Student Name_____Instructor Name_____

High School or Vocational Center_____Grade_____

COMPETENCY RECORD FOR ARTICULATION
Muskegon Community College
Electronics

Please check below each skill the student has mastered as described, with 80 percent accuracy, or with an A or B grade. The skills needed for articulation of each course are listed.

ELTC 101AL&L
Basic Electricity
4 Credit Hours

A theory and activity course designed to introduce the basic relationships between voltage, current, and resistance. Topics include: soldering, DC circuits, volt-ohm-amp meter operation, alternating current, relays, ladder diagrams, residential wiring, and safety. Practical laboratory experiments reinforcing the above topics are provided.

Task	Satisfactory	Unsatisfactory
Explain the atom's subatomic particles		
Describe the difference between conventional current flow and electron flow		
Describe why current is directly proportional to voltage		
Explain the difference between: a. a conductor b. an insulator c. a semiconductor		
Explain the terms: a. open circuit b. closed circuit c. short circuit		
Describe the difference between a fixed- and a variable-value resistor		
Explain the differences between the six basic types of fixed-value resistors: carbon composition, carbon film, metal film, wirewound, metal oxide, and thick film		
Identify the different resistor wattage ratings, and their value and tolerance labeling methods		
Calculate resistance values needed for desired drops in a series resistive circuit		
Briefly describe first aid, treatment, and resuscitation of a shock victim		
Explain how magnetic energy can be used to generate AC current		

Task	Satisfactory	Unsatisfactory
State the difference between a primary and a secondary cell		
Describe the operation and use of various types of fuses, circuit breakers, and switches		
Evaluate voltage distribution in a series circuit (calculate, construct and measure within $\pm$ 10%)		
Calculate the power dissipated by a resistance when in a circuit		
Design, calculate and measure E, I, and R in a series circuit		
Explain how Ohm's law can be applied to calculate current, voltage, and resistance		
Describe why the series circuit is known as a voltage divider		
Evaluate the operation of the loaded voltage divider. Design, construct and test measured results in comparison to calculations		
Describe how to troubleshoot and recognize: a. an open component b. a component value variation c. a short circuit in a series circuit		
Describe the difference between a series and a parallel circuit		
State Kirchoff's current law		
Determine the total resistance of any parallel-connected resistive circuit		
Describe and be able to apply all formulas associated with the calculation of voltage, current resistance, and power in a parallel circuit		
Describe how a short, open, or component variation will affect a parallel circuit's operation and how it can be recognized		
Identify the difference between a series, a parallel, and a series-parallel circuit		
Describe for the series-parallel circuit how to use a five-step procedure to calculate: a. total resistance b. total current c. voltage division d. branch current e. total power dissipated		

Task	Satisfactory	Unsatisfactory
Explain how to identify the following problems in a series-parallel circuit: a. open series resistor b. open parallel resistor c. shorted series resistor d. shorted parallel resistor e. resistor value variation		
Describe why, when using the ammeter to measure current, shunt resistors are used to achieve different range scales		
Calculate shunt resistor sizes for given current scales		
Describe why, when using the voltmeter to measure voltage: a. multiplier resistors are used to achieve different range scales b. voltmeter sensitivity determines meter accuracy		
Calculate multiplier ohmage size for various voltmeter scales		
Explain the difference between alternating current and direct current		
Compare the advantages and disadvantage of analog multi-meter and digital multi-meter		
Define the term *capacitance* and describe basic capacitor construction		
List and explain the factors determining capacitance		
Describe capacitance breakdown and capacitor leakage		
Calculate total capacitance in parallel and series capacitance circuits		
Describe the advantages and differences between the five basic types of fixed capacitors		
Describe the advantages and differences between the four basic types of variable capacitors		
Explain the capacitor time constant as it relates to dc charging and discharging		
Define and explain capacitive reactance		
Calculate R-C time constants		
Describe impedance, phase angle, power, and power factor as they relate to a series and parallel R-C circuit		
Explain some of the more common capacitor failures and how to use an ohmmeter and capacitance analyzer to test them		

