Lab Report 3: Diode Applications (Clippers and Clampers)

Contents that should be delivered for every report:

1- Netlist code for each experiment showing all components, models and control statements.
2- Output graph of each experiment.
3- Filling all tables and answering all questions in the report.

Note: Lab reports are formed in groups of two and delivered in the next lab session.

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**Purpose:** Study the use of diodes in wave-shaping (clipper) circuits and in level-shifting (clamper) circuits and other applications.

**Experiment 1:** (Diode D1N4148)

Simulate the following circuit to state its function. $V_{in}$ is a 4Vpp (peak to peak) sine wave at a frequency of 400 Hz. Using transient analysis (carefully choose step and stop variables) Plot $V_{in}$ and $V_{out}$ on the same graph and comment on the output graph before and after turn on of each diode?

**Experiment 2:** (Zener Diode D1N5231)

Apply a 5 kHz sine wave with 15V (peak) amplitude and $R = 1k$. Using transient analysis (carefully choose step and stop variables) Plot $V_{in}$ and $V_{out}$ on the same graph. Get threshold voltage of zener diode in case of forward and reverse bias modes.

**Experiment 3:** (Zener Diode D1N5231)

(a) Apply a 1 kHz sine wave with 20V (peak) amplitude, $R_{limiting} = 1k$ and $R = 1k$. Plot the output voltage and input voltage. From values obtained in experiment 2, comment on the clipping effect of the zener diodes.

(b) Change the input amplitude to 5V (peak). Explain output voltage behavior?

(c) If zener diodes were replaced by 2 diodes, what would be value of $V_{out}$?
Experiment 4:

The four circuits on the next page are known as clipper circuits. The clippers use a diode, resistor, and voltage source in 4 possible locations and orientations in a circuit. \( R_L = 1k\Omega, V_{SIN} = 8V_{P-P} \) and \( V_B = 2V \).

Perform a simulation of each circuit and plot the output waveform. Does the clipping occur at 2V exactly? If not, find out the value at which it occurs and explain why it clips at that value.