# School District of Marshfield Course Syllabus

**Course Name: Electricity/Electronics**
**Length of Course: 1 Semester**
**Credit: .5**

## Program Goal(s):

Empower learners to be college and career ready through standards-based experiences in the classroom and career-based learning experiences with business and industry partners. Learners will engage through technology in design, building, problem-solving, repair or service, in a collaborative environment through theory and hands-on experiences.

## Course Description:

Learn the fundamentals of electrical and electronic systems and components in order to build and troubleshoot working circuits and devices. Examples of activities may include building electromagnets, household wiring, electric motors, circuit boards, robots, two-way radios, soldering joints, and basic computer hardware.

## Standards:

| Wisconsin Technology & Engineering – Broad Based (BB) | | |
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| **Standard** | **Learning Priority** | **Performance Indicators** |
| BB1: Students will analyze the core concepts of technology | BB1.a Analyze and use technological systems | BB1.a.5.h Describe how systems can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities |

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| | | BB1.a.6.h Describe how the outputs of one subsystem given a prominent energy, power and transportation system |
| | BB1.c Analyze and use mechanisms. | BB1.c.5.h Given a linear, rotary and/or compound motion mechanism, students will measure and calculate units such as work, power, torque, gear ratios, and mechanical advantage. |
| | BB1.d Analyze and use electricity and electronic systems. | BB1.d.6.h Perform a voltage drop test and describe the relationship between voltage, current, and resistance with a multimeter.<br>BB1.d.7.h Inspect and test components such as switches, connectors, relays, and solid state devices and conductors and take appropriate action. |
| | BB1.e Analyze, explain, and use control systems. | BB1.e.6.h Select and perform appropriate maintenance is the process in order for the product or system to continue functioning properly, to extend its life or to upgrade its capability given a flawed product or system. |
| **Wisconsin Technology & Engineering – Electronics (EL)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| EL1: Students will develop, use, and apply basic electronics and electricity concepts. | EL1.a Apply electronic theory to practice. | EL1.a.12.h Explain electronic physics terminology of work and energy.<br>EL1.a.13.h Calculate current, voltage, or resistance using Ohm's Law and Kirchoff's Voltage Law.<br>EL1.a.14.h Describes Watts Law.<br>EL1.a.16.h Demonstrate standard metric conversions.<br>EL1.a.17.h Convert fixed numbers to scientific notation.<br>EL1.a.18.h Explain the difference between conventional current theory and electron current theory. |
| EL2: Students will develop the ability to use symbols, measurements and schematics to build, test, and troubleshoot. | EL2.a Construct and measure a basic circuit using electronic components. | EL2.a.8.h Explain the basic operation of the following electronic components: Capacitors, Resistors, Diodes, Transistors, Insulators, Conductors, Switches, Fuses, Circuit Breakers, Batteries, and Power Supplies.<br>EL2.a.9.h Recognize the following electronic components by constructing simple circuits: Capacitors, Resistors, Diodes, Transistors, Insulators, Conductors, |

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| | | Switches, Fuses, Circuit Breakers, Batteries, and Power Supplies.<br>EL2.a.10.h Demonstrate multimeter and usage.<br>EL2.a.11.h Explain the reasons for flux usage and describe it's interaction between metals.<br>EL2.a.12.h List types of solder and reasons for choosing each.<br>EL2.a.13.h Describe and demonstrate the differences between good and bad mechanical and electrical solder connections.<br>EL2.a.14.h Analyze the process of manufacturing a printed circuit board and construct a soldered circuit. |
| | EL2.b Demonstrate electronic measurement to series, parallel, and combination circuits. | EL2.b.5.h Explain how a series circuit is used in DC electronic equipment.<br>EL2.b.6.h Calculate an unknown current, voltage, or resistance in a series circuit using Ohm's Law.<br>EL2.b.7.h Explain how a parallel circuit is used in DC electronic equipment.<br>EL2.b.8.h Calculate an unknown current, voltage, or resistance in a parallel circuit using Ohm's Law.<br>EL2.b.9.h Apply Kirchoff's Current Law to a construction circuit.<br>EL2.b.10.h Explain multimeter construction, components, and usage, and distinguish between digital and analog meters. |
| EL3: Students will analyze and use digital electronics. | EL3.a Analyze, develop, use, and apply digital electronics. | EL3.a.5.h Identify and describe the operation of common electronic components.<br>EL3.a.6.h Perform basic soldering techniques and printed circuit board construction. |
| EL7: Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology. | EL7.a Demonstrate, apply, and measure electronic safety concepts applied to circuits. | EL7.a.6.h Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment.<br>EL7.a.7.h Describe personal safety precautions for working with electric and electronic devices electrical shock.<br>EL7.a.8.h List various degrees of current the body can tolerate. |

