1. A shunt regulator is shown in Fig. 1. $R_S = 5\Omega$. If the input changes 1.3V, what is the incremental change in output voltage?

\[
\frac{\Delta v_o}{\Delta v_s} = \frac{5}{5+82}
\]

**Solution:**

\[
\Delta v_o = \frac{5}{87} \times \Delta v_s
\]

\[
\Delta v_o = \frac{5}{87} \times 1.3
\]

\[
\Delta v_o = 74.7mV
\]

2. Consider the rectifier in Fig. 2. $V_s$ is a sinusoid with 15V peak amplitude, and $R = 1.5k\Omega$. Use the Constant Voltage Drop model with $V_D = 0.7V$.

a) What kind of rectifier is this circuit?

b) Sketch the Voltage Transfer Characteristic.
c) Sketch the waveform $V_o$.
d) Find the peak current in the diode.
e) Find the PIV of the diode.

**Solution:**  a) Half-wave rectifier

b) 

![Figure 3](image)

$$V_o$$

-0.7V $\rightarrow$ $V_s$

Slope = 1

**Figure 3.**

c) 

![Figure 4](image)

**Figure 4.**

d) Peak Current:

$$\frac{15V - 0.7V}{1.5k\Omega} = 9.5mA$$

e) PIV = 15V (Normally it would be 30, if there were a filter cap... but there isn’t... don’t worry... no points lost for 30)

3. [2] A full-wave rectifier circuit with a 1kΩ load operates from a 120-V (rms) 60-Hz household supply through a 5-1 transformer having a center-tapped secondary winding (12Vrms at the secondary windings). It uses two identical silicon diodes that can be modeled to have a 0.7V drop for all currents. (Note: no capacitor)
a) What is the peak voltage of the rectified output?
b) For what fraction of a cycle does each diode conduct?
c) What is the average current in the load?

Now add a smoothing capacitor in parallel with the load resistance.

d) What capacitor value will give a ripple voltage of 10%?
e) What is the conduction angle $\phi_C$?
f) What is the average diode current?
g) What is the peak diode current?

Now change the capacitor for one that gives a 1% ripple.

h) What is the value of this capacitor?
i) What is the conduction angle $\phi_C$?
j) What is the average diode current?
k) What is the peak diode current?

Solution: See other documents

4. [2] A full-wave bridge rectifier circuit with a 1kΩ load operates from a 120-V (rms) 60-Hz household supply through a 10:1 step down transformer having a single secondary winding (again... delivers 12Vrms at the secondary winding). It uses 4 diodes, each which can be modeled to have a 0.7V drop for any current. (Note: no capacitor)

a) What is the peak value of the rectified voltage across the load?
b) What fraction of a cycle does each diode conduct? c) What is the average current in the load?

Now add a smoothing capacitor in parallel with the load resistance.

d) What capacitor value will give a ripple voltage of 10%?
e) What is the conduction angle $\phi_C$?
f) What is the average diode current?
g) What is the peak diode current?

Now change the capacitor for one that gives a 1% ripple.

h) What is the value of this capacitor?
i) What is the conduction angle $\phi_C$?
j) What is the average diode current?
k) What is the peak diode current?

Solution: See other documents
5. [2] Sketch the output waveforms \( V_o \) for all of the limiter circuits shown in Fig. 5. First assume that the diodes are ideal. Next, assume a constant voltage drop of 0.7V.

![Diagram of limiter circuits](image)

**Figure 5.**

**Solution:** See other documents
6. [2] Use SPICE to generate the Voltage Transfer characteristic of the circuit in Fig. 6.

- Figure 6.

**Solution:** Do a DC sweep