GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: HVAC 201 DIVISION: 50 ALSO LISTED AS:

TERM EFFECTIVE: Fall 2020 CURRICULUM APPROVAL DATE: 06/09/2020

SHORT TITLE: BASIC ELECTRICAL

LONG TITLE: Basic Electrical Theory

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	3	54
		Lab:	3	54
		Other:	0	0
		Total:	6	108

COURSE DESCRIPTION:

Students will study concepts of electricity, controls, and electrical loads found on air conditioning and refrigeration circuits. The course includes both the theory and practices of electricity applicable to the air conditioning and refrigeration industries. The course establishes a thorough understanding of electron theory, voltage, current, resistance, Ohm's law, magnetism, mathematical concepts, and common units of electrical measurements.

PREREQUISITES:

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion
03 - Lecture/Laboratory
04 - Laboratory/Studio/Activity
04A - Laboratory - LEH 0.65
05 - Hybrid
71 - Dist. Ed Internet Simultaneous
72 - Dist. Ed Internet Delayed
73 - Dist. Ed Internet Delayed LAB
73A - Dist. Ed Internet LAB-LEH 0.65

STUDENT LEARNING OUTCOMES:

1. Troubleshoot an electrical circuit.
Measure of assessment: demonstration, exam
Year assessed, or planned year of assessment: 2018
Semester: Fall

2. Solve electrical control problems.
Measure of assessment: exam, homework, demonstration
Year assessed, or planned year of assessment: 2018
Semester: Fall

3. Test electrical components and perform preventative maintenance checks.
Measure of assessment: demonstration, exam
Year assessed, or planned year of assessment: 2018
Semester: Fall

4. Calculate the voltage, amperage and resistance using Ohm's law.
Measure of assessment: exam, homework
Year assessed, or planned year of assessment: 2018
Semester: Fall

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 06/09/2020

Lecture content:

9 Hours

Content: Principles of Electricity, Structure of an Atom, Ohm's Law, Series/Parallel Circuits, Electrical Measurements, Use of Multi-meter to Measure, Ohms, Voltage, Current

Student Performance Objectives: Describe the structure of an atom. Describe how magnetism is used to produce electricity. List the units of measurement for electricity. State Ohm's law. State the formula for determining electrical power. Explain inductance. Describe a sine wave.

9 Hours

Content: Electric Heaters, Solenoids, Wiring Diagrams, Principles of Designing Ladder Diagrams, Differences Between Schematic Pictorial/Ladder Diagrams, Reading and Interpreting Diagrams

Student Performance Objectives: Describe a solenoid. Discuss space temperature control. Describe the mercury control bulb. Describe system overshoot and temperature swing. Describe the difference between low- and high-voltage controls. Name two ways motors are protected from high temperature. Describe the difference between a diaphragm and a bellows control. State the uses of pressure-sensitive controls. Describe a high-pressure and a low-pressure control. Discuss the range and differential of a control. Describe pressure transducers. Describe a pressure relief valve. Describe the functions of mechanical and electromechanical controls.

12 Hours

Content: Heating Systems, Principles of Residential Gas Fired Heating Systems, Principles of Electric Heat, Controls and Safeties, Differences Between Control and Safety Switches, Interpretation of Control and Safety Symbols, Adjustment of Controls and Safeties, Electric Circuits, Troubleshooting Electrical Circuits, Fundamentals of Electric Circuit Design

Student Performance Objectives: Make general comparisons between different dimetal applications. Describe the rod and tube. Describe fluid-filed controls. Describe partial liquid/partial vapor-filled controls. Distinguish among the bellows, diaphragm, and Bourdon tube.

9 Hours

Content: Electric Loads, Fan Motors, Compressor Motors

Student Performance Objectives: Describe the different types of open single-phase motors used to drive fans, compressors, and pumps. Describe various types of motor applications. State which motors have high starting torque. List the components that cause a motor to have a higher starting torque. Describe a motor used for a hermetic compressor.

12 Hours

Content: Refrigeration Plant, Principles of the Mechanics of the Refrigeration Cycle, Principles of Heat Transfer, Three Phase Loads and Supplies, Three Phase Electricity Generation, Wye/Delta Transformers, Wye/Delta Motors, Customer Relations

Student Performance Objectives: Summarize the refrigeration cycle. Explain how heat is transferred from the air to the evaporating refrigerant. State the differences between the wye and delta transformers. Explain how wye-delta motors operate. List the major factors that are an important part of customer relations.

2 Hours

Final

Lab Content:

9 Hours

Content: Safety, Use of Equipment, Principles of Electricity, Structure of an Atom, Ohm's Law, Series/Parallel Circuits, Electrical Measurements, Use of Multi-meter to Measure, Ohms, Voltage, Current

Student Performance Objectives: Discuss the importance of safety when working in the lab. Identify atoms with a positive charge and atoms with a negative charge. Explain the characteristics that make certain materials good conductors and others good insulators. State the differences between alternating current and direct current. Explain the differences between series and parallel circuits. Describe the construction of a transformer and the way a current is induced in a secondary circuit. Describe how a capacitor works. State the reasons for using proper wire sizes. Describe the physical characteristics and the function of several semiconductors. Describe procedures for making electrical measurements.

