hour
I (Incomplete)	0 points per semester hour
AUD (Audit)	0 points per semester hour

IP (In Progress) is given only in certain developmental courses. The student must re-enroll to receive credit. COM (Completed) is given in non-credit and continuing education courses.

FINAL GRADE OF FX: Students who stop attending class and do not withdraw themselves prior to the withdrawal deadline may either be dropped by their professor for excessive absences or be assigned the final grade of "FX" at the end of the semester. Students who stop attending classes will receive a grade of "FX", compared to an earned grade of "F" which is due to poor performance.

Logging into a DE course without active participation is seen as non-attending. Please note that HCC will not disperse financial aid funding for students who have never attended class.

Students who receive financial aid but fail to attend class will be reported to the Department of Education and may have to pay back their aid. A grade of "FX" is treated exactly the same as a grade of "F" in terms of GPA, probation, suspension, and satisfactory academic progress.

To compute grade point average (GPA), divide the total grade points by the total number of semester hours attempted. The grades "IP," "COM" and "I" do not affect GPA.

*Health Sciences Programs Grading Scales may differ from the approved HCC Grading Scale. For Health Sciences Programs Grading Scales, see the "Program Discipline Requirements" section of the Program's syllabi.*

### **Instructor Grading Criteria**

<b>Class Participation</b>	220	22%
<b>Quiz (8 x 30)</b>	240	24%
<b>Lab (8 x 30)</b>	240	24%
<b>Midterm Examination</b>	150	15%
<b>Final Examination</b>	150	15%
<b>Total Possible Points</b>	1000	-
<b>Total Percentage</b>	-	100%

### **Instructional Materials**

ELECTRICITY FOR REFRIGERATION, HEATING, AND AIR CONDIDTIONING 8TH EDITION, RUSSELL E. SMITH ISBN-13: 978-1111038748

### **HCC Policy Statement:**

#### **HCC ADA STATEMENT (Services to Students with Disabilities)**

Any student with a documented disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the Disability Services Office at the respective college at the beginning of each semester. Faculty is authorized to provide only the accommodations requested by the Disability Support Services Office. For questions, please contact (713) 718-8397 or the Disability Counselor at your college. To visit the ADA Web site, please visit [www.hccs.edu](http://www.hccs.edu) then click on Information for... Students, scroll down the page and click on the words Disability Services.

#### **Southeast ADA Counselor:**

Mr. John Reno, MA, CRC – Tel. (713)718-8397 or (713)718-7144

### **Access Student Services Policies on their Web site:**

<http://www.hccs.edu/district/about-us/procedures/student-rights-policies--procedures/>

### **EGLS3 -- Evaluation for Greater Learning Student Survey System**

At Houston Community College, professors believe that thoughtful student feedback is necessary to improve teaching and learning. During a designated time near the end of the term, you will be asked to answer a short online survey of research-based questions related to instruction. The anonymous results of the survey will be made available to your professors and department chairs for continual improvement of instruction. Look for the survey as part of the Houston Community College Student System online near the end of the term.

### **Distance Education and/or Continuing Education Policies**

#### **Access DE Policies on their Web site:**

[http://de.hccs.edu/media/houston-community-college/distance-education/student-services/2015-HCC-DE-Student-Handbook-\(Revised-1\\_7\\_15\).pdf](http://de.hccs.edu/media/houston-community-college/distance-education/student-services/2015-HCC-DE-Student-Handbook-(Revised-1_7_15).pdf)

**Access CE Policies on their** <http://www.hccs.edu/continuing-education/students/financialaid/continuing-education/>  
**Web site:**