3.6 CHAPTER SUMMARY

- In addition to the exponential and constant-voltage models, an "ideal" model is sometimes used to analyze diode circuits. The ideal model assumes the diode turns on with a very small forward bias voltage.
- For many electronic circuits, the "input/output characteristics" are studied to understand the response to various input levels, e.g., as the input level goes from $-\infty$ to $+\infty$.

- "Large-signal operation" occurs when a circuit or device experiences arbitrarily large voltage or current excursions. The exponential, constant-voltage, or ideal diode models are used in this case.
- If the *changes* in voltages and currents are sufficiently small, then nonlinear devices and circuits can be approximated by linear couterparts, greatly simplifying the analysis. This is called "small-signal operation."
- The small-signal model of a diode consists of an "incremental resistance" given by V_T/I_D.
- Diodes find application in many circuits, including rectifiers, limiting circuits, voltage doublers, and level shifters.
- Half-wave rectifiers pass the positive (negative) half cycles of the input wavefrom and block the negative (positive) half cycles. If followed by a capacitor, a rectifier can produce a dc level nearly equal to the peak of the input swing.
- A half-wave rectifier with a smoothing capacitor of value C_1 and load resistor R_L exhibits an output ripple equal to $(V_P - V_{D,on})/(R_L C_1 f_{in})$.
- Full-wave rectifiers convert both positive and negative input cycles to the same polarity at the output. If followed by a smoothing capacitor and a load resistor, these rectifiers exhibit an output ripple given by $0.5(V_P - 2V_{D,on})/(R_L C_1 f_{in})$.
- Diodes can operate as limiting devices, i.e., limit the output swing even if the input swing continues to increase.