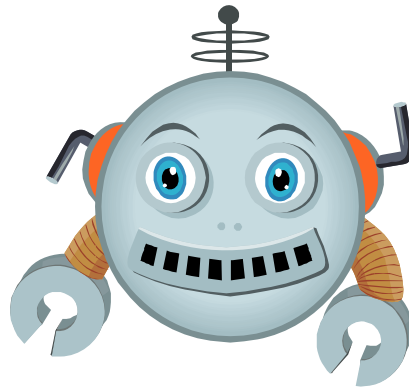




**This workforce solution was funded by a grant awarded under Workforce Innovation in Regional Economic Development (WIRED) as implemented by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require the prior authorization of the copyright owner.**



# Mechatronics Institute 2008

July 28 - July 31





Name: \_\_\_\_\_

## Summer 2008 Mechatronics Institute Pre-Course Survey

1. Have you ever taken an electronics course? If so, where was it held and how long was the course?
  
2. Can you name five circuit components and describe their basic function in a circuit? If yes, do so in the space provided here.
  
  
  
  
  
  
  
  
  
  
3. Can you name electrical sensors that react to the following?
  - Light
  - Heat
  - Rotation
  - Electromagnetic waves
  - Pressure
  - Magnets
  
  
  
  
  
  
  
  
  
  
4. Name some of the performance measures of sensors.
  
  
  
  
  
  
  
  
  
  
5. What is meant by "signal conditioning"?



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6. Why are gears used with motors in driving vehicles?
  
7. Can you describe the difference between a **cam** and a **bearing**?
  
8. Can you count from one to ten in binary?
  
9. Can you write the truth tables for the digital logic gates (AND, OR, NOT, XOR)?
  
10. What is a **microcontroller**?
  
11. Do you know how to program in BASIC language?
  
12. Have you done any of the following? Check those that are appropriate.
  - Built electronic kits
  - Breadboarded circuits
  - Built robot kits
  - Programmed a robot

# Mechatronics Institute

## Intro to Electronic Sensors and Robotics

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Monday, July 28<sup>th</sup>

### A. Number Systems

1. Binary (Lecture) (Handout) (Check for Understanding)
2. Hexadecimal (Lecture) (Check for Understanding)

### B. NIDA CAI on DC Industrial Electronics: Introduction to Electricity

1. Safety Practices
  - a. Electrical Shock
  - b. Electrical Safety
2. Metric Notation
  - a. Powers of Ten (NIDA Software)
  - b. Engineering Notation (Lecture)
  - c. Metric Prefixes (Lecture) (Check for Understanding)
3. Atoms, Voltage and Current (NIDA Software) (Check for Understanding)
  - a. Use of the Voltmeter (Demo) (Lab)
4. Resistors (NIDA Software)
  - a. Resistor Color Code (Lecture)
  - b. Use of the Ohmmeter (Demo) (Lab) (Check for Understanding)

### C. NIDA CAI on DC Industrial Electronics: Basic DC Circuits

1. Ohm's Law and Power (NIDA Software) (Check for Understanding)

### D. What's a Microcontroller?

1. Appendix F
  - a. Activity: Ohms Law, Voltage, Current and the Electric Circuit

2. Chapter 1: Getting Started

- a. Activity 3: Testing for Communications – (start at page 18)
- b. Activity 4: First Program
  - 1. New PBasic Instructions:
    - a. DEBUG
    - b. ‘ ‘ (adding comments)
    - c. “ “ (ASCII text declaration)
    - d. DEC (formatter command used to define as Decimal values)
    - e. CR (control character – carriage return)
    - f. END
  - c. Activity 5: Looking up Answers
  - d. Activity 6: When You’re Done

3. Chapter 2: Lights On – Lights Off

- a. Activity 2: On/Off Control with the Basic Stamp
  - 1. New PBasic Instructions:
    - a. Do . . .Loop
    - b. HIGH
    - c. LOW
    - d. PAUSE

# Mechatronics Institute

## Intro to Electronic Sensors and Robotics

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Tuesday, July 29<sup>th</sup>

3. Chapter 2: Lights on – Lights off
  - a. Activity : Counting and Repeating
    1. New PBasic Instructions
      - a. VAR
      - b. For . . NEXT
      - c. DEBUG?
    - b. Activity 4: Building and Testing a Second LED Circuit
    - c. Activity 5: Using Current Direction to Control a Bi-Color LED
4. Chapter 3: Activity 3: Push Button Control of LED
  - a. Activity 1: Testing a Pushbutton with a LED Circuit
  - b. Activity 2: Reading a Pushbutton with the Basic Stamp
    1. New PBasic Instructions:
      - a. IN(port number) (as ... IN3)
  - c. Activity 3: Pushbutton Control of an LED Circuit
    1. New PBasic Instructions:
      - a. If ... Then ... Else
      - b. ENDIF
  - d. Activity 4: Two Pushbuttons Controlling Two LED Circuits
  - e. Activity 5: Reaction Timer Test
    1. New PBasic Instructions:
      - a. UNTIL
5. Chapter 4: Controlling Motion
  - a. Activity 1: Connecting and Testing the servo
    1. New PBasic Instructions:
      - a. PULSOUT
  - b. Activity 2: Controlling Position with your Computer
  - c. Activity 3: Converting Position to Motion
    1. New PBasic Instructions:
      - a. STEP (FOR ...NEXT)
  - d. Activity 4: Pushbutton Controlled Servo

