Problem 1. (30 points) Sketch the Voltage Transfer Characteristic of the diode circuit shown in Figure 1. Assume \( V_{D\text{on}} = 0.7 \text{V} \).

Figure 1  Diode circuit

Problem 2. (40 points) A modified BJT inverter is shown in Figure 2 below. Sketch the Voltage Transfer Characteristic – VTC (Vout vs. Vin) for this inverter. Mark all the break-points and for each region of the VTC, and determine the mode of operation for the diodes (ON or OFF) and BJT (CUT-OFF, FORWARD ACTIVE or SATURATION). Assume that \( V_{D\text{on}} = V_{BE\text{on}} = 0.7 \text{V}, V_{BE\text{sat}} = 0.8 \text{V} \) and \( V_{CE\text{sat}} = 0.1 \text{V}, \beta_F = 100 \).

Figure 2  Modified BJT inverter
Problem 3. (30 points) For the modified BJT inverter shown in Figure 3, sketch the VTC and compute the values of all the break-points. Assume that $V_{D(on)} = V_{BE(on)} = 0.7V$, $V_{BE(sat)} = 0.8V$ and $V_{CE(sat)} = 0.1V$. For each region of the VTC, determine the mode of operation for the BJT. The values of the break-points must be explicitly shown.

![Modified BJT inverter](image.jpg)