| **Wisconsin Common Career Technical Standards (WCCTS)-**Creativity, Critical Thinking, Communication and Collaboration (C) | | |
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| **Standard** | **Learning Priority** | **Performance Indicators** |
| Standard: 4C1: Students will think and work creatively to develop innovative solutions to problems and opportunities. | 4C1.a: Develop original solutions, products and services to meet a given need. | 4C1.a.4.m: Analyze elements of a problem to develop creative solutions.<br>4C1.a.6.m: Describe how past experiences can inform current problem solving.<br>4C1.a.7.h: Develop original ways to solve a given problem.<br>4C1.a.8.h: Design a product or service that could fulfill a human need or desire.<br>4C1.a.9.h: Apply past experiences to current problems in developing innovative solutions. |
| | 4C1.b: Work creatively with others to develop solutions, products and services. | 4C1.b.4.m: Explain how multiple people can develop better solutions than an individual.<br>4C1.b.5.m: Explain how multiple people and perspectives can develop better ideas than an individual.<br>4C1.b.6.m: Explain how multiple people and perspectives can improve an existing product or process better than an individual.<br>4C1.b.7.h: Incorporate the skills and experiences of others to develop a new solution to a problem.<br>4C1.b.8.h: Work as part of a team to design a product or service that could fulfill a human need or desire.<br>4C1.b.9.h: Work as part of a team to improve an existing product or process. |
| Standard: 4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills. | 4C2.a: Develop effective resolutions for a given problem, decision or opportunity using available information. | 4C2.a.5.m: Analyze symptoms to identify the root cause of a problem.<br>4C2.a.6.m: Develop multiple resolutions for a given problem, decision or opportunity.<br>4C2.a.7.m: Identify problems that became worse due to poorly thought out or poorly informed solutions.<br>4C2.a.8.m: Explain how implementation of a solution or action may affect one or more corresponding systems.<br>4C2.a.9.m: Explain how different resolutions may be appropriate under different circumstances.<br>4C2.a.10.m: Explain the process for choosing an action or making a decision. |

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| | | 4C2.a.11.h: Determine the information needed to address an identified problem.<br>4C2.a.12.h: Contrast the benefits and drawbacks of various proposed resolutions to a given situation.<br>4C2.a.13.h: Predict how an action could result in unintended consequences, both positive and negative.<br>4C2.a.14.h: Analyze the impact of a decision using a systems thinking model.<br>4C2.a.15.h: Determine the best resolution for a problem, decision or opportunity based on given criteria.<br>4C2.a.16.h: Defend an action taken or a decision implemented. |
| | 4C2.b: Develop and implement a resolution for a new situation using personal knowledge and experience. | 4C2.b.3.m: Analyze problems to determine what past experiences might be related and relevant.<br>4C2.b.4.m: Analyze a problem to determine how it relates to existing knowledge.<br>4C2.b.5.h: Apply past experience to develop a course of action for a new situation.<br>4C2.b.6.h: Use existing knowledge to develop a resolution for a new situation, problem or opportunity. |
| Standard: 4C3: Students will communicate and collaborate with others to accomplish tasks and develop solutions to problems and opportunities. | 4C3.a: Communicate thoughts and feelings with others using verbal and non-verbal language. | 4C3.a.8.m: Implement effective listening skills in resolving a situation.<br>4C3.a.9.h: Develop a mutually acceptable response to a question or problem.<br>4C3.a.11.h: Communicate effectively in the presence of a language barrier.<br>4C3.a.12.h: Utilize effective listening skills in creating consensus in a group. |
| | 4C3.b: Work collaboratively with others. | 4C3.b.4.m: Use idea generating practices as part of a group.<br>4C3.b.5.m: Describe ways to facilitate group collaboration.<br>4C3.b.6.m: Demonstrate the use of various tools to communicate effectively with an individual or a group.<br>4C3.b.7.h: Participate in group processes to generate consensus.<br>4C3.b.8.h: Lead group processes to generate consensus. |

