Diode Problems (10) — Problems Only

1. 1) (Ideal diode) For the circuit shown: a sinusoidal source v_s(t)=10sin(ωt) V in series with a diode and a 1kΩ resistor to ground. Sketch v_o(t) across the resistor using the ideal diode model. What is the peak output voltage?

2. 2) (Half-wave rectifier with load) A diode in series with a 100Ω load is driven by v_s(t)=20sin(1000t) V. Assuming an ideal diode, find the DC (average) output voltage across the load.

3. 3) (Diode with DC bias) A diode (ideal) is connected between a 5 V DC source and a resistor R=2kΩ to ground as: +5V -> diode (anode at +5V) -> node Vo -> R to ground. Find Vo.

4. 4) (Clipper - positive) Design a diode clipper that limits the output to ±3V using ideal diodes and a ±12V input. Sketch the transfer behavior and explain operation.

5. 5) (Clamper) A series capacitor C=1µF, diode (ideal), and 10kΩ load form a positive clamper. Input is v_s(t)=5sin(2π1000t) V. Describe qualitatively how the DC level of the output shifts and why.

6. 6) (Diode with threshold) Replace the diode by a silicon diode with Vγ=0.7V in problem (1). For v_s(t)=10sin(ωt), what is the peak output approximately?

7. 7) (Bridge rectifier + capacitor filter) A full-wave bridge fed from 12VAC RMS transformer (ideal), load R=1kΩ, filter C large. Estimate the DC output (approx) after the filter and peak-to-peak ripple (approx).

8. 8) (Piecewise linear analysis) For circuit: 10V source -> series 1kΩ resistor -> diode (ideal) -> 2kΩ to ground. Find Vo at node between diode and 2kΩ. Determine conduction state and numeric Vo.

9. 9) (Two-diode limiter) Two identical diodes in opposite directions (ideal) in series with 1kΩ to ground form a limiter driven by ±15V source. Sketch Vout and find thresholds.

10. 10) (Temperature/real diode) Brief conceptual: how does junction temperature affect the forward voltage and leakage current of a silicon diode? Explain consequences for precision circuits.