EE 461G Exam 1

Print your name. You must show your work to receive partial credit. You may bring a piece of paper with formula, a calculator, a ruler, a pencil, and an eraser.

**Problem 1** (10 points) What is voltage $v_1$?

![Circuit Diagram](image)

**Problem 2** (15 points) Draw symbols of pn junction diode, Schottky diode, and Zener diode and their corresponding I-V characteristic curves schematically. (Use the widely accepted values for turn-on voltages and breakdown voltage of 6V for Zener diode).

**Problem 3** (15 points) Using the Thevenin equivalent circuit to derive the $v_x$-$i_x$ equation and plot $i_x$-$v_x$ curve for the port of X-X’ of the circuit shown below. (Considering X-X’ is connected to an unknown load.)

![Circuit Diagram](image)
**Problem 4** (20 points) A diode protection circuit is shown below. Which two points (ABCG) should the light bulb be connected to so that the maximum voltage can be applied to the bulb without breaking it? The specifications of the light bulb are 1.5V and 2.8 mW. If the voltage is 20% over its specified value, the light bulb is burn out. What is the current of the light bulb so that the output power of the light bulb is 2.8 mW? The turn-on voltage of the diode is $V_f=0.7V$.

![Diode Protection Circuit Diagram](image)

**Problem 5** (20 points) A Zener diode with $V_{zk}=6V$, $V_f=0.7V$ is connected to the circuit as shown below.

(a) Find the operating point a of the Zener diode graphically.

(b) If the voltage of the source is increased to 6V and 8 V, find the operating points b and c of the Zener diode separately using graphic method on the same graph as in (a)?

Note: Label a,b,c on the graph and obtain the values of the operating points.
Problem 6 (20 points) Calculate the output voltage $V_{out}$ and the diode current $I_d$ for (a) $V_o=-3V$ and (b) $V_o=3V$, using the piecewise linear model ($r_d=0.026 \text{ k}\Omega$ and $V_f=0.7V$).