FIGURE 5.1. The Fermi-Dirac distribution function and the density-of-states function for electrons and holes in the conduction and valence bands of a semiconductor respectively, for $T > 0 \text{ K}$.
FIGURE 5.2. The normalized electron density, $n_0/N_e$, versus the reduced Fermi energy, $\eta$. The solid line is obtained from Eq. (5.5) and the dashed line is calculated from Eq. (5.10).

FIGURE 5.3. Constant-energy surfaces near the conduction band edges for (a) Si, (b) Ge, and (c) GaAs.
FIGURE 5.4. Energy band structures for Si, Ge, and GaAs along the (111) and (100) axes. For the valence bands, H represents the heavy-hole band and L denotes the light-hole band. Note that both bands are degenerate at $k = 0$. After Sze$^{(1)}$, reprinted by permission of John Wiley & Sons Inc.

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Figure 5.5
Figure 5.6

Figure 5.7. A covalent bond model for intrinsic and extrinsic silicon.
FIGURE 5.8. Ionization energies for various impurity levels in (a) Si, (b) Ge, and (c) GaAs. After Sze, reprinted by permission of John Wiley & Sons Inc.
FIGURE 5.9. Electron density versus $10^2/T$ for two n-type silicon samples with different impurity compensations.

FIGURE 5.10. The Fermi level as a function of temperature for n-type and p-type silicon with different compensation ratios ($N_D/N_A$).
FIGURE 5.11. Hall effect for a p-type semiconductor bar. The Hall voltage $V_H$, the applied electric field $E$, and the applied magnetic field $B$ are mutually perpendicular to one another. For an n-type sample, electrons are deflected in the $y$-direction to the bottom of the sample.

FIGURE 5.12 Calculated and measured values of bandgap narrowing versus donor density in n-type silicon material. (2)