1. At room temperature, a diode for which n=1 operates in a circuit for which the current is essentially a constant value of 1 mA. Find the corresponding diode incremental resistance. (10%)

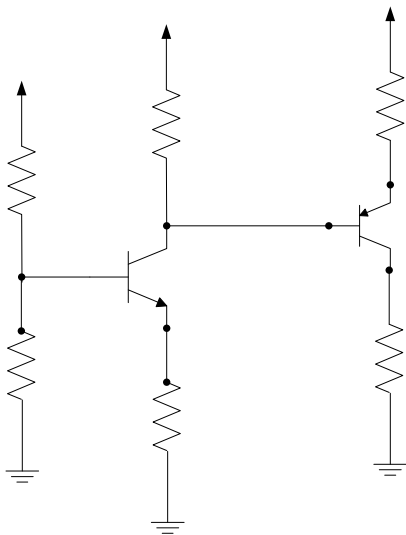2. For the circuit as shown in Figure 1, find the labeled node voltages. β=100. (20%)

+15 V

+15 V

+15 V

1 kΩ

10 kΩ

200 kΩ

V_3

V_4

V_1

V_5

Figure 1

3. An amplifier has the voltage transfer function

$$T(s) = \frac{10s}{(1+s/100)(1+s/10000)}$$

(a) Find the poles and zeros. (5%)

(b) Sketch the magnitude of the gain versus frequency. (10 %)

(c) Find approximate values for the gain at ω = 10, 10^2, and 10^6 rad/s. (15%)

4. Design a NAND logic gate using BJTs. (15%)

5. Explain the Wilson current mirror. (10%)

6. Draw and explain the transfer characteristics of a CMOS inverter. (15%)