SYLLABUS

DATE OF LAST REVIEW: 02/2013

CIP CODE: 46.0302

SEMESTER: Departmental Syllabus

COURSE TITLE: Electromechanical Systems

COURSE NUMBER: ELET0101

CREDIT HOURS: 3

INSTRUCTOR: Departmental Syllabus

OFFICE LOCATION: Departmental Syllabus

OFFICE HOURS: Departmental Syllabus

TELEPHONE: Departmental Syllabus

EMAIL: KCKCC issued email accounts are the official means for electronically communicating with our students.

PREREQUISITE (S): None

REQUIRED TEXT AND MATERIALS: Please check with the KCKCC TEC bookstore, http://www.kckccbookstore.com for the required texts for your particular class.

COURSE DESCRIPTION:

Upon successful completion of this course, the student should be able to identify electrical components and their relationships to the various repair and troubleshooting techniques. The materials in this course will prove useful to service technicians whose background in electricity is limited. The course includes material from basic electrical theory to troubleshooting complex electrical circuits. This course will provide practice in the application of electrical theory as well as in the interconnection of components of heating and cooling systems.
METHOD OF INSTRUCTION:

A variety of instructional methods may be used depending on content area. These may include but are not limited to lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, and panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE:

I. Basic Electricity
   A. Explain the flow of electrons and how it is accomplished.
   B. Explain electrical potential, current flow, and resistance and how each is measured.
   C. Explain electrical power and how it is measured
   D. Explain Ohm's law
   E. Calculate the potential, current and resistance of an electrical circuit using Ohm's law.

II. Electric Circuits
   A. Explain the characteristics of a series circuit.
   B. Explain the characteristics of a parallel circuit.
   C. Describe how parallel circuits are utilized as power circuits in the air-conditioning industry
   D. Calculate the current, resistance and electromotive force in a series circuit.
   E. Calculate the current, resistance and electromotive force in a parallel circuit
   F. Explain the operation of the basic analog meter.
   G. Describe the operation of an analog voltmeter.
   H. Describe the operation of an analog and a digital clamp-on ammeter.
   I. Describe the operation of an analog ohmmeter.
   J. Explain the operation of a digital volt-ohm meter.

III. Electric Symbols of Air Conditioning Wiring Diagrams
   A. Identify the symbols of relays and contactors in heating, cooling and refrigeration systems.
   B. Identify the symbols of switches and the types used in heating, cooling and refrigeration systems.
   C. Read simple air conditioning schematic diagrams.
   D. Read advanced air conditioning schematic diagrams.

IV. Alternating Current, Power Distribution and Voltage Systems
   A. Explain the basic difference between direct and alternating currents.
   B. Explain how alternating current is produced.
   C. Explain the difference between single-phase and three-phase power distribution systems.
   D. Explain inductance, reactance and impedance.

V. Basic Electric Motors
A. Explain magnetism and the part it plays in the operation of electric motors.
B. Explain torque and the purpose of different types of single-phase motors.
C. Describe the operation, install, reverse the rotation, if possible, and diagnose problems in a shaded-pole motor.
D. Describe the purpose of capacitors in the operation of a single-phase motor and be able to explain the difference between a starting and running capacitor.
E. Explain the operation of split-phase and capacitor-start motors.
F. Explain the operation of permanent split-capacitor motors.
G. Explain the operation of capacitor-start-capacitor-run motors.

VI. Heating Control Devices
A. Explain the purpose of the electrical controls in warm air and hydronic heating applications that are necessary to safely operate and maintain the desired temperature in a conditioned space.
B. Describe the pilot safety controls and methods of ignition of the burners in a gas furnace.
C. Explain the operation of an electric furnace or electric resistance duct heater and the methods of control that are commonly used.
D. Draw the wiring diagram of an electric furnace.

VII. Air Conditioning Control Systems
A. Explain the electrical circuitry of a residential condensing unit.
B. Make all electrical connections to install a condensing unit in a residential application.
C. Make all electrical connections for a complete residential installation.
D. Draw the control systems used in gas heat electric air-conditioning packaged units.

VIII. Control Systems: Circuits and Troubleshooting
A. Describe the control circuit used in residential applications.
B. Draw the basic circuit of control systems used on light commercial and industrial applications.
C. Describe the best troubleshooting procedures to use for a particular problem.
D. Troubleshoot basic light commercial conditioned air control systems.

EXPECTED LEARNER OUTCOMES:

A. The student will be able to explain the flow of electrons and how it is accomplished.
B. The student will be able to explain electrical potential, current flow, and resistance and how each is measured.
C. The student will be able to explain and identify symbols of air conditioning circuits.
D. The student will be able to explain the difference between alternating current and direct current.
E. The student will be able to explain the operation of basic electric motors.
F. The student will be able to explain component, symbols of circuitry of air Conditioning Wiring Diagrams.
G. The student will be able to explain installation of heating, cooling and refrigeration Systems.
H. The student will be able to explain heating control devices.
I. The student will be able to explain air conditioning control systems.
J. The student will be able to explain control circuits and troubleshooting electric control
circuits.

