

**School:** Cornerstone Academy  
**Course Title:** Electronics Technology and Robotics 1  
**Course Credit:** ½

**Course Description:** Electronics Technology and Robotics 1 provide students with the knowledge, hands-on experience, and technical skill to:

- Describe the structure of matter related to electronics.
- Construct, conduct, and analyze experiments with basic dc and ac circuits and with circuits using magnetism.
- Identify, measure, and describe the function of transformers and inductors in electronic circuits.
- Use Ohm's law and Watt's law to analyze and experiment with resistive circuits.
- Construct, analyze, and experiment with capacitive circuits.
- Demonstrate the proper use of electronic equipment.
- Demonstrate proper electronic assembly methods, including soldering and printed circuit boards.
- Demonstrate an understanding of basic electrical and electronic circuits.
- Demonstrate the ability to use and maintain basic electronic circuits.
- Demonstrate safe and appropriate use of tools, machinery, and materials in electronics technology.
- Fabricate a line following robot using a comparator, printed circuit board, and gearhead motors.

**Course Requirements:**

- Each student must pass a mathematics entry exam. A sample test and an answer key may be found on the pages that following.

**Guidelines:**

- Students are expected to cooperate with Christian standards of behavior and conversation.
- Discussions and conversations in the classroom are to encourage and buildup all participants. The atmosphere in the classroom must be one of mutual respect. Requests and instruction by the instructor should not have to be repeated.
- The parent must come to the classroom to pick-up their student.

## Lessons and Assignments:

- All lessons and assignments are available on-line at: <http://www.cornerstonerobotics.org/curriculumyear1.php>. If changes are made to a lesson, those changes are posted prior to the date the lesson is given.
- When homework assignments are made, they are to reinforce problem solving skills taught in class. The assignments are in the form of the Student Activity Sheets from the The Study Guide and Laboratory Activities for Electricity & Electronics
- For logistical reasons, there are no makeup sessions for missed classes.

## Tests and Quizzes:

- A take-home quiz is given almost every week.
- Quizzes are **not** open book unless expressly stated by the instructor.
- Quizzes are administered at home by the student's parents or guardians and returned the following class period.
- All late quizzes are assessed a ten percent (10%) penalty for every class period late.
- A test is given at the end of each grading period.

## Grading:

- Tests and quizzes: 30 – 40%
- Labs 60 – 70%

## Textbooks and Study Guide:

- Electricity and Electronics by Gerrish, Dugger, and Roberts, The Goodheart-Willcox Company, Inc., Publisher
- Electricity and Electronics Study Guide with Laboratory Activities by Gerrish, Dugger, and Roberts, The Goodheart-Willcox Company, Inc., Publisher
- Robot Building for Beginners by David Cook, A! Publisher

May 31, 2008

Dear Parents,

Electronics Technology and Robotics 1 will be offered for the 2008 – 2009 school year as a credited course. The class is open to Cornerstone Academy and home school students who attend the eighth through twelfth grades. A list of pertinent items relating to the course follows:

- The class size will be limited to only eight students.
- The course fee for the school year is \$150.00 for students enrolled at Cornerstone Academy and \$200.00 for home school students. The fee covers expenses which include:
  - Parts for Sandwich, the line following robot (\$79.00, see the attached parts list).
  - The use of the textbook Electricity & Electronics by Gerrish, Dugger, and Roberts. The instructor retains ownership of the textbooks. If you would like to purchase the textbook, they are available for \$46.50 plus shipping.
  - Your copy of The Study Guide and Laboratory Activities for Electricity & Electronics (\$15.00 from the publisher).
  - Your copy of Robot Building for Beginners by David Cook (\$19.47 from Amazon.com).
  - Copies of the year's class notes (\$10.00)
  - Shipping for all course purchases.
- A mathematics pretest will be administered prior to the first class to qualify students for the course. I strongly suggest that the student take the attached sample test and practice any area of weakness. The answers to the pretest follow the Parts List for Sandwich.
- The course will be held on Thursdays from 3:00 until 6:00 pm.
- Lesson class notes are posted on the internet at:  
<http://cornerstonerobotics.org/curriculumyear1.php>
- Electronics Technology and Robotics 1 will not be taught again until the 2010 – 2011 school year.
- Parents or guardians must read and sign the Registration Form for their child to participate in the Cornerstone Electronics and Robotics program.