6. Chapter 5: Measuring Rotation

- a. Activity 1: Building and Testing the Potentiometer Circuit
- b. Activity 2: Measuring Resistance by Measuring Time
- c. Activity 3: Reading the Dial with the Basic Stamp
  - 1. New PBasic Instructions:
    - a. RCTIME
    - b. HOME
- d. Activity 4: Controlling a Servo with a Potentiometer



# Mechatronics Institute

## Intro to Electronic Sensors and Robotics

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Wednesday, July 30<sup>th</sup>

### E. Smart Sensors and Applications

1. Chapter 1: LCDS
  - a. Activity 1: Connecting and Testing the LCD
  - b. Activity 2: Displaying Simple Messages
    1. New PBasic Instructions:
      - a. SEROUT
      - b. CRSRXY
2. Chapter 2: The Ping))) Ultrasonic Distance Sensor
  - a. Activity 1: Measuring Echo Time
  - b. Activity 3: Inch Measurements

### F. Robotics with the Boe-Bot

1. Chapter 2: Your Boe-Bot's Servo Motors
  - a. Activity 1: How to Track Time and Repeat Actions
  - b. Activity 2: Tracking Time and Repeating Actions with a Circuit
  - c. Activity 3: Connecting the Servo Motors
  - d. Activity 4: Centering the Servos
  - e. Activity 5: How to Store Values and Count
  - f. Activity 6: Testing the Servos
2. Chapter 3: Assemble and Test Your Boe-Bot
  - a. Activity 2: Re-Test the Servos
  - b. Activity 3: Start/Reset Indicator Circuit and Program
  - c. Activity 4: Testing Speed Control with the Debug Terminal
3. Chapter 4: Boe-Bot Navigation
  - a. Activity 1: Basic Boe-Bot Maneuvers
  - b. Activity 2: Turning the Basic Maneuvers
  - c. Activity 3: Calculating Distances
  - d. Activity 3: Maneuvers – Ramping

- e. Activity 5: Simplify Navigation with Subroutines
- f. Activity 6: Advanced Topic – Building Complex Maneuvers in EEPROM

4. Chapter 5: Tactile Navigation with Whiskers

- a. Activity 1: Building and Testing the Whiskers
- b. Activity 2: Field Testing the Whiskers
- c. Activity 3: Navigation with Whiskers
- d. Activity 4: Artificial Intelligence and Deciding When You're Stuck



# Mechatronics Institute

## Intro to Electronic Sensors and Robotics

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Thursday, July 31<sup>st</sup>

5. Chapter 6: Light Sensitive Navigation with Photo-Resistors
  - a. Activity 1: Building and Testing Photo Resistor Circuits
  - b. Activity 2: Roam and Avoid Shadows, Like Objects
  - c. Activity 3: A More Responsive Shadow Controlled Boe-Bot
  - d. Activity 4: Getting More Information from Your Photo Resistor
  - e. Activity 5: Flashlight Beam Following Boe-Bot
  - f. Activity 6: Roaming toward the Light
  
6. Chapter 7: Navigating with Infrared Headlights
  - a. Activity 1: Building and Testing the IR Pairs
  - b. Activity 2: Field Testing for Object Detection and IR Interference
  - c. Activity 3: IR Detection Range Adjustments
  - d. Activity 4: Object Detection and Avoidance
  - e. Activity 5: High Performance IR Navigation
  - f. Activity 6: The Drop-Off Detector (Table Top)
  
7. Chapter 8: Robot Control with Distance Detection
  - a. Activity 1: Testing the Frequency Sweep
  - b. Activity 2: Boe-Bot Shadow Vehicle
  - c. Activity 3: Following a Stripe



Name: \_\_\_\_\_

## Summer 2008 Mechatronics Institute Post-Course Survey

1. Have you ever taken an electronics course? If so, where was it held and how long was the course?
2. Can you name five circuit components and describe their basic function in a circuit? If yes, do so in the space provided here.
3. Can you name electrical sensors that react to the following?
  - Light
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4. Name some of the performance measures of sensors.
5. What is meant by "signal conditioning"?



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12. Have you done any of the following? Check those that are appropriate.
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  - Built robot kits
  - Programmed a robot



## Summer 2008 Mechatronics Institute Evaluation Form

Dear Student:

We hope you had an enjoyable experience this past week at the Mechatronics Institute, an activity that has been funded in large part through our college's Department of Labor, Employment and Training Administration: WIRED Initiative and our National Science Foundation SpaceTEC grant. We are always looking for ways to improve this program, so please help us by providing feedback by answering the following questions.

1. What did you like best about the Mechatronics Institute?

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2. How can the Mechatronics Institute be improved?

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3. Would you recommend this Institute to a friend? Yes \_\_\_\_\_ No \_\_\_\_\_  
If you answered "No," please tell us why: \_\_\_\_\_

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4. Any other comment you'd like to share? \_\_\_\_\_

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