Standards: NGSS HS.Engineering Design standards and ABET standards

# DC Introduction to Electrical and Computer Engineering BSU: Alignment Table

|  | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 | Unit 6 | Unit 7 | Unit 8 |
|---|---|---|---|---|---|---|---|---|
| HS-ETS1-1. |  |  | x |  |  |  |  | x |
| HS-ETS1-2. |  |  |  |  |  | x |  | x |
| HS-ETS1-3. |  |  | x |  |  |  |  | x |
| HS-ETS1-4. |  |  |  |  |  | x |  | x |
| ABET-1 |  | x | x | x | x | x | x | x |
| ABET-2 |  |  | x |  | x |  |  | x |
| ABET-3 | x |  | x |  | x | x |  | x |
| ABET-4 |  |  | x |  |  |  |  |  |
| ABET-5 |  |  |  |  |  | x |  | x |
| ABET-6 |  | x |  | x | x | x | x | x |

| ABET-7 | x | x | x |  | x |  |  | x |
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# DC Introduction to Electrical and Computer Engineering BSU: Course Map
# Unit 1: What is Electrical and Computer Engineering?

| Idaho Standards | Unit Objectives |
|---|---|
| **ABET**<br>ABET-3 an ability to communicate effectively with a range of audiences.<br>ABET-7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | <ul><li>discuss the history and foundations of electrical engineering and computer science.</li><li>explain the different specialties in electrical engineering, computer engineering, and computer science.</li><li>discuss your own personal interests and career goals.</li></ul> |
| Lesson 1: Introduction to Electrical and Computer Engineering | |
| Lesson Objectives<br>1. describe the people and things important to engineering and computer science.<br>    ○ correlation: ABET-3, ABET-7<br>2. reflect on what important technology is most critical in your life.<br>    ○ correlation: ABET-3, ABET-7 | Assessments<br><ul><li>Objective 1: U1D1: People and Things of Engineering and Computer Science…And You</li><li>Objective 2: U1D1: People and Things of Engineering and Computer Science…And You</li></ul> |
| Lesson 2: What Do Engineers Do? | |
| Lesson Objectives<br>1. distinguish the specialty areas in electrical engineering (EE), computer engineering (CE), and computer science (CS).<br>    ○ correlation: ABET-7<br>2. explain what electrical engineering (EE), computer engineering (CE), and computer science (CS) graduates can do.<br>    ○ correlation: ABET-7 | Assessments<br><ul><li>Objective 1: U1A1: Where Could I Work?</li><li>Objective 2: U1A1: Where Could I Work?</li></ul> |

| Lesson 3: Charting Your Path | |
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| Lesson Objectives<br>   1.  discuss your career values.<br>      ○  correlation: ABET-7<br>   2.  identify your "favorite" area of specialization.<br>      ○  correlation: ABET-7<br>   3.  assess your values in relation to selecting preferred specializations.<br>      ○  correlation: ABET-7 | Assessments<br>   ●  Objective 1: U1A2: My Perfect Job<br>   ●  Objective 2: U1A2: My Perfect Job<br>   ●  Objective 3: U1A2: My Perfect Job |

# Unit 2: Learning the Basics

| Idaho Standards | Unit Objectives |
|---|---|
| **ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.<br>ABET-7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. |    ●  identify basic electrical and electronic components, including the parts of an Arduino board.<br>   ●  construct a simple Arduino project.<br>   ●  explain the requirements for a Bachelor of Science (BS) degree in electrical engineering (EE), computer engineering (CE), or computer science (CS) at BSU and other Idaho universities. |
| Lesson 1: Electronic Devices and Their Connection | |
| Lesson Objectives<br>   1.  identify basic electrical and electronic components.<br>      ○  correlation: ABET-1<br>   2.  describe how electricity flows in a circuit using the water analogy and basic terminology.<br>      ○  correlation: ABET-1 | Assessments<br>   ●  Objective 1: U2L1: Electronic Devices and Their Connection–Drawing the Circuit interactive<br>   ●  Objective 2: U2A1: Electronic Devices and Their Connections Quiz |
| Lesson 2: First Arduino Project | |
| Lesson Objectives | Assessments |