**Cornerstone Academy Cougars  
Electronics Technology & Robotics Registration Form**

(Please Print)

Student's Name: \_\_\_\_\_

Age: \_\_\_\_\_ Birthday: \_\_\_\_/\_\_\_\_/\_\_\_\_ Male/Female: \_\_\_\_\_ Grade Level: \_\_\_\_\_

Home Address: \_\_\_\_\_

Emergency Contact (Parent or Guardian): \_\_\_\_\_

Home Phone # ( ) \_\_\_\_\_ Emergency Phone # ( ) \_\_\_\_\_

Cell Phone # ( ) \_\_\_\_\_ Work Phone # ( ) \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Physician: \_\_\_\_\_ Hospital Preference: \_\_\_\_\_

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**Registration Deadline is August 30, 2008**

**Make checks payable to Cornerstone Academy**

**Write Robotics in the comment area.**

**Cost:**

- Cornerstone students - \$150 for the year.
- Non-Cornerstone students - \$200 for the year.
- All fees are non-refundable.

**Please Read Before Signing**

**I give my child permission to participate in Cornerstone Academy Electronics Technology and Robotics program. I agree to use my personal insurance if needed. I agree not to hold Cornerstone Academy or Mr. J K responsible for any injury or accident and authorize Mr. K to obtain medical care in the event of an injury or accident if a parent or guardian is unavailable to give permission. By the very nature of electronic and metal workshop activities, there is a risk of physical injury. The possible injuries include catastrophic injury, such as permanent paralysis and even death. The risk of physical injury can be minimized, but never eliminated.**

**This is a contract defining the terms of enrollment in this Electronics Technology and Robotics program between my family and Cornerstone Academy. This contract represents my commitment to the terms stated, and it is expected that my family and Cornerstone Academy will honor the terms of this contract. Cornerstone Academy reserves the right to add, change, limit, or cancel the event according to enrollment. I also give Cornerstone Academy permission to publish any photo that may be taken of me or my child for school use.**

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**Signature of Parent or Guardian**

**Date**

Cornerstone Academy admits students of any race, color, national and ethnic origin to all rights, privileges, programs and activities made available to students of the school. It does not discriminate on the basis of race, color, national and ethnic origin in the administration of its educational policies, admissions policies, financial assistance, athletics or any other school-administered programs.

## Sample Qualification Test for Electronics and Robotics Enrollment

Show your work for of the all questions.

1. Convert  $7/8$ " to decimal form.
2. Express .17 as a common fraction.
3. Express  $10^3$  as a whole number.
4. What percent of 24 is 6?
5. What is 20% of 60?
6. Give the percent that each resistor contributes to the total as well as the total percent for all of the resistors. Take your answers to the tenth of a percent. (3 points)

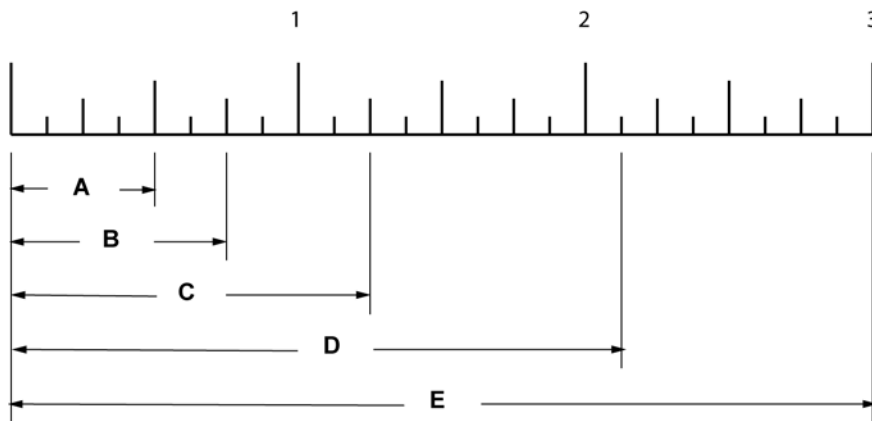
Resistor	Value in Ohms	%
1	56	
2	330	
3	470	
4	1000	
5	89	
Total:	1945	

