















# Multiple Category Scope and Sequence: Scope and Sequence Report For Course Standards and Objectives, Content, Skills, Vocabulary

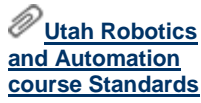
Wednesday, August 20, 2014, 2:59PM



Unit	Course Standards and Objectives	Content	Skills	Vocabulary	
Hunter High Advanced <b>Automation &amp; Robotics (21.0117)</b> 2014-2015 <b>Watson, Scott</b>	<b>History of Robotics (Basic)</b>  (Week 1, 1 Week) 	 <b>Robotics &amp; Automation Standards.pdf</b>	<ul style="list-style-type: none"> <li>The word "android"</li> <li>Builds an automated loom that is controlled with punched cards</li> <li>"Difference Engine"</li> <li>remote-controlled vehicle</li> <li>The word ROBOT is used for the first time in the context of mechanical people</li> <li>"Laws of Robotics".</li> <li>The "Turing Test".</li> </ul>	<ul style="list-style-type: none"> <li>Students will be able to recite major events in robotics history</li> </ul>	<ul style="list-style-type: none"> <li>Robot</li> <li>Android</li> <li>Drone</li> <li>Automation</li> <li>Artificial Intelligence</li> </ul>
	<b>History of Robotics (Advanced)</b>  (Week 20, 1 Week) 	 <b>Robotics &amp; Automation Standards.pdf</b>	<ul style="list-style-type: none"> <li>The word "android"</li> <li>Builds an automated loom that is controlled with punched cards</li> <li>"Difference Engine"</li> <li>remote-controlled vehicle</li> <li>The word ROBOT is used for the first time in the context of mechanical people</li> <li>"Laws of Robotics".</li> <li>The "Turing Test".</li> </ul>	<ul style="list-style-type: none"> <li>Students will be able to recite major events in robotics history</li> </ul>	<ul style="list-style-type: none"> <li>Robot</li> <li>Android</li> <li>Drone</li> <li>Automation</li> <li>Artificial Intelligence</li> </ul>
	<b>Safety</b>  (Week 1, 1 Week) 	 <b>Utah Robotics and Automation Course Standards</b>	<p>The reason and purpose of safety regulations</p> <ul style="list-style-type: none"> <li>Safe practice around electrical circuitry</li> <li>Basic hand and power tool safety</li> </ul>	<p>State reasons why we have safety regulations</p> <ul style="list-style-type: none"> <li>Discuss general safety practices to observe around electrical circuits</li> <li>Demonstrate proper hand and power tool use.</li> </ul>	<p>Circuit Breaker</p> <ul style="list-style-type: none"> <li>Lock-out tag-out</li> <li>Material Safety Data Sheets (MSDS)</li> <li>Fatal Current</li> <li>Lethal Voltage</li> </ul>
	<b>Competition Safety</b>  (Week 20, 1 Week) 	 <b>Utah Robotics and Automation Course Standards</b>	<p>The reason and purpose of safety regulations</p> <ul style="list-style-type: none"> <li>Safe practice around electrical circuitry</li> <li>Basic hand and power tool safety</li> </ul>	<p>State reasons why we have safety regulations</p> <ul style="list-style-type: none"> <li>Discuss general safety practices to observe around electrical circuits</li> <li>Demonstrate proper hand and power tool use.</li> </ul>	<p>Circuit Breaker</p> <ul style="list-style-type: none"> <li>Lock-out tag-out</li> <li>Material Safety Data Sheets (MSDS)</li> <li>Fatal Current</li> <li>Lethal Voltage</li> </ul>

**Engineering Design Process (Basic)**

(Week 2, 3 Weeks)



The 3 stages of the engineering design process

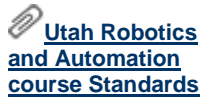
(Conceptual stage, Development stage, and evaluation stage)

- The students will be able to perform the steps necessary to complete the conceptual stage of the engineering design process.
- The students will be able to perform the steps necessary to complete the development stage of the engineering design process.
- The students will be able to perform the steps necessary to complete the evaluation stage of the engineering design process.

- conceptual design problem statement
- constraints
- brainstorm
- development
- prototype
- engineering drawing
- reengineering
- testing

**Engineering Design Process (Advanced)**

(Week 22, 3 Weeks)



The 3 stages of the engineering design process

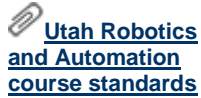
(Conceptual stage, Development stage, and evaluation stage)

- The students will be able to perform the steps necessary to complete the conceptual stage of the engineering design process.
- The students will be able to perform the steps necessary to complete the development stage of the engineering design process.
- The students will be able to perform the steps necessary to complete the evaluation stage of the engineering design process.

