

Skills Canada ELECTRONICS

Study Guide

1 or 2 exam questions from each section!!! Evaluate how you can do on each part!!!

Standards:

Tier 3 Advanced: Demonstrates competency; performs independently

Tier 2 Proficient: Demonstrates competency; additional development is required

Tier 1 Basic: Familiar with competency; further education is required

Tier NA Not Applicable

Core Competencies:

Survey of Electronics	3	2	1	NA
List milestones in the history of the development of Electronics				
List the names of famous scientists who contributed to the development				
List a variety of different career opportunities				
List the names of the most common electronic components				
Describe the function of each listed component				
List the most common pieces of test equipment				
Describe the main function of each piece of test equipment				
Electricity	3	2	1	NA
List the basic particles of electric charges				
Describe the basic structure of an atom				
Define and give an example of a conductor, insulator, and semi-conductor				
Define the coulomb unit of electrical charge				
Define potential difference and voltage				
Define current and list its unit of measurement				
Describe the difference between voltage and current				

Define resistance and conductance, list the units of each				
List requirements of an electric circuit				
Describe the difference between DC and AC				
Batteries	3	2	1	NA
Explain the difference between primary and secondary cells				
Define internal resistance of a cell				
List several types of voltaic cells				
Explain how cells can be connected to increase the voltage of a battery				
Explain how cells can be connected to increase battery current				
Explain how cells can be connected to increase voltage and current				
Explain why the terminal voltage of a battery drops with increased load				
Resistors	3	2	1	NA
List 5 types of resistors and describe the makeup of each				
Interpret the resistor color code to determine the resistance and tolerance				
Explain the difference between a potentiometer and rheostat				
Explain the significance of a resistor power rating				
List the most common problems with resistors				
Explain the precautions used when measuring a resistor with an ohmmeter				
Ohms Law	3	2	1	NA
List the 3 forms of Ohms Law				
Use Ohms Law to calculate current, voltage, or resistance of a circuit				
List the multiple and submultiple units of voltage, current, and resistance				
Explain the difference between linear and non-linear resistance				
Explain the difference between Work and Power, list the units of each				
Calculate the power in a circuit when other values are known				
Understand the shock hazards when working with electricity				
Explain the difference between an open and short circuit				
Series Circuits	3	2	1	NA
Explain why current is the same in all parts of a series circuit				
Determine the total resistance of a series circuit				

Determine individual resistor voltage drops in a series circuit				
Determine the polarity of a resistor's IR voltage drop				
Calculate the total power dissipated in a series circuit				
Determine the net voltage of a series-aiding and series-opposing voltage and current				
Solve for voltage, current, resistance, and power in a series circuit with random unknowns				
Describe the effects of an open in a series circuit				
Parallel Circuits	3	2	1	NA
Explain why voltage is the same across all branches in a parallel circuit				
Calculate the individual branch currents in a parallel circuit				
Calculate the total current in a parallel circuit				
Calculate the equivalent resistance of two or more resistors in parallel				
Explain why the combined resistance of a parallel circuit is always less than the smallest branch				
Calculate the total power in a parallel circuit				
Solve for the voltage, current, power, and resistance in a parallel circuit having random unknowns				
Describe the effects of an open and short in a parallel circuit				
Describe how parallel connected switches can be used to describe the OR logic function				
Series-Parallel Circuits	3	2	1	NA
Determine the total resistance of a series-parallel circuit				
Calculate the voltage, current, resistance, and power in a series-parallel circuit				
Calculate the voltage, current, resistance, and power in a series-parallel circuit having random unknowns				
Explain how a Wheatstone bridge can be used to determine the resistance of an unknown resistor				
Define the term "chassis ground"				
Calculate the voltage at a given point in a circuit with respect to chassis ground				
Describe the effects of opens and shorts in a series-parallel circuit				
Describe how series-parallel switches can be used to describe the operation of a logic circuit containing AND and OR gates				