**CORE COMPETENCIES:**

*The student will be able to explain the flow of electrons and how it is accomplished.*
1. The student will be able to explain the electron theory and the cause of electrons
   flowing from their valence orbit.
2. The student will be able to explain how electrical resistance, voltage and current are
   measured.
3. The student will be able to explain how power is measured in a circuit.
4. The student will be able to explain Ohm's Law and calculate resistance, current and
   voltage using Ohm's Law.

*The student will be able to explain electrical potential, current flow, and resistance
and how each is measured.*
5. The student will be able to explain the characteristics of a series circuit and parallel
   circuit.
6. The student will be able to calculate current, resistance and voltage in a series circuit
   and a parallel circuit.
7. The student will be able to explain how an analog meter operates.
8. The student will be able to explain how an analog voltmeter operates.
9. The student will be able to explain how an analog and a digital clamp-on ammeter
   operates.
10. The student will be able to explain the operation of an analog ohmmeter.
11. The student will be able to explain the operation of a digital volt-ohmmeter.

*The student will be able to identify electric symbols of air conditioning wiring
diagrams.*
12. The student will be able to identify symbols of relays, pressure switches and
    contactors in an air conditioning circuit.
13. The student will be able to identify switches used in heating, refrigeration and air
    conditioning.
14. The student will be able to read and explain simple air conditioning diagrams.
15. The student will be able to explain advance air conditioning diagrams with pneumatic
    controls.

*The student will be able to explain the difference between alternating current and
direct current.*
16. The student will be able to explain how alternating current has a peak on the positive
    cycle and the negative cycle.
17. The student will be able to explain how direct current does not have a change from
    positive to negative.
18. The student will be able to explain how alternating power is produced at the generating station.
19. The student will be able to determine single phase power from three phase power by the number of conductors.
20. The student will be able to explain the elements in a circuit that causes inductance, reactance and impedance.

*The student will be able to explain the basic operation of electric motors.*
21. The student will be able to explain how magnetism plays a crucial role in the electric motor operation.
22. The student will be able to explain how the different characteristics of single phase motors determine motor torque value.
23. The student will be able to explain the rotating field in a shaded pole motor and how to diagnose problems.
24. The student will be able to explain the operation of a single phase capacitor start and capacitor run motor.
25. The student will be able to explain the operation of a single phase split-phase capacitor motor.
26. The student will be able to explain the operation of a permanent split capacitor motor.
27. The student will be able to explain the operation of a capacitor start and capacitor run motor.

*The student will be able to explain the operation and control of electrical heating devices.*
28. The student will be able to explain the purpose of electrical control devices and how they control the temperature of hydronic heating safely to maintain a desired temperature.
29. The student will be able to describe the pilot ignition and different methods of ignition on gas furnaces.
30. The student will be able to explain the operation of an electric furnace or electric resistance duct heater and how the temperatures are controlled.
31. The student will be able to draw a wiring diagram of an electric furnace.

*The student will be able to explain the electric circuit of an air conditioning control system.*
32. The student will be able to explain the electric circuit of the condensing unit.
33. The student will be able to make all electrical connections for the condensing unit.
34. The student will be able to complete all electrical connections on the furnace.
35. The student will be able to draw a diagram of the controls used in a gas fired furnace and electric air conditioner.

*The student will be able to describe control circuits and troubleshooting in residential applications.*
36. The student will be able to describe the schematic functions of a control circuit.
37. The student will be able to draw the circuit for control systems on commercial and industrial applications.
38. The student will be able to describe the best procedures for troubleshooting by starting at the source of voltage.
39. The student will be able to troubleshoot light commercial air conditioning systems by checking the power supply and air distribution system.

ASSessment of Learner Outcomes:

Student progress is evaluated by means that include, but are not limited to, exams, written assignments, and class participation.

SPECIAL NOTES:

This syllabus is subject to change at the discretion of the instructor. Material included is intended to provide an outline of the course and rules that the instructor will adhere to in evaluating the student’s progress. However, this syllabus is not intended to be a legal contract. Questions regarding the syllabus are welcome any time.

Kansas City Kansas Community College is committed to an appreciation of diversity with respect for the differences among the diverse groups comprising our students, faculty, and staff that is free of bigotry and discrimination. Kansas City Kansas Community College is committed to providing a multicultural education and environment that reflects and respects diversity and that seeks to increase understanding.

Kansas City Kansas Community College offers equal educational opportunity to all students as well as serving as an equal opportunity employer for all personnel. Various laws, including Title IX of the Educational Amendments of 1972, require the college’s policy on non-discrimination be administered without regard to race, color, age, sex, religion, national origin, physical handicap, or veteran status and that such policy be made known.

Kansas City Kansas Community College complies with the Americans with Disabilities Act. If you need accommodations due to a documented disability, please contact the Director of the Academic Resource Center at (913) 288-7670 V/TDD.