Task	Satisfactory	Unsatisfactory
Explain the following magnetic terms: a. magnetic flux b. flux density c. magnetizing force d. magnetomotive force e. reluctance f. permeability (relative and absolute)		
Define electromagnetic induction		
Describe self-induction		
List and explain the factors affecting inductance		
Identify inductors in series and parallel and understand how to calculate total inductance when inductors are in combination		
List and explain the fixed and variable types of inductors		
Describe the basic operation of a transformer		
Explain the differences between a loaded and unloaded transformer		
List the three basic applications of transformers		
Describe how a transformer's turns ratio can be used to step up or step down voltage or current, or match impedances		
Explain how to test the windings of a transformer for opens, partial shorts, or complete shorts		
Identify the difference between a series and parallel R-L-C circuit		
Evaluate a series and parallel resonant circuit (find Q, rac, and fr)		
Demonstrate how the Q of a resonant circuit determines the damping of oscillations		
Describe complex numbers in both rectangular and polar form		
Describe how complex numbers apply to ac circuits containing series-parallel R-L-C components		
Demonstrate how to determine the phase angle of an R-C circuit through the use of a. dual trace oscilloscope b. trigonometric calculation based on accurate voltage measurements		
Describe the characteristics of resonant circuits (series and parallel)		
Calculate the phase angle of an inductor resistor series circuit using a dual trace scope to show phase angle		
Evaluate the characteristics of the resistor inductor series circuit		
Measure charge and discharge slopes in an active R-C circuit		

Task	Satisfactory	Unsatisfactory
Measure voltage distribution in an ac series capacitive circuit		
Confirm that capacitive ac voltages are dependent upon reactance		
Show how a step-down transformer can be used to match the high impedance output from the function generator to the low impedance of the speaker		
Show how the ac characteristics of an RC circuit can be measured with the oscilloscope		
Given a terminal strip, the student will make 6 good solder connections as determined by the lab instructor		
Given a printed circuit board, the student will remove and replace 6 components to the lab instructor's satisfaction		
Given any color coded resistor, the student will determine the wattage rating and value with 100% accuracy		
Given a PC board, the student should be able to explain and demonstrate 2 methods of solder removal		
Given soldering equipment, the student should be able to demonstrate correct procedures for preparing and caring for the tip		
The student should be able to identify 3 different types of bad soldering joints: a. rosin joint b. cold joint c. fractured joint		
Using two different brand ohmmeters, check and chart 10 resistor sizes (wattage, ohmages, types) and their specification as to proper ohmages. Note typical sizes as to wattage and ohms		
Given any ohmmeter and/or any resistor in lab, the student will determine wattage, accurate, color code, and ohmage value with 100% accuracy		
Given any parallel circuit, the student will state the correct method of measuring current, voltage, or resistance in the current		
The student will list 4 general characteristics of parallel circuits		
The student will be able to explain meter loading in either series or parallel connections		
The student will be able to design meter shunt circuitry and multiplies circuitry		
The student should be able to design, construct, test for all currents and voltage drops in a series parallel circuit. Be able to explain circuit current and voltage changes if a part shorts or opens		
Given a scope displayed sinewave, the student will determine the frequency, period, E_m, E, E_{ave}, E_{p-p} within accuracy limitations of the given scope		

Task	Satisfactory	Unsatisfactory
Given an AC voltmeter reading, the student will determine the correct voltage within the accuracy limitations of the meter		
Given E_m, E, E_{ave}, E_{p-p}, the student will determine the others correct to 2 significant figures		
The student will demonstrate setting the oscilloscope controls for correct operation		
List the 4 physical factors which determine inductance		
Define inductance		
Know operating procedures for inductance meter (LCR meter). Given L in Henrys, the student will determine X_L.		
Given a series RL circuit, the student will calculate and measure the voltage drops and current and describe the relationships between them and prove phase angle with a dual trace scope		
Draw a phasor diagram and syncrogram , the student will draw the other		
Given an AC series circuit containing L and C, the student will determine the voltage and phase relationship $\pm$ 5% accuracy(calculate and measure)		
Given an AC series circuit, the student will determine when the circuit is primarily resistive, capacitive or inductive		
Given an AC circuit, the student will determine the power and power factor $\pm$ 5% accuracy		
Given a parallel AC circuit, the student will calculate and measure all currents, voltages, phase angles, impedance, and draw phasor diagram $\pm$ 5% accuracy		
Given a parallel AC resonant circuit, the student will calculate and measure all currents, voltages, phase angles, impedance, Q, B_w, Z_t, and draw phasor diagram		
Given a transformer circuit, the student will calculate turns ratio, current ratio, reflected impedance, and explain operation		
The student will be able to explain impedance matching		
The student will understand and explain max power transfer		

Instructor's Signature_____Date_____