Voltage Dividers and Current Dividers	3	2	1	NA
Calculate the voltage drops in an unloaded voltage divider				
Explain why resistor voltage drops are proportional to the resistor values in a series circuit				
Calculate the branch currents in a parallel circuit				
Explain why the branch currents are inversely proportional to the branch resistances in a parallel circuit				
Define what is meant by the term loaded voltage divider				
Calculate the voltage, current, and power values in a loaded voltage divider				
Kirchhoff's Laws	3	2	1	NA
State Kirchhoff's current and voltage laws				
Use the method of branch currents to solve for all voltages and currents in a circuit containing two or more voltage sources in different branches				
Use node-voltage analysis to solve for the unknown voltages and currents in a circuit containing two or more voltage sources in different branches				
Use the method of mesh currents to solve for the unknown voltages and currents in a circuit containing two or more voltage sources in different branches				
Magnetism	3	2	1	NA
Describe the magnetic field surrounding a magnet				
Define the units of magnetic flux and flux density				
Describe how an iron bar is magnetized by induction				
Define the term relative permeability				
Explain the difference between a bar magnet and an electromagnet				
List the three classifications of magnetic materials				
Explain the electrical and magnetic properties of ferrites				
Describe the Hall effect				
Electro-Magnetic Induction	3	2	1	NA
Describe the magnetic field associated with an electric current				
Determine the magnetic polarity of a coil by using the left-hand rule				
Explain what is meant by motor action between two magnetic fields				
Understand how a magnetic flux cutting across a conductor can produce				

an induced current				
State Lenz' Law				
Calculate the amount of induced voltage across the ends of a conductor by using Faraday's law				
Understand the construction and operation of a basic relay				
List and explain some important relay settings				
Capacitive Circuits	3	2	1	NA
Explain why the current leads the voltage by 90 degrees for a capacitor				
Define the term impedance				
Calculate the total impedance and phase angle of a series RC circuit				
Describe the operation and application of an RC phase-shifter circuit				
Calculate the total current, equivalent impedance, and phase angle of a parallel RC circuit				
Understand how a capacitor can couple some AC frequencies but not others				
Calculate the individual capacitor voltage drops for capacitors in series				
Calculate the capacitive current that flows with nonsinusoidal waveforms				
Inductance	3	2	1	NA
Explain the concept of self-inductance				
Define the henry unit of inductance and define mutual inductance				
Calculate the inductance when the induced voltage and rate of current change are known				
List the physical factors affecting the inductance of an inductor				
Calculate the induced voltage across an inductor given the inductance and rate of current changes				
Explain how induced voltage opposes a change in current				
Describe how a transformer works and list important transformer ratings				
Calculate the currents, voltages, and impedances of a transformer circuit				
Identify the different types of transformer cores				
Calculate the total inductance of series connected inductors				
Calculate the equivalent inductance of parallel connected inductors				
List some common troubles with inductors				
Inductive Reactance	3	2	1	NA

Explain how inductive reactance reduces the amount of alternating current				
Calculate the reactance of an inductor when the frequency and inductance are known				
Calculate the total reactance of series connected inductors				
Calculate the equivalent reactance of parallel connected inductors				
Understand how Ohm's Law can be applied to inductive reactance				
Understand the waveshape of induced voltage produced by sine-wave alternating current				
Explain why the voltage leads the current by 90 degrees for an inductor				
Calculate the total impedance and phase angle of a series RL circuit				
Calculate the total current, equivalent impedance, and phase angle of a parallel RL circuit				
Define what is meant by the Q of a coil				
Understand how an inductor can be used to pass some AC frequencies but blocks others				
Calculate the induced voltage that is produced by a nonsinusoidal current				
RC and L/R Time Constants	3	2	1	NA
Define the term transient response				
Define the term time constant				
Calculate the time constant of a circuit containing resistance and inductance				
Explain the effect of producing high voltage when opening an RL circuit				
Calculate the time constant of a circuit containing resistance and capacitance				
Explain how capacitance opposes a change in voltage				
List the criteria for proper differentiation and integration				
Explain why a long time constant is required for an RC coupling circuit				
Use the universal time constant graph				
Explain the difference between time constants and reactance				
Alternating Current Circuits	3	2	1	NA
Explain why opposite reactances in series cancel				
Determine the total impedance and phase angle of a series circuit containing resistance, capacitance, and inductance				
Determine the total current, equivalent impedance, and phase angle of a				