- conceptual design problem statement
- constraints
- brainstorm
- development
- prototype
- engineering drawing
- reengineering
- testing

**Mechanical Advantage and Power Efficiency (Basic)**

(Week 5, 2 Weeks)




- The six simple machines defined by Renaissance scientists
- How to analyze the effects of various forces on a mechanical device.
- How to calculate and demonstrate mechanical advantage of gears, pulleys, and levers.
- How to calculate and measure mechanical rates
- Describe the effects of friction.
- Describe power and efficiency

- Students will be able to identify, understand, and utilize mechanical advantage and power efficiency to perform robotic tasks. These tasks will include concepts of force, torque, mechanical rates and friction.

- Levers
- Wheel and axle
- Pulley
- Inclined plane
- Wedge
- Screw
- Gravitational forces
- Friction or drag forces
- Normal force
- Horizontal and vertical forces
- Rotational forces called torque
- Mechanical advantage
- Gear
- Pulley
- Lever
- Mechanical rate
- Linear velocity
- Linear acceleration
- Angular speed
- Angular acceleration.

## Mechanical Advantage and Power Efficiency

(Advanced)  (Week 24, 2 Weeks) 


 Utah Robotics and Automation course standards

- The six simple machines defined by Renaissance scientists
  - How to analyze the effects of various forces on a mechanical device.
  - How to calculate and demonstrate mechanical advantage of gears, pulleys, and levers.
  - How to calculate and measure mechanical rates
  - Describe the effects of friction.
  - Describe power and efficiency
- Students will be able to identify, understand, and utilize mechanical advantage and power efficiency to perform robotic tasks. These tasks will include concepts of force, torque, mechanical rates and friction.

- Friction.
  - Mechanical power
  - Horse power
  - Watts
- 
- Levers
  - Wheel and axle
  - Pulley
  - Inclined plane
  - Wedge
  - Screw
  - Gravitational forces
  - Friction or drag forces
  - Normal force
  - Horizontal and vertical forces
  - Rotational forces called torque
  - Mechanical advantage
  - Gear
  - Pulley
  - Lever
  - Mechanical rate
  - Linear velocity
  - Linear acceleration
  - Angular speed
  - Angular acceleration.
  - Friction.
  - Mechanical power
  - Horse power
  - Watts

## Energy Sources and Power Conversion

(Basic)  (Week 7, 1 Week) 

 Utah Robotics and Automation course standards

- Identify energy sources and the process of energy conversion.
  - Describe energy ratings
  - Explain how energy in a robotic system is converted and used
  - Use a batteries, solar cells or generator to provide energy for the operation of small motors and other mechanical devices.
  - Identify batteries and describe their uses and
- The student will be able to identify sources of energy and the process of energy conversion.
  - The students will be able to describe energy ratings such as amp/hour and kilowatt/hour
  - The students will be able to explain how energy in a robotic system is converted and used
  - The students will be able to use a batteries, solar cells or generators to provide energy for the operation of small motors and other mechanical devices
  - The students will be able to identify

- Energy Sources
- Energy conversion
- Amp/hour
- Kilowatt/hour
- Chemical energy
- electrical energy
- magnetic energy
- mechanical energy
- heat energy

## Energy Sources and Power Conversion

(Advanced)  (Week

26, 1 Week) 

## Utah Robotics and Automation course standards

- hazards
- Properly connect and disconnect batteries and power supplies
- Define and calculate increase performance through series and parallel connections

- Identify energy sources and the process of energy conversion.
- Describe energy ratings
- Explain how energy in a robotic system is converted and used
- Use a batteries, solar cells or generator to provide energy for the operation of small motors and other mechanical devices.
- Identify batteries and describe their uses and hazards
- Properly connect and disconnect batteries and power supplies
- Define and calculate increase performance through series and parallel connections

batteries and describe their uses and hazards.

- The students will be able to properly connect and disconnect batteries and power supplies.

- The student will be able to identify sources of energy and the process of energy conversion.
- The students will be able to describe energy ratings such as amp/hour and kilowatt/hour
- The students will be able to explain how energy in a robotic system is converted and used
- The students will be able to use a batteries, solar cells or generators to provide energy for the operation of small motors and other mechanical devices
- The students will be able to identify batteries and describe their uses and hazards.
- The students will be able to properly connect and disconnect batteries and power supplies.