7. If 1 inch equals 25.4 millimeters, express 2.3 inches as millimeters.

8. If  $V = I \times R$ , (where  $V$  is in volts,  $I$  is in amperes, and  $R$  is in ohms), and  $I = 2.9$  amperes and  $R = 78.5$  ohms, solve for  $V$ .

9. If  $X = Z \times T$ , solve for  $T$ .

10. Write the fraction or the mixed number that each length, A through E, represents.  
(5 points)



A = \_\_\_\_\_

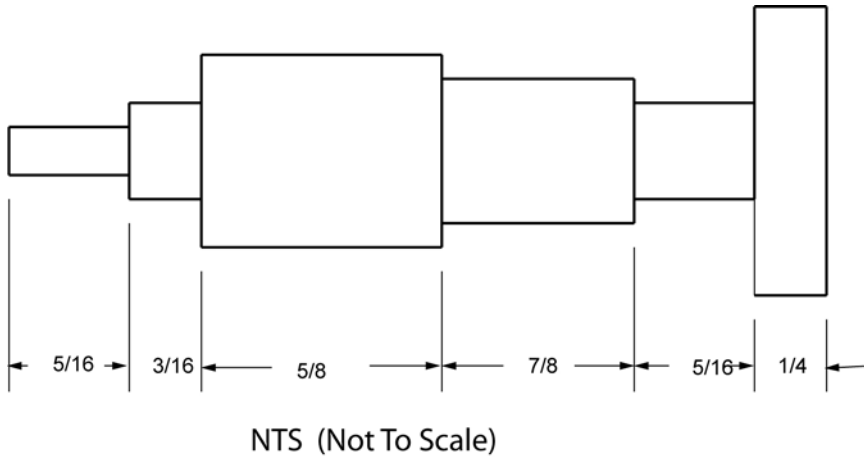
B = \_\_\_\_\_

C = \_\_\_\_\_

D = \_\_\_\_\_

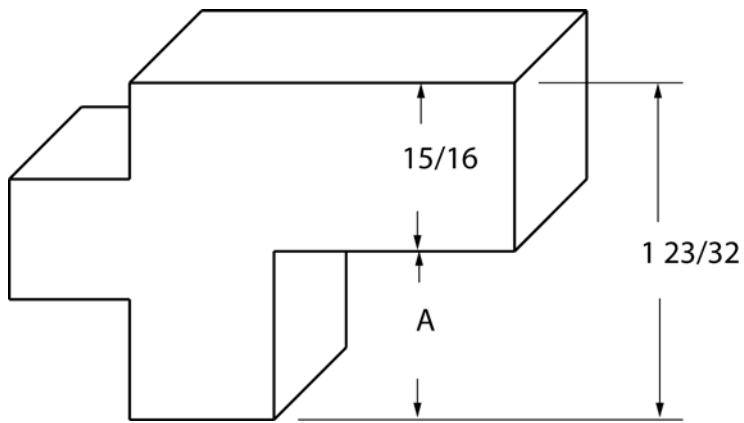
E = \_\_\_\_\_

11. Determine the total length of the shaft. Give your answer as a mixed number.



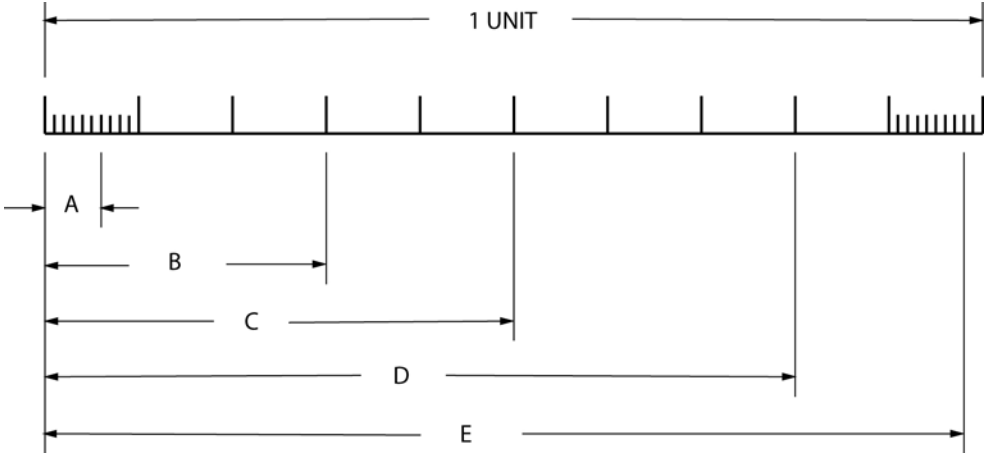
Shaft length = \_\_\_\_\_

12. Determine dimension A.



Dimension A = \_\_\_\_\_

13. Determine the decimal values of the distances A through E. (5 points)



A = \_\_\_\_\_

B = \_\_\_\_\_

C = \_\_\_\_\_

D = \_\_\_\_\_

E = \_\_\_\_\_

## Parts for Sandwich the Line Follower

Updated 6/1/08

Part Description	Source	Part #	Unit Cost	Quantity	Total Cost	Notes
<b>Electronics:</b>						
Yellow LED's	Electronics Express	08L53YD	\$0.08	3	\$0.24	Purchased in quantities of 100
Green LED's	Electronics Express	08L53GD	\$0.07	3	\$0.21	Purchased in quantities of 100
5000 mcd White LED's	Electronics Express	08LCHW5	\$0.80	5	\$4.00	Purchased in quantities of 10+
1N5817 Schottky Diode	Jameco	177949	\$0.12	2	\$0.24	Purchased in quantities of 10+
150 Ohm Resistor	Electronics Express	13.55150	\$0.03	4	\$0.12	Purchased in quantities of 200
1k Ohm Resistor	Electronics Express	13.551K	\$0.03	2	\$0.06	Purchased in quantities of 200
20k Ohm Tripot	Electronics Express	18STS25K	\$0.75	2	\$1.50	Purchased in quantities of 10+
Photoresistors Sensors	Jameco	169578	\$1.59	4	\$6.36	Purchased in quantities of 10+
DPDT Switch	Jameco	22841	\$1.31	1	\$1.31	Purchased in quantities of 10+
Power Switch	Radioshack	275-693	\$2.99	1	\$2.99	
2N2907A Transistors	Jameco	178520	\$0.08	2	\$0.16	Purchased in quantities of 10+
8-Pin DIP Socket	Jameco	112206	\$0.09	1	\$0.09	Purchased in quantities of 10+
LM393N Comparator	Jameco	24281	\$0.17	1	\$0.17	Purchased in quantities of 10+
Printed Circuit Board	Solarbotics	SandPCB	\$12.00	1	\$12.00	
1/8" Heat Shrink Tubing, Yellow	Digi-Key	FP332-Y-5-ND	\$0.35	1	\$0.35	Purchased in 5' lengths