parallel circuit containing resistance, capacitance, and inductance				
Define the terms real power, apparent power, volt-ampere reactive, and power factor				
Calculate the power factor of a circuit				
Resonance	3	2	1	NA
Define the term resonance				
List four circuit characteristics of a series resonant circuit				
List four circuit characteristics of a parallel resonant circuit				
Understand how the resonant frequency formula is derived				
Calculate the Q of a series and parallel resonant circuit				
Calculate the equivalent impedance of a parallel resonant circuit				
Explain what is meant by the bandwidth of a series or parallel resonant circuit				
Calculate the bandwidth of a series or parallel resonant circuit				
Explain the effect of varying L or C in tuning an LC circuit				
Choose L or C for a resonant circuit				
Filters	3	2	1	NA
State the difference between a low-pass and a high-pass filter				
Explain what is meant by pulsating direct current				
Understand how a transformer acts as a high-pass filter				
Understand how an RC coupling circuit couples AC but blocks DC				
Understand the function of a bypass capacitor				
Calculate the cutoff frequency, output voltage, and phase angle of basic RL and RC filters				
Explain the operation of bandpass and bandstop filters				
Explain why log-log graph paper or semilog graph paper is used to plot a frequency response				
Define the term decibel				
Explain how resonant circuits can be used as bandpass or bandstop filters				
Describe the function of a power-line filter and a television antenna filter				
Electronic Devices	3	2	1	NA
Explain the difference between an intrinsic and an extrinsic semiconductor				

Explain what a hole charge is and describe the concept of hole current flow				
Describe the physical construction of a diode				
List the approximate values of forward voltage V_f for a silicon and germanium PN junction				
Name the three terminals of a bipolar transistor				
State the relationship among the three transistor currents				
Test diodes and transistors using an ohmmeter				
Electronic Circuits	3	2	1	NA
Explain the difference between an analog and a digital signal				
Give examples of analog and digital signals				
Calculate the voltage gain, current gain, and power gain of an amplifier or a chain of amplifiers				
Explain the roles of resistors, capacitors, and inductors in an amplifier circuit				
Explain what is meant by positive feedback				
Describe the operation of an RF feedback oscillator				
List three different types of multivibrators				
Define amplitude modulation and frequency modulation and list the main characteristics of each				
Explain the operation of a half-wave power supply				
Explain the operation of a full-wave power supply				
Transistor Amplifiers	3	2	1	NA
List the three different amplifier configurations for bipolar transistors				
Define Class A, Class B, and Class C operation of a transistor amplifier and list the characteristics of each				
Analyze a common-emitter amplifier in terms of biasing voltages and signal variations				
Define the terms alpha and beta				
Explain the term transconductance as it relates to an FET amplifier				
Troubleshoot a transistor amplifier circuit				
Digital Electronics	3	2	1	NA
Count using the binary and hexadecimal number systems				
Convert from binary and hexadecimal number systems to the decimal				

number system				
Understand the BCD system and the ASCII code				
Describe the operation of and construct truth tables for the inverter, AND, OR, NAND, NOR, XOR, and XNOR logic gates				
Understand Boolean algebra and DeMorgan's theorem				
Define what is meant by the terms active high and active low				
Explain how to handle unused inputs on logic gates				
Derive a Boolean expression from a truth table				
Simplify Boolean expressions				
Describe the operation of RS flip-flops, D-type flip-flops, and JK flip-flops				
Understand binary counters				
Identify the new rectangular logic symbols				
Integrated Circuits	3	2	1	NA
Understand what is meant by the open-loop voltage gain of an OP amp				
Define the terms slew rate and power bandwidth				
Calculate the voltage gain of an inverting amplifier				
Calculate the voltage gain of a noninverting amplifier				