- Energy Sources
- Energy conversion
- Amp/hour
- Kilowatt/hour
- Chemical energy
- electrical energy
- magnetic energy
- mechanical energy
- heat energy

## Robot Electronics

(Basic)  (Week 8, 2

Weeks) 


## Utah Robotics and Automation course standards

- State series circuit characteristics
- Calculate theoretical voltage, resistance, current, and electrical power values in a series resistor circuit.
- State parallel circuit characteristics
- Calculate theoretical voltage, resistance, current, and electrical power values in a parallel resistor circuit.
- Basic common digital logic gate operation
- How to use Boolean Algebra to simplify digital logic
- Multi-meter settings and whether item being tested power is on or off when

- Students will be able to state series circuit characteristics
- Students will be able to calculate theoretical voltage, resistance, current, and electrical power values in a series resistor circuit.
- Students will be able to state parallel circuit characteristics
- Students will be able to calculate theoretical voltage, resistance, current, and electrical power values in a parallel resistor circuit.
- Students will be able to describe the basic logic operation of the common digital logic gate types.
- Students will be able to use Boolean algebra to simplify a digital logic expression.
- Students will select the correct multimeter

- Voltage
- Current
- Resistance
- Ohm's Law
- Kirchhoff's law
- Power
- Series
- Parallel
- GATE
- INVERTOR
- AND
- OR
- NAND
- NOR
- Exclusive OR
- Exclusive NOR
- Boolean Algebra
- Multimeter

**Robot Electronics**  
**(Advanced)**  (Week  
 26, 2 Weeks) 



 **Utah Robotics  
 and Automation  
 course standards**


- using the setting.
- State series circuit characteristics
- Calculate theoretical voltage, resistance, current, and electrical power values in a series resistor circuit.
- State parallel circuit characteristics
- Calculate theoretical voltage, resistance, current, and electrical power values in a parallel resistor circuit.
- Basic common digital logic gate operation
- How to use Boolean Algebra to simplify digital logic
- Multi-meter settings and whether item being tested power is on or off when using the setting.

setting, meter lead connection points and circuit power setting to test voltage, current, or resistance.

- Students will be able to state series circuit characteristics
- Students will be able to calculate theoretical voltage, resistance, current, and electrical power values in a series resistor circuit.
- Students will be able to state parallel circuit characteristics
- Students will be able to calculate theoretical voltage, resistance, current, and electrical power values in a parallel resistor circuit.
- Students will be able to describe the basic logic operation of the common digital logic gate types.
- Students will be able to use Boolean algebra to simplify a digital logic expression.
- Students will select the correct multimeter setting, meter lead connection points and circuit power setting to test voltage, current, or resistance.

- Ohmmeter
- Voltmeter
- Ammeter
- Voltage
- Current
- Resistance
- Ohm's Law
- Kirchhoff's law
- Power
- Series
- Parallel
- GATE
- INVERTOR
- AND
- OR
- NAND
- NOR
- Exclusive OR
- Exclusive NOR
- Boolean Algebra
- Multimeter
- Ohmmeter
- Voltmeter
- Ammeter

**Technology Systems**  
**(Basic)**  (Week 10, 2  
 Weeks) 


 **Utah Robotics  
 and Automation  
 course standards**

- The elements of a technological system.
- Device control flow chart.
- Electrical control devices

- Students will be able to identify the elements of a technological system.
- Students will be able to create device control flow chart.
- Students will identify the input, process, output, and feedback parts of a system.
- Students will be able to explain Closed-Loop and Open-Loop systems.
- Students will be able to connect sensors to obtain feedback signals to control robot movement.

- Technological system
- Flow chart
- Input
- Process
- Output
- Feedback
- Closed-Loop
- Open-Loop
- Sensors

**Technology Systems**  
**(Advanced)**  (Week  
 28, 2 Weeks) 

 **Utah Robotics  
 and Automation  
 course standards**

- The elements of a technological system.
- Device control flow chart.
- Electrical control devices

- Students will be able to identify the elements of a technological system.
- Students will be able to create device control flow chart.
- Students will identify the input, process, output, and feedback parts of a system.
- Students will be able to explain Closed-Loop and Open-Loop systems.
- Students will be able to connect sensors to obtain feedback signals to control robot

- Technological system
- Flow chart
- Input
- Process
- Output
- Feedback
- Closed-Loop
- Open-Loop



**Robot Control Devices (Basic)**  (Week 12, 3 Weeks) 


 **Utah Robotics and Automation course standards**

- Flip-flop operation
- shift register operation
- frequency divider and counter operation
- sequential logic operation

- movement.
- Students will be able to describe Flip-flop operation
- Students will be able to describe shift register operation
- Students will be able to describe frequency divider and counter operation
- Students will be able to describe sequential logic operation

- Sensors
- flip-flops
- shift registers
- counters
- dividers
- sequential logic



**Robot Programming (Basic)**  (Week 15, 3 Weeks) 


 **Utah Robotics and Automation course standards**

- program specification tables
- program flow charts
- decision logic
- branching
- loops

- Students will be able to create program specification tables
- Students will be able to create program flow charts
- Students will be able to create decision logic
- Students will be able to create branching logic
- Students will be able to create loop structures