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| | 4C3.c: Use interpersonal skills to resolve conflicts with others in an ethical manner. | 4C3.c.5.m: Contribute to resolving conflicts that occur within a team or group.<br>4C3.c.6.m: Explore the ethical considerations of a current or historical action or decision.<br>4C3.c.7.h: Resolve conflicts productively with individuals as they arise.<br>4C3.c.8.h: Lead a team or group through a conflict resolution process to reach a productive outcome. |
| **Wisconsin Common Career Technical Standards (WCCTS) – Career Development (CD)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| CD1: Students will consider, analyze and apply an awareness of self, identity and culture to identify skills and talents. | CD1.a: Identify person strengths, aptitudes and passions. | CD1.a.3.h: Evaluate various occupations and career pathways to identify personal, academic and career goals based on personal strengths, aptitudes and passions. |
| | CD1.b: Demonstrate effective decision-making, problem solving and goal setting. | CD1.b.1.e: Recognize consequences of decisions and choices.<br>CD1.b.3.m: Develop effective coping skills for dealing with problems.<br>CD1.b.5.h: Use a decision-making and problem-solving model.<br>CD1.b.6.h: Develop an action plan to set and achieve realistic goals. |
| | CD1.c: Interact effectively with others in similar and diverse teams. | CD1.c.3.e: Demonstrate cooperative behavior in groups.<br>CD1.c.5.m: Distinguish between appropriate and inappropriate behavior in a team setting.<br>CD1.c.7.m: Display cooperative behavior and identify personal strengths and assets in groups. |
| CD2: Students will identify the connection between educational achievement and work opportunities in order to reach personal and career goals. | CD2.b: Assess attitudes and skills that contribute to successful learning in school and across the life span. | CD2.b.1.e: Set realistic expectations for work and achievement.<br>CD2.b.3.e: Explore local and regional labor market and job growth information.<br>CD2.b.6.m: Research local and regional labor market and job growth information to analyze career opportunities.<br>CD2.b.8.h: Assess education and training opportunities to acquire new skills necessary for career advancement. |
| CD3: Students will create and manage a flexible and responsive individualized learning plan to meet their career goals. | CD3.b: Examine and evaluate opportunities that could enhance life and career plans and articulate plan to guide decisions and actions. | CD3.b.2.m: Describe educational levels (e.g., work-based learning, certificate, two-year, four-year and professional degrees) and performance skills needed to attain personal and career goals. |

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| | | CD3.b.3.m: Demonstrate openness to exploring a wide range of occupations and career pathways.<br>CD3.b.5.h: Evaluate the relationship between educational achievement and career development. |
| | CD3.c: Employ career management strategies to achieve future career success and satisfaction. | CD3.c.2.e: Demonstrate the ability to seek assistance (e.g., with problems at school or work) from appropriate resources, including other people.<br>CD3.c.3.m: Identify work values and needs.<br>CD3.c.6.h: Discuss how adaptability and flexibility, especially when initiating or responding to change, contributes to career success. |
| CD4: Students will identify and apply employability skills. | CD4.a: Identify and demonstrate positive work behaviors and personal qualities needed to be employable. | CD4.a.3.m: Demonstrate self-discipline, self-worth, positive attitude and integrity.<br>CD4.a.4.m: Demonstrate flexibility and willingness to learn new knowledge and skills. |
| | CD4.b: Demonstrate skills related to seeking and applying for employment to find and obtain a desired job. | CD4.b.1.e: Identify the qualities employers may seek in a candidate.<br><br>CD4.b.4.m: Compare and contrast personal attributes with employment needs and trends.<br>CD4.b.6.h: Prepare a resume, cover letter, employment application. |
| | CD4.c: Identify and exhibit traits for retaining employment. | CD4.c.2.m: Demonstrate the behavior and etiquette appropriate to interactions with adults.<br>CD4.c.3.m: Distinguish between appropriate behaviors in a social vs. professional setting.<br>CD4.c.4.h: Model behaviors that demonstrate reliability and dependability.<br>CD4.c.5.h: Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite. |
| **Wisconsin Common Career Technical Standards – Environment, Health, and Safety (EHS)** | | |
| **Standard** | **Learning Priority** | **Performance Indicators** |
| EHS1: Students will identify the importance and interrelationships of health, safety and environmental systems and evaluate the impacts of these systems on organizational performance for continuous improvement. | EHS1.d: Implement personal and jobsite safety rules and regulations to maintain and improve safe and healthful working conditions and environments. | EHS1.d.1.e: Identify health and safety considerations in the classroom along with individual responsibility for maintaining conditions.<br>EHS1.d.5.m: Recognize and use systems in school and in the community that protect and enhance personal, environmental health and safety. |

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| | | EHS1.d.8.h: Identify different workplace systems that protect and enhance personal and environmental health and safety. |

| Key Vocabulary: | | | |
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| AC Current | DC Current | Movement | Series Circuit |
| Ammeter | Diode | Ohmmeter | Transistor |
| Capacitor | Electromagnet | Parallel Circuit | Voltage |
| Conductor | Generator | Power | Voltmeter |
| Combination Circuit | Insulator | Resistance | |
| Current | Magnetism | Resistor | |

## Topics/Content Outline- Units and Themes:

### Quarter 1:

- Electricity
  - Generating Electricity
  - Parts of Circuits
  - Types of Circuits
  - Measureable Electrical Terms (Ohm's Law)
  - Digital Multimeter Usage
  - Wiring Diagrams

### Quarter 2:

- Electronics and Soldering
  - EKI Software – Electrical Components
  - Ohm's Law
  - Snap-Circuits
  - Soldering
  - Understanding Relays

## Primary Resource(s):

- **Electricity & Electronics**
  Goodheart Wilcox
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