

Name _____

CM _____ Section _____

ME430 - Mechatronics

Examination I
December 13, 2012

Problem	Score
1	/ 10
2	/ 15
3	/ 12
4	/ 6
Total	/ 43

For the written portion of the exam, you may use only:

- Any paper notes (such as notes on the videos) you brought to the exam, so long as those notes were written by you or your lab partner.
- A pencil/pen.
- A calculator (optional).

For the computer portion of the exam, you may use only:

- Your computer
- Any paper notes (such as notes on the videos) you brought to the exam, so long as those notes were written by you or your lab partner.
- Any electronic notes or code residing on your local (C:) hard drive, so long as those notes/code were written by you or your lab partner.
- The course website. (This is the only approved use of the internet for this exam.)
- A calculator (optional).
- ANGEL for code submission.

Anything not specifically allowed is prohibited. In particular, you may not use notes or code written by someone outside your lab group.

Problem 1 – Operators:

What is stored in **unsigned char X** in each of the following cases?
(*beware of potential unsigned char overflow*)

Calculation**X value** $X = 7 / 3 * 3;$ $X = 7 * 3 / 3;$ $X = 7 * 40 / 3;$ $X = 0b0110 \& 0b0011;$ $X = 17 \% 4;$

Problem 2 – Resistor sizing:

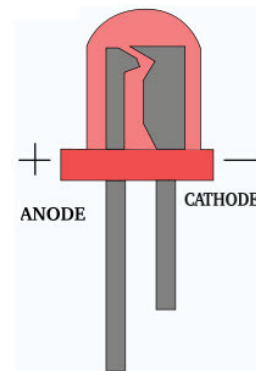
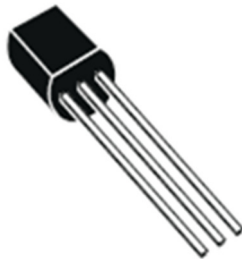
We have an LED with a 1.6 volt forward voltage drop that we'd like to run at 100 mA using a 24 volt power supply. Instead of having the LED on all the time, connect it to the BJT shown below. Instead of driving the BJT from a PIC we'll use a 2 volt signal to control the BJT. On the diagram below, make connections to the physical devices shown, don't redraw a schematic symbols for those items.

- Show calculations for your resistor sizes
- For any resistors, choose the real resistor size from the E12 (10%) series that is closest to the calculated value.
- Label resistor sizes on the diagram.

Signal that will
be at 2 volts



24 volts



Problem 3 – Number systems:

Assume humans were born with 12 fingers and we lived in a base 12 world where the symbol representing this many IIIII IIIII (what you know as 10) is @ and the symbol representing this many IIIII IIIII I (what you know as 11) is #. (Symbols for 0-9 are still 0-9 in that parallel dimension.) Write the number for this many IIIII IIIII IIIII IIIII III (what you know as 23) in that reality.

Using base 12 world symbols what is a maximum quantity you can represent with only 2 **unsigned** characters?

First, express this answer using two base 12 symbols.

base 12

Second, express your answer in base 10.

base 10

Problem 4 – Special Function registers:

Write the lines of code you'd use within the main function to turn on all 4 LEDs of the PICDEM board (only those 4 pins should be high).

```
#pragma code
void main(void)
{
```

```
    while(1) {
    }
}
```