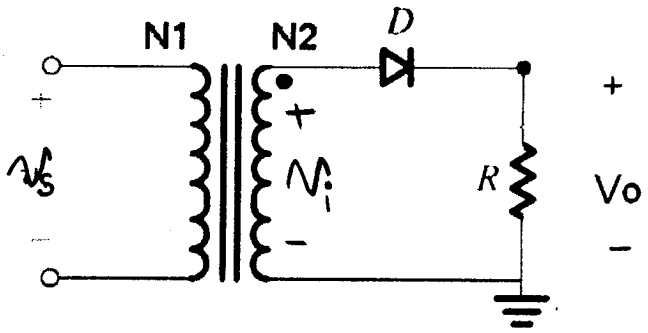
EE-203 : Electronics I MAJOR I EXAM (072)
Instructor: Dr. Saad Mohammad Al-Shahrani

Name: ID #

Question # 1: *(3 Marks)*

Consider the half-wave rectifier circuit shown below, let V_S be a sinusoid with 100V peak amplitude, and R= 500Ω. Find the required turns ratio N_2/N_1 of the transformer to have an average output voltage of 10V. (use constant-voltage-drop model with V_D=0.7V).

a) Sketch the waveform of V_o. 0.75
b) Find the peak current in the diode. 0.5
c) Find the PIV of the diode. 0.75



$N_2/N_1 = ??$

$V_{dc} = 10V = \frac{V_{opeak}}{\pi} \Rightarrow$

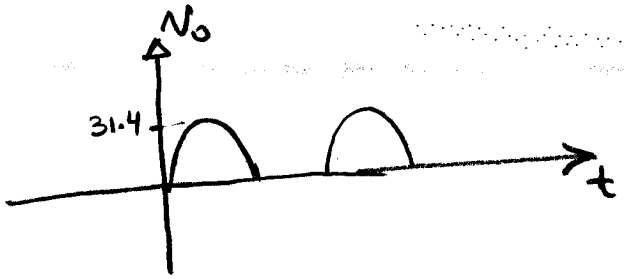
$V_{opeak} = 31.4\ V$

$V_{ipeak} = V_{opeak} + V_D = 31.4 + 0.7 = 32.1\ V$

$\frac{N_2}{N_1} = \frac{V_{ipeak}}{V_{speak}} \simeq \frac{1}{3}$

b) $I_{Peak} = \frac{V_{opeak}}{R} = \frac{31.4}{500} = 62.8\ mA$

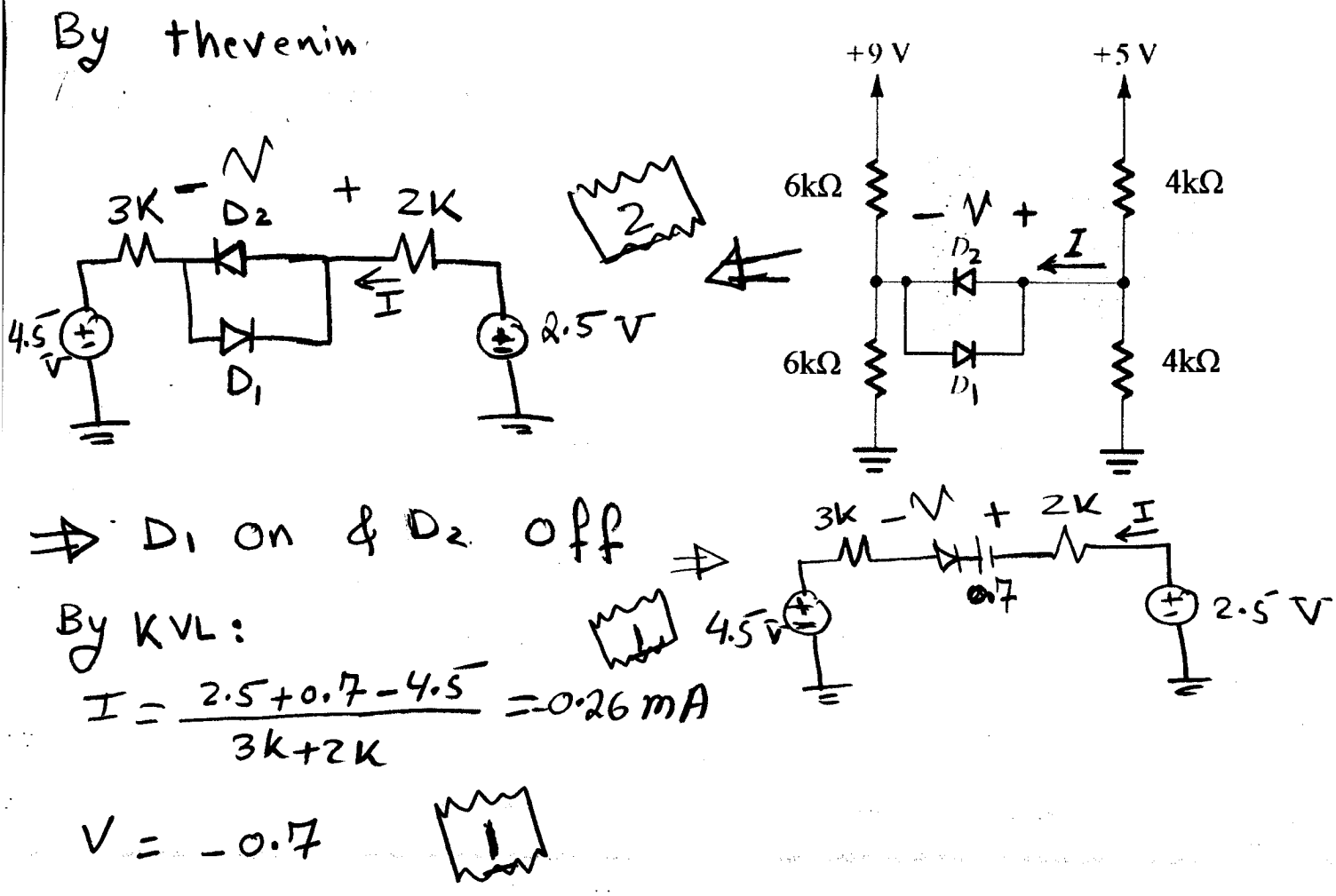
a)