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| 1. complete the Arduino setup process for your device.<br>    ○ correlation: ABET-6<br>2. demonstrate the first LED blinking light and modify the code slightly to change behavior.<br>    ○ correlation: ABET-6 | ● Objective 1: U2A2: Arduino Setup<br>● Objective 2: U2A2: Arduino Setup |
| Lesson 3: Building a Simple Circuit | |
| Lesson Objectives<br>1. construct a simple Arduino project on the breadboard and show it behaves correctly.<br>    ○ correlation: ABET-6 | Assessments<br>● Objective 1: U2D1: Circuit Building Reflections |
| Lesson 4: EE, CE, and CS in College | |
| Lesson Objectives<br>1. compare and contrast the requirements for electrical engineering (EE), computer engineering (CE), and computer science (CS) degrees at Idaho universities.<br>    ○ correlation: ABET-7 | Assessments<br>● Objective 1: U2D2: Comparing Program Requirements |

# Unit 3: Becoming an Engineer

| Idaho Standards | Unit Objectives |
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| **Next Generation Science Standards**<br>HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions.<br>HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs.<br><br>**ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-2 an ability to apply engineering design to produce solutions that meet specified needs with consideration of public | ● identify major issues in ethics that might be experienced as an engineer.<br>● describe ways to improve your current study habits and explain some of the theory behind how we learn.<br>● complete a more advanced Arduino UNO R3 project and report your experience. |

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| health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.<br>ABET-3 an ability to communicate effectively with a range of audiences.<br>ABET-4 an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.<br>ABET-7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | |
| Lesson 1: Ethics in Engineering | |
| Lesson Objectives<br>  1. describe the differences and similarities between ethics and morals.<br>     ○ correlation: HS-ETS1-1, ABET-4<br>  2. identify issues of ethics that are critical for professional engineers and computer scientists.<br>     ○ correlation: HS-ETS1-1, ABET-3, ABET-4<br>  3. apply personal or professional ethics to example cases.<br>     ○ correlation: HS-ETS1-3, ABET-3, ABET-4 | Assessments<br>  ● Objective 1: U3L1: Ethics in Engineering–What Are Ethics? interactive<br>  ● Objective 2: U3D1: An Ethical Dilemma Example<br>  ● Objective 3: U3D1: An Ethical Dilemma Example |
| Lesson 2: Having a Growth Mindset | |
| Lesson Objectives<br>  1. identify strategies to help you be successful in college.<br>     ○ correlation: ABET-7<br>  2. describe the research into the science of learning.<br>     ○ correlation: ABET-7 | Assessments<br>  ● Objective 1: U3A1: Growth Mindset and Study Habits Notes<br>  ● Objective 2: U3A1: Growth Mindset and Study Habits Notes |
| Lesson 3: Effective Study Habits | |
| Lesson Objectives<br>  1. identify strategies to help you be successful in college.<br>     ○ correlation: ABET-7<br>  2. describe the research into the science of learning. | Assessments<br>  ● Objective 1: U3A1: Growth Mindset and Study Habits Notes<br>  ● Objective 2: U3A1: Growth Mindset and Study Habits |

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| ○ correlation: ABET-7 | Notes |
| **Lesson 4: Intermediate Arduino Project** | |
| Lesson Objectives<br>   1.  explain the role of sensors in Arduino projects.<br>       ○  correlation: ABET-1<br>   2.  complete an Arduino project that uses an LCD display as an output device.<br>       ○  correlation: ABET-2 | Assessments<br>  ●  Objective 1: U3A2: Thermometer Project Reflection<br>  ●  Objective 2: U3A2: Thermometer Project Reflection |

# Unit 4: Circuit Analysis Basics

| Idaho Standards | Unit Objectives |
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| **ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. | ● identify various circuit topologies.<br>● analyze series and parallel resistor networks.<br>● analyze electronic circuits using simple measurement equipment. |
| **Lesson 1: Circuit Topologies** | |
| Lesson Objectives<br>   1.  differentiate between series and parallel elements in a circuit.<br>       ○  correlation: ABET-1<br>   2.  calculate the effective resistance of networks of resistors.<br>       ○  correlation: ABET-1, ABET-6 | Assessments<br>  ●  Objective 1: U4L1: Circuit Topologies–Knowledge Check: Series and Parallel Resistor interactive<br>  ●  Objective 2: U4A1: Ohm's Law and Equivalent Resistance |
| **Lesson 2: Drawing Circuits in Tinkercad** | |
| Lesson Objectives<br>   1.  create a simple circuit using Tinkercad. | Assessments<br>  ●  Objective 1: U4A2: RGB LED Circuit Drawing |

