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 **Automation & Robotics (21.0117)** 2014-2015 **Watson, Scott**	**History of Robotics (Basic)** (Week 1, 1 Week)	**Robotics & Automation Standards.pdf**	▪ The word "android" ▪ Builds an automated loom that is controlled with punched cards ▪ "Difference Engine" ▪ remote-controlled vehicle ▪ The word ROBOT is used for the first time in the context of mechanical people ▪ “Laws of Robotics”. ▪ The "Turing Test".	▪ Students will be able to recite major events in robotics history	▪ Robot ▪ Android ▪ Drone ▪ Automation ▪ Artificial Intelligence
	History of Robotics (Advanced) (Week 20, 1 Week)	**Robotics & Automation Standards.pdf**	▪ The word "android" ▪ Builds an automated loom that is controlled with punched cards ▪ "Difference Engine" ▪ remote-controlled vehicle ▪ The word ROBOT is used for the first time in the context of mechanical people ▪ “Laws of Robotics”. ▪ The "Turing Test".	▪ Students will be able to recite major events in robotics history	▪ Robot ▪ Android ▪ Drone ▪ Automation ▪ Artificial Intelligence
	Safety (Week 1, 1 Week)	**Utah Robotics and Automation Course Standards**	The reason and purpose of safety regulations ▪ Safe practice around electrical circuitry ▪ Basic hand and power tool safety	State reasons why we have safety regulations ▪ Discuss general safety practices to observe around electrical circuits ▪ Demonstrate porper hand and power tool use.	Circuit Breaker ▪ Lock-out tag-out ▪ Material Safety Data Sheets (MSDS) ▪ Fatal Current ▪ Lethal Voltage
	Competition Safety (Week 20, 1 Week)	**Utah Robotics and Automation Course Standards**	The reason and purpose of safety regulations ▪ Safe practice around electrical circuitry ▪ Basic hand and power tool safety	State reasons why we have safety regulations ▪ Discuss general safety practices to observe around electrical circuits ▪ Demonstrate porper hand and power tool use.	Circuit Breaker ▪ Lock-out tag-out ▪ Material Safety Data Sheets (MSDS) ▪ Fatal Current ▪ Lethal Voltage

Engineering Design Process (Basic) (Week 2, 3 Weeks)	**Utah Robotics and Automation course Standards**	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)	**Utah Robotics and Automation course Standards**	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)	**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.	▪ 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
Mechanical Advantage and Power Efficiency (Advanc) (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.	▪ 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

		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.	
Energy Sources and Power Conversion (Advanced) (Week 26, 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 hazards ▪ Properly connect and disconnect batteries and power supplies ▪ Define and calculate increase performance through series and parallel connections	▪ 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

		using the setting.	setting, meter lead connection points and circuit power setting to test voltage, current, or resistance.	▪ Ohmmeter ▪ Voltmeter ▪ Ammeter
Robot Electronics (Advanced) (Week 26, 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 using the setting.	▪ 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.	▪ 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

			movement.	▪ Sensors
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	▪ 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 (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

				▪ pneumatics
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.	▪ 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 (Advan (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