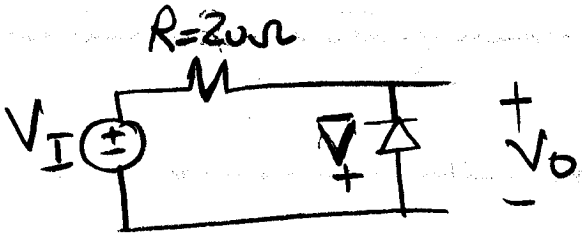
c) PIV = $V_{ipeak} \simeq 32.1\ V$

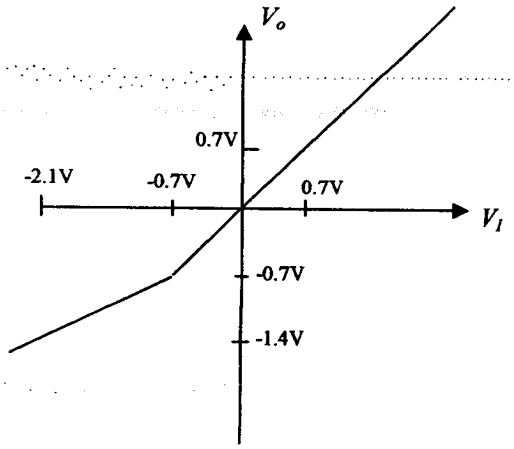
Question # 2:

a). Assuming constant voltage drop model with V_{DO}=0.7V for the diodes shown below, use thevenin's theorem to simplify the circuit and thus find the values of labeled voltage and current. *(4 Marks)*



b). Design a limiter circuit using only one diode and one resistor to realize the transfer characteristics shown below, (assuming piecewise linear model V_{DO}=0.7V & r_d=20 Ω). *(3 Marks)*

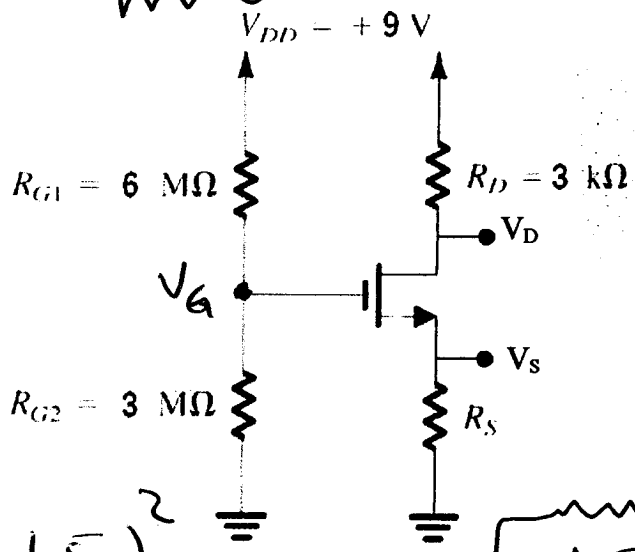




Question # 3: (5)

For the circuit shown below, the enhancement NMOS transistor parameters are: **V_t=1.5V, and $K_n'(W/L)$=2mA/V²**.
Design **R_S** so that V_S=1V;
Calculate drain current **I_D**, and voltage **V_D**.

Analysis 3.



$$I_D = \frac{1}{2} K_n' \frac{W}{L} (V_{GS} - V_t)^2$$

$$I_D = 1m (V_{GS} - 1.5)^2 \quad (1)$$

$$V_G = 9 \times \frac{3}{6+3} = 3\,V$$

$$V_{GS} = V_G - V_S = 3 - 1 = 2\,V$$

from (1) $I_D = 1m \times (2-1.5)^2$ 0.75

$$= 0.25\,mA$$

$$R_S = \frac{V_S}{I_D} = \frac{1}{0.25m} = 4\,K\Omega$$ 0.5

By KVL

$$V_D = 9 - I_D R_D = 9 - 3 \times 0.25 = 8.25\,V$$

0.75