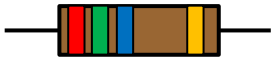
ELE 4142 HW1 Name_____

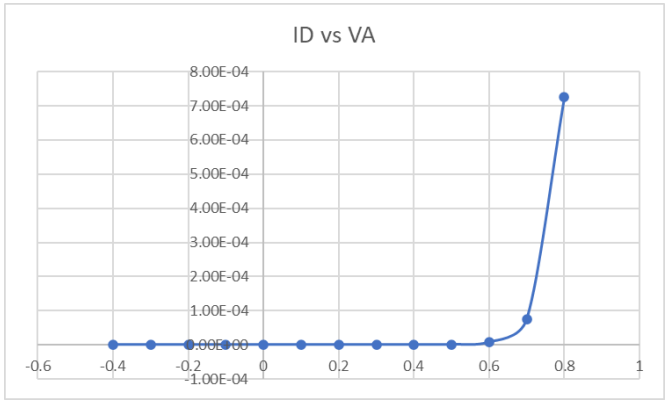
1 – Identify each resistor value 20pts



25MΩ – 5% 749Ω – 10% 10KΩ 5.6Ω 120MΩ

2 – Plot the current in a P-N Diode vs V_A from -0.4V to 0.8V in 0.2V increments.
Assume I_S = 1e-11A, n = 1.7, and V_T = 26mV 20 pts

$$I = I_s\left[e^{\left(\frac{V_A}{nV_T}\right)} - 1\right] = 1 \times 10^{-11} A\left[e^{\left(\frac{V_A}{1.7 \times 0.026V}\right)} - 1\right]$$



ELE 4142 HW1 Name_____

3 – ELE 2610 is switching to a new STM part (STM32U575xx) this year. The data sheet for this part family is linked on the HW page. Below is a picture of the part as implemented on the development board. Answer the following questions: 30 pts

STM - manufacturer
32 – 32bit
U – Ultra low power
575 – sub-family
Z – 144pins
I – 2MB flash
T – LQFP
6 – industrial
Q – step down converter
U - ?

Package type (be specific): LQFP144

What does the L stand for: Low Profile

Circle PIN 1

How tall is this part (mm): 1.6mm

How many pins are dedicated to: VDD 9 GND/VSS 11

What is the allowed temperature range for this part -40 to 85 °C

What is the ESD_{HBM} rating for this part 2000 V

Compare the required board area for this part vs the UFBGA169 with more pins available

22mm x 22mm = $484mm^2$

vs

7mm x 7mm = $49mm^2$

~ 10x board area

ELE 4142 HW1 Name_____

4 – ELE 2610 is switching to a new STM part (STM32U575xx) this year. The data sheet for this part family is linked on the HW page. Operating this part at 3.3V, 160MHZ, and using a specific program profile the part dissipates 1W internally. While most of the I/Os drive CMOS gates, 10 of them drive 10KΩ resistors tied to gnd. 30 pts

Determine the worst-case junction temperature this part would reach.

$\theta_{JA} = 35.9°C/W$
$T_{Amax} = 85°C$
$PD_{int} = 1W$
$PD_{I/O} = 10 * (3.3V)^2 / 10K\Omega = 10.9mW$ (heat is external)

$PD_{tot} = 1.0W$

$T_J = T_{Amax} + PD_{tot} * \theta_{JA} = 85°C + 1.0W * 35.9°C/W = 121°C$

Is this a problem? If yes, why?

Yes – exceeds the max value for $T_J = 105C$ for designation 6