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|   ○ correlation: ABET-1, ABET-6<br> 2. draw a circuit with more components in Tinkercad.<br>   ○ correlation: ABET-1, ABET-6 | ● Objective 2: U4A2: RGB LED Circuit Drawing |
| Lesson 3: Test and Measurement in Tinkercad | |
| Lesson Objectives<br> 1. measure current and voltage in a circuit.<br>   ○ correlation: ABET-1, ABET-6<br> 2. describe what a diode is and how it behaves in a circuit.<br>   ○ correlation: ABET-1, ABET-6 | Assessments<br>● Objective 1: U4A3: Tinkercad Drawing Analysis<br>● Objective 2: U4A3: Tinkercad Drawing Analysis |

# Unit 5: Success as an Engineer

| Idaho Standards | Unit Objectives |
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| **ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-2 an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.<br>ABET-3 an ability to communicate effectively with a range of audiences.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.<br>ABET-7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | ● identify opportunities for experiential learning during college.<br>● discuss how experiential learning could be part of your college plan.<br>● draw simple circuit schematics from an English-language description of the circuit.<br>● measure more complex circuit behavior. |
| Lesson 1: Experiential Learning | |
| Lesson Objectives<br> 1. describe the various opportunities available to learn more about an engineering career while you are in | Assessments<br>● Objective 1: U5D1: My Future Career Priorities Poster<br>● Objective 2: U5D1: My Future Career Priorities Poster |

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| college.<br>    ○ correlation: ABET-3, ABET-7<br>2. identify resources from the State of Idaho to help you going forward.<br>    ○ correlation: ABET-3, ABET-7 | |
| **Lesson 2: Drawing Schematics** | |
| Lesson Objectives<br>1. draw schematics using a schematic capture tool.<br>    ○ correlation: ABET-1<br>2. apply circuit analysis to schematics.<br>    ○ correlation: ABET-1 | Assessments<br>● Objective 1: U5A1: LED Schematic and Circuit<br>● Objective 2: U5A1: LED Schematic and Circuit |
| **Lesson 3: Tinkercad Project** | |
| Lesson Objectives<br>1. create a Tinkercad design for testing.<br>    ○ correlation: ABET-1, ABET-2, ABET-6<br>2. measure current in a circuit for a combination of voltage and resistor values.<br>    ○ correlation: ABET-1, ABET-2, ABET-6<br>3. write in order to report on your experiment.<br>    ○ correlation: ABET-1, ABET-2, ABET-6 | Assessments<br>● Objective 1: U5A2: LED Circuit Project Lab Data<br>● Objective 2: U5A2: LED Circuit Project Lab Data<br>● Objective 3: U5A2: LED Circuit Project Lab Data |

# Unit 6: Digital Logic

| Idaho Standards | Unit Objectives |
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| **Next Generation Science Standards**<br>HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, manageable problems.<br>HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. | ● convert between binary, decimal, and hexadecimal number systems.<br>● describe simple logic gates including schematic representation, truth tables, and functionality.<br>● simplify logic expressions using Boolean algebra. |

| ABET | |
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| **ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-3 an ability to communicate effectively with a range of audiences.<br>ABET-5 an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. | |
| Lesson 1: Logic Gates | |
| Lesson Objectives<br>1. convert between binary, decimal, and hexadecimal number systems.<br>    ○ correlation: ABET-1, ABET-6<br>2. describe the fundamental operations of digital logic gates.<br>    ○ correlation: ABET-1, ABET-6 | Assessments<br>● Objective 1: U6A1: Binary Conversions<br>● Objective 2: U6A2: Logic Gate Truth Tables |
| Lesson 2: How Are Logic Gates Made? | |
| Lesson Objectives<br>1. create truth tables to describe the function of logic gates.<br>    ○ correlation: ABET-1, ABET-6<br>2. create more complex functions from basic gates.<br>    ○ correlation: ABET-1, ABET-6 | Assessments<br>● Objective 1: U6A2: Logic Gate Truth Tables<br>● Objective 2: U6A2: Logic Gate Truth Tables |
| Lesson 3: Boolean Algebra | |
| Lesson Objectives<br>1. identify the rules of Boolean algebra.<br>    ○ correlation: HS-ETS1-2, HS-ETS1-4, ABET-3, ABET-5, ABET-6 | Assessments<br>● Objective 1: U6D1: Logic Gate Challenge<br>● Objective 2: U6D1: Logic Gate Challenge<br>● Objective 3: U6D1: Logic Gate Challenge |

