Please work the problems carefully. Partial credit is given only if work is shown neatly or qualitative understanding of the solution is indicated in words. Give appropriate units. The exam has 10 questions, and one bonus question.

Q1: Find $I_{D0}$ and $V_{D0}$ for the diode in the circuit shown below using the characteristics also shown below. (10 pts.)

![Diode Circuit with Characteristics](image)

$V_{D0} =$ ______  $I_{D0} =$ ______

Q2. (10 pts.) Assuming ideal diodes, find $I$ and $V$ in the following circuit.

![Ideal Diode Circuit](image)

$I =$ ______  $V =$ ______
Q3. (10 pts.) Sketch $v_o$ vs. $v_i$ in the circuit shown below. Assume ideal diodes.

Q4. (10 pts.) In the circuit shown below, a bridge rectifier and a capacitor filter is used to convert an ac signal to dc. Carefully sketch the voltages shown as a function of time. Assume ideal diodes.
Q5. (10 pts.) Consider a Zener diode regulator circuit shown below. The minimum current needed to turn the Zener on is 5 mA. If the Zener voltage is 20V, find the load voltage for $R_L = 10k\Omega$.

Q6. (10 pts.) Sketch the transfer characteristics to scale for the circuit shown below. Allow 0.6V for the forward drops of the diodes.
Q7: (10 pts.) Consider the circuit shown below. The source voltage consists of a dc component and an ac ripple. The diode has a forward drop of 0.6V and n=1. Find an approximate expression for the output voltage, \( V_d(t) \), including both the dc term and a small ac term.

\[ V_d(t): \]

Q8. (10 pts.) For the transistor circuit shown below, find the base current, \( I_{BQ} \) and the collector current, \( I_{CQ} \). Assume identical transistors with \( \beta = 100 \).

\[ I_{BQ} = \quad I_{CQ} = \]
Q9. (10 pts.) A certain transistor input characteristics are shown below. Using the input circuit of the transistor shown, determine the maximum and minimum base currents.

\[ V_{BE} = 0.7 \, \text{V} \]

Q10. (10 pts.) Find the value of \( \beta \) for the transistor in the circuit shown below.

\[ I_C = \beta I_B \]
BONUS QUESTION: (10 pts.) An EE 3130 student is assigned the following design problem on an "analog switch" design. The student used the circuit shown and looked at the output on the oscilloscope that is also sketched. Is this an "analog switch"? What is wrong? Explain.

![Circuit Diagram]

a) (10 pts.) Sketch the transfer function \((v_o \text{ vs. } v_i)\)

![Transfer Function Graph]

Q2. (10 pts.) Assuming ideal diodes, find \(I\) and \(V\) in the following circuit.