3/32" Heat Shrink Tubing, Green	Digi-Key	FP332-G-5-ND	\$0.35	1	\$0.35	Purchased in 5' lengths
3/32" Heat Shrink Tubing, Red	Digi-Key	FP332-R-5-ND	\$0.35	1	\$0.35	Purchased in 5' lengths
3/32" Heat Shrink Tubing, Black	Digi-Key	FP332-K-5-ND	\$0.35	1	\$0.35	Purchased in 5' lengths
3/32" Heat Shrink Tubing, White	Digi-Key	FP332-W-5-ND	\$0.35	1	\$0.35	Purchased in 5' lengths
Molex KK Two-Pin Headers	Digi-Key	WM4200-ND	\$0.21	5	\$1.05	Purchased in quantities of 10+
Molex KK Two-Pin Housings	Digi-Key	WM2000-ND	\$0.13	5	\$0.65	Purchased in quantities of 10+
Molex KK Four-Pin Header	Digi-Key	WM4202-ND	\$0.37	1	\$0.37	Purchased in quantities of 10+
Molex KK Four-Pin Housings	Digi-Key	WM2002-ND	\$0.26	1	\$0.26	Purchased in quantities of 10+
Molex KK Crimp Terminals	Digi-Key	WM1114-ND	\$0.10	20	\$2.00	Purchased in quantities of 100
Crimping Tool	Digi-Key	WM9999-ND	\$50.75	1	-	Not included in unit costs
Wire, #22 AWG	-	-	-	-	-	Not included in unit costs
9 Volt Battery Snap	Electronics Express	2801BSI	\$0.20	1	\$0.20	Purchased in quantities of 10+
9 Volt Battery	Home Depot	-	\$2.40	1	\$2.40	Purchased in quantities of 4
<b>Motors:</b>						
Gearhead Motor, HNGH12-1324Y-R	Jameco	162191	\$16.01	2	\$32.02	Purchased in quantities of 10+
<b>Body &amp; Hardware:</b>						
Gladware Container	Grocery Store	3 1/8 Cup	\$0.60	1	\$0.60	Purchased in quantities of 5
M&M Candy Tube	Grocery Store	-	\$0.75	1	\$0.75	
9 Volt Battery Holder	RadioShack	270-326	\$0.50	1	\$0.50	Purchased in quantities of 2
#6 x 1" Long Nylon Round Spacer	Small Parts	RSN-06/16-25	\$0.10	4	\$0.40	Purchased in quantities of 25
#6 x 1 1/2" Stainless Steel Screw	Small Parts	MPX-0632-24P	\$0.06	4	\$0.24	Purchased in quantities of 100
#6/32 Nylon Insert Nut	Small Parts	HLNX-632	\$0.07	4	\$0.28	Purchased in quantities of 100
M2.5x6mm S/S Machine Screw	Small Parts	MPX-M025/06P-25	\$0.05	4	\$0.20	Purchased in quantities of 25
M2.5 Nylon Flat Washer	Small Parts	WN-M025-C	\$0.03	8	\$0.24	Purchased in quantities of 100
Wheels, Large Lawn Tire & Hub	Lego Education	Z970111	\$2.50	2	\$5.00	Purchased in quantities of 4
6-Stud Axle	Lego Education	Z970614	\$0.20	1	\$0.20	Purchased in quantities of 50
Wheel Couplings	Homemade on Lathe	-	-	2	-	
<b>Total:</b>					<b>\$78.56</b>	Costs exclude shipping & sales tax