- flow chart
- specification table
- low level
- high level
- sequential
- object oriented
- loop
- branching
- 



**Robot Control Devices (Advanced)**  (Week 30, 3 Weeks) 


 **Utah Robotics and Automation course standards**

- Flip-flop operation
- shift register operation
- frequency divider and counter operation
- sequential logic operation

- Students will be able to describe Flip-flop operation
- Students will be able to describe shift register operation
- Students will be able to describe frequency divider and counter operation
- Students will be able to describe sequential logic operation

- flip-flops
- shift registers
- counters
- dividers
- sequential logic

**Robot Programming (Advanced)**  (Week 32, 3 Weeks) 


 **Utah Robotics and Automation course standards**

- program specification tables
- program flow charts
- decision logic
- branching
- loops

- Students will be able to create program specification tables
- Students will be able to create program flow charts
- Students will be able to create decision logic
- Students will be able to create branching logic
- Students will be able to create loop structures

- flow chart
- specification table
- low level
- high level
- sequential
- object oriented
- loop
- branching
- 

**Mechanical System Comparison (Basic)**  (Week 18, 1 Week) 


 **Utah Robotics and Automation course standards**

- The industrial application of robotic systems using:
  - Stepper motors
  - Hydraulics
  - Pneumatics

- The students will be able to describe the industrial application of stepper motors, hydraulics and, pneumatics in a robotic system.

- Automation
- Programmable Logic Controller (PLC)
- stepper motor
- hydraulics

**Mechanical System Comparison**  
**(Advanced)**  (Week 35, 1 Week) 


 **Utah Robotics and Automation course standards**

- The industrial application of robotic systems using:
  - Stepper motors
  - Hydraulics
  - Pneumatics

- The students will be able to describe the industrial application of stepper motors, hydraulics and, pneumatics in a robotic system.

- pneumatics
- Automation
- Programmable Logic Controller (PLC)
- stepper motor
- hydraulics
- pneumatics

**Industrial Application of Robotics (Basic)**  (Week 18, 1 Week) 


 **Utah Robotics and Automation course standards**

- The uses of robotics in industry and how it impacts manufacturing and production.

- Identify the advantages and disadvantages of automated assembly lines.
- Describe how robotics can improve manufacturing safety.
- Identify five or more industries that utilize robotic applications.

- Automation
- Programmable Logic Controller (PLC)
- stepper motor
- hydraulics
- pneumatics

**Industrial Application of Robotics**  
**(Advanced)**  (Week 36, 1 Week) 


 **Utah Robotics and Automation course standards**

- The industrial application of robotic systems using: Stepper motors, Hydraulics and, Pneumatics
- The uses of robotics in industry and how it impacts manufacturing and production.

- Identify the advantages and disadvantages of automated assembly lines.
- Describe how robotics can improve manufacturing safety.
- Identify five or more industries that utilize robotic applications.

- Automation
- Programmable Logic Controller (PLC)
- stepper motor
- hydraulics
- pneumatics

**Ethical and Social Impact of Robotics**  
**(Basic)**  (Week 18, 2 Weeks) 


 **Utah Robotics and Automation course standards**

- How to effectively use robot and automation technology.
- How to be effective and responsible robot and automation technology users.

- Practice safe, legal and responsible use of robotics and automation technology.
- Understand and evaluate different robotics and automation topologies and security methods.
- Define and describe intellectual property, piracy, copyright, licensing, and Creative Commons.

- Social Impact
- Ethics
- Technological Unemployment

**Ethical and Social Impact of Robotics**  
**(Advanced)**  (Week 37, 1 Week) 

 **Utah Robotics and Automation course standards**

- How to effectively use robot and automation technology.
- How to be effective and responsible robot and automation technology users.

- Practice safe, legal and responsible use of robotics and automation technology.
- Understand and evaluate different robotics and automation topologies and security methods.
- Define and describe intellectual property, piracy, copyright, licensing, and Creative Commons.

- Social Impact
- Ethics
- Technological Unemployment



**Educational and Career pathways in**

 **Utah Robotics and Automation**

- How to plan for a successful

- Students will be able to describe the

- Occupation
- Professional

**Robotics (Basic)**   
(Week 18, 2 Weeks) 


**course standards**

career

actions necessary to plan a career.

- Association
- Trade Journal
- Advanced Training
- Employment Opportunity

**Educational & Career pathways in Robotics (Advanced)**   
(Week 38, 1 Week) 

 **Utah Robotics and Automation course standards**

- How to plan for a successful career

- Students will be able to describe the actions necessary to plan a career.

- Occupation
- Professional Association
- Trade Journal
- Advanced Training
- Employment Opportunity