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| 2. draw simple logic schematics with Scheme-it.<br>    ○ correlation: HS-ETS1-2, HS-ETS1-4, ABET-3, ABET-5, ABET-6<br>3. simplify Boolean algebra expressions.<br>    ○ correlation: HS-ETS1-2, HS-ETS1-4, ABET-3, ABET-5, ABET-6 | |

# Unit 7: What is a Computer?

| Idaho Standards | Unit Objectives |
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| **ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. | ● describe the functions that make up a modern computer including memory, storage, processing, and input/output devices.<br>● compare and contrast different types of memory and their advantage/disadvantages.<br>● explain the techniques used to perform high-speed addition in a modern CPU. |
| Lesson 1: How Does a Computer Compute? | |
| Lesson Objectives<br>1. identify hardware and software components of a computer.<br>    ○ correlation: ABET-1 | Assessments<br>● Objective 1: U7A1: Hardware and Software |
| Lesson 2: Memory and Storage | |
| Lesson Objectives<br>1. describe different types of computer memory (DRAM, SRAM, registers, Flash, ROM, etc.).<br>    ○ correlation: ABET-1<br>2. compare performance and cost of different memory types.<br>    ○ correlation: ABET-6 | Assessments<br>● Objective 1: U7A2: Types of Memory<br>● Objective 2: U7A2: Types of Memory |
| Lesson 3: The Brains of the Computer (CPU) | |

| Lesson Objectives | Assessments |
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| 1. describe the flow of instructions and data through the CPU of a computer.<br>    ○ correlation: ABET-1<br>2. explain how and why computers can do arithmetic so quickly.<br>    ○ correlation: ABET-6 | ● Objective 1: U7A3: The CPU Flow<br>● Objective 2: U7A3: The CPU Flow |
| **Lesson 4: Simple Computer Programming** | |
| Lesson Objectives | Assessments |
| 1. identify the primary constructs used in most high-level programming languages.<br>    ○ correlation: ABET-1 | ● Objective 1: U7A4: Computer Programming |

# Unit 8: What's Next?

| Idaho Standards | Unit Objectives |
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| **Next Generation Science Standards**<br>HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions.<br>HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, manageable problems.<br>HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs.<br>HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.<br><br>**ABET**<br>ABET-1 an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.<br>ABET-2 an ability to apply engineering design to produce | ● present the final Arduino project.<br>● identify future objectives and plans for education and career success.<br>● describe the hardware and software tools that engineers use. |

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| solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.<br>ABET-3 an ability to communicate effectively with a range of audiences.<br>ABET-5 an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.<br>ABET-6 an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.<br>ABET-7 an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | |
| **Lesson 1: What It Means to Study Electrical and Computer Engineering** | |
| Lesson Objectives<br>1. list education and career goals.<br>    ○ correlation: ABET-7<br>2. identify education paths for electrical and computer engineering.<br>    ○ correlation: ABET-7<br>3. describe computer science education opportunities.<br>    ○ correlation: ABET-7 | Assessments<br>● Objective 1: U8A1: My Perfect Job, Take Two<br>● Objective 2: U8A1: My Perfect Job, Take Two<br>● Objective 3: U8A1: My Perfect Job, Take Two |
| **Lesson 2: Tools of Engineering and Computer Science** | |
| Lesson Objectives<br>1. describe several pieces of lab equipment seen in a BSU ECE lab.<br>    ○ correlation: ABET-1<br>2. describe some of the software tools used by engineers and computer scientists in school and in the workforce.<br>    ○ correlation: ABET-1 | Assessments<br>● Objective 1: U8A2: Engineering and Computer Science Tools<br>● Objective 2: U8A2: Engineering and Computer Science Tools |
| **Lesson 3: Presenting Your Arduino Project** | |

| Lesson Objectives | Assessments |
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| 1. create a presentation describing your final Arduino project.<br> ○ correlation: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4, ABET-1, ABET-2, ABET-3, ABET-5, ABET-6, ABET-7<br>2. provide feedback for your fellow classmates' Arduino project presentations.<br> ○ correlation: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ETS1-4, ABET-1, ABET-2, ABET-3, ABET-5, ABET-6, ABET-7 | ● Objective 1: U8A3: Arduino Project Presentation, U8D1: Arduino Presentation Peer Celebrations<br>● Objective 2: U8D1: Arduino Presentation Peer Celebrations |