### Source List:

Vendor Name	Website	Telephone	Notes:
Allied	alliedelec.com	800-433-5700	\$25.00 Minimum order over phone
Digi-Key	digikey.com	800-344-4539	\$5 Handling fee on orders < \$25
Electronics Express	eleexp.com	800-972-2225	\$20.00 Minimum order
Jameco	jameco.com	800-831-4242	\$20.00 Minimum order over phone
Lego Education-Pitsco	legoeducation.com	800-362-4308	No Minimum
RadioShack	radioshack.com	800-843-7422	No Minimum
Small Parts	smallparts.com	800-220-4242	\$20.00 Minimum order over phone
Solarbotics	solarbotics.com	866-276-2687	No Minimum

## Answers to the Sample Qualification Test for Electronics and Robotics Enrollment

1. 0.875
2. 17/100
3. 1,000
4. 25%
5. 12
- 6.

Resistor	Value in Ohms	%
1	56	2.9%
2	330	17.0%
3	470	24.2%
4	1000	51.4%
5	89	4.6%
Total:	1945	100.0%

7. 58.4 mm
8.  $V = 228$  volts
9.  $T = X/Z$
10.  $A = \frac{1}{2}$   
 $B = \frac{3}{4}$   
 $C = 1 \frac{1}{4}$   
 $D = 2 \frac{1}{8}$   
 $E = 3$
11.  $2 \frac{9}{16}$
12.  $25/32$
13.  $A = .06$   
 $B = .3$   
 $C = .5$   
 $D = .8$   
 $E = .98$