9 Hours

Content: Electric Heaters, Solenoids, Wiring Diagrams, Principles of Designing Ladder Diagrams, Differences Between Schematic Pictorial/Ladder Diagrams, Reading and Interpreting Diagrams

Student Performance Objectives: Identify some commonly used low- and high-voltage controls. Describe and identify power- and non-power consuming devices. Describe and demonstrate how a voltmeter is used to troubleshoot electrical circuits. Identify some typical problems in an electrical circuit. Describe and demonstrate how an ammeter is used to troubleshoot an electrical circuit. Recognize the components in a heat-cool electrical circuit. Follow the sequence of electrical events in a heat-cool electrical circuit. Different between a pictorial and a line-type electrical wiring diagram.

12 Hours

Content: Heating Systems, Principles of Residential Gas Fired Heating Systems, Principles of Electric Heat, Controls and Safeties, Differences Between Control and Safety Switches, Interpretation of Control and Safety Symbols, Adjustment of Controls and Safeties, Electric Circuits, Troubleshooting Electrical Circuits, Fundamentals of Electric Circuit Design

Student Performance Objectives: Describe and demonstrate the function of a bimetal device. Discuss and demonstrate the thermocouple. Explain and demonstrate the thermistor. Complete a variety of troubleshooting exercises.

9 Hours

Content: Electric Loads, Fan Motors, Compressor Motors

Student Performance Objectives: Describe a multispeed, permanent, split-capacitor motor and indicate how the different speeds are obtained. Explain the operation of shaded pole motors. Explain potential and current motor relays and Positive temperature Coefficient Resistors (PTCRs), Explain the operation of a three-phase motor. Explain the motor terminal connections in various compressors. Describe the different types of compressors that use hermetic motors. Describe the use of variable-speed motors, inverters, variable frequency drives (VFDs) and electronically commutated motors (ECMs). Complete a variety of troubleshooting exercises.

12 Hours

Content: Refrigeration Plant, Principles of the Mechanics of the Refrigeration Cycle, Principles of Heat Transfer, Three Phase Loads and Supplies, Three Phase Electricity Generation, Wye/Delta Transformers, Wye/Delta Motors, Customer Relations, Troubleshoot the field repair of leaking heat exchangers. Customer service scenarios.

Student Performance Objectives: Describe and demonstrate the mechanics of the refrigeration cycle. Identify a wye and a delta transformer. Demonstrate a technician?s `soft skills? as it relates to customer service. Complete a troubleshooting scenario of leaking heat exchangers. Perform several customer service scenarios.

2 Hours

METHODS OF INSTRUCTION:

Lecture, discussion, multi-media presentation, demonstration, guided practice.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours: 18

Assignment Description: Read corresponding information in Unit 12 of textbook. Complete Review Questions at end of Unit. Study for quizzes/examinations.

Required Outside Hours: 18

Assignment Description: Read corresponding information in Units 14 and 15 of textbook. Complete Review Questions at end of Units. Study for quizzes/examinations. Homework: Complete the Service Technician Calls scenarios.

Required Outside Hours: 24

Assignment Description: Read corresponding information in Units 13, 14 and 15 of textbook. Complete Review Questions at end of Units. Study for quizzes/examinations. Homework: Complete the Service Technician Calls scenarios. Troubleshoot an electrical circuit.

Required Outside Hours: 18

Assignment Description: Read corresponding information in Unit 17 of textbook. Complete Review Questions at end of Unit. Study for quizzes/examinations.

Required Outside Hours: 24

Assignment Description: Read corresponding information in Unit 12 of textbook and related Handouts. Complete Review Questions provided on Handouts. Study for quizzes/examinations. Homework: Complete several troubleshooting and customer service scenarios.

METHODS OF EVALUATION:

Writing assignments

Percent of total grade: 20.00 %

Homework, Lab Reports

Problem-solving assignments

Percent of total grade: 20.00 %

Lab Projects

Skill demonstrations

Percent of total grade: 20.00 %

Lab Projects/Troubleshooting

Objective examinations

Percent of total grade: 40.00 %

Quizzes/Examinations

REPRESENTATIVE TEXTBOOKS:

Required Representative Textbooks

John A. Tomczyk, Eugene Silberstein, William C. Whitman, William M. Johnson. Refrigeration and Air Conditioning Technology, 8th Edition. Boston, MA: Cengage Learning,2017.

ISBN: 978-1-305-57829-6

Reading Level of Text, Grade: 12th Verified by: MS Word

Tomczyk, Silberstein, Whitman, Johnson. Lab Manual for Refrigeration and Air Conditioning Technology, 8th Edition. Boston, MA: Cengage Learning,2017.

ISBN: 978-1305578708

Reading Level of Text, Grade: 12th Verified by: MS Word

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:
CSU GE:
IGETC:
CSU TRANSFER:
Not Transferable
UC TRANSFER:
Not Transferable

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN:
CAN Sequence:
CSU Crosswalk Course Department:
CSU Crosswalk Course Number:
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: C
Maximum Hours: 4
Minimum Hours: 4
Course Control Number: CCC000587350
Sports/Physical Education Course: N
Taxonomy of Program: 094600