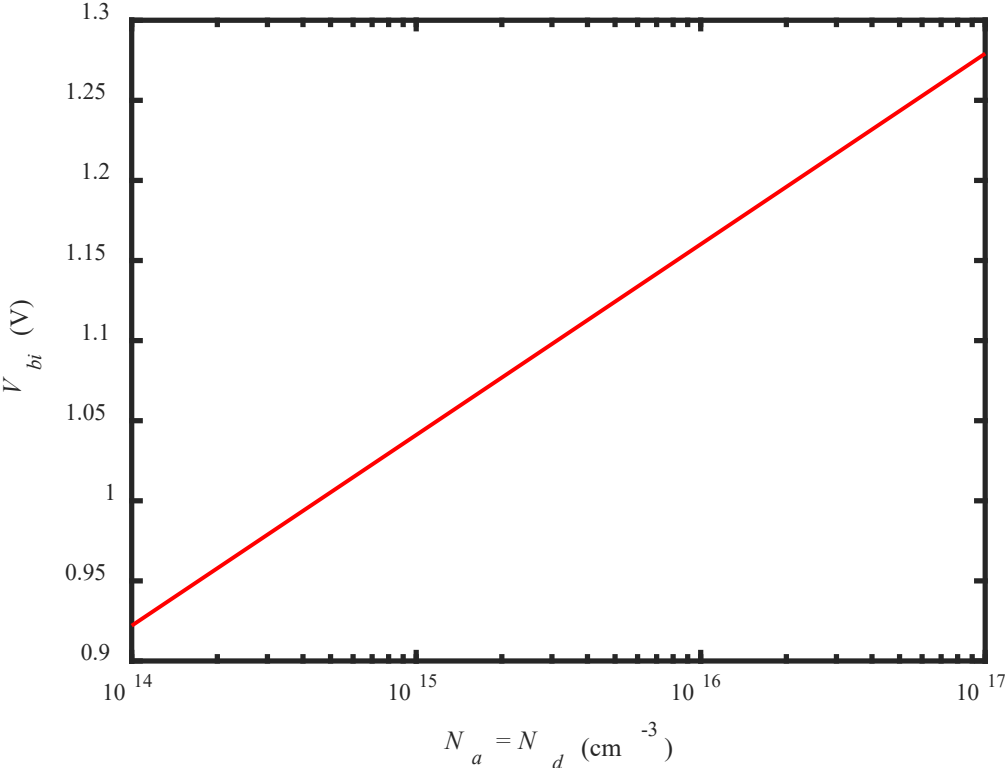
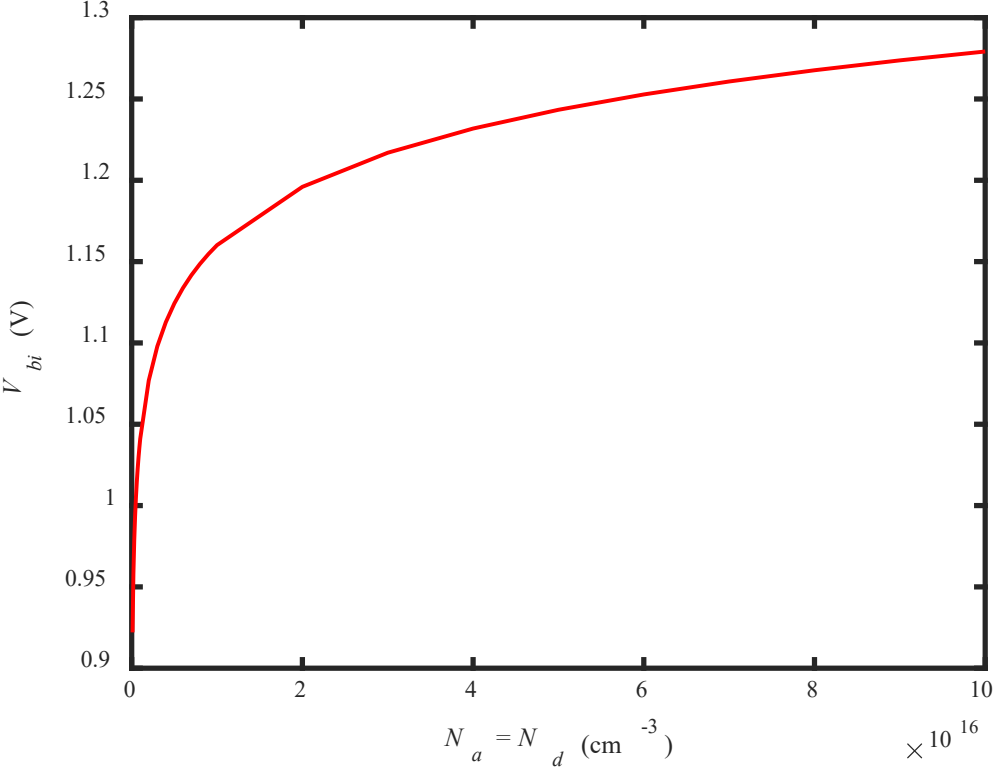


**7.3** (a) Plot the built-in potential barrier for a symmetrical ( $N_a = N_d$ ) silicon pn junction at  $T = 300$  K over the range  $10^{14} \leq N_a = N_d \leq 10^{17} \text{ cm}^{-3}$ . (b) Repeat part (a) for a GaAs pn junction.

➤ Do both linear and semilog plots using Matlab. Include m-file.



```
% EE 362 problem 7.3b (p7_03b.m)
% Plot Vbi for Na = Nd from 10^14 to 10^17 cm^-3 for GaAs
clear; clc; close all;
kB = 1.380649e-23; % Boltzmann constant (J/K)
T = 300; % temperature (K)
qe = 1.602176634e-19; % magnitude of electron charge (C)
ni = 1.8e6; % intrinsic charge conc. GaAs at 300 K, Table B.4
Vt = kB*T/qe; % thermal voltage (V)
n = 1:9; N1 = 1e14*n; N2 = 1e15*n; N3 = 1e16*n;
N = [N1, N2, N3, 1e17];
Vbi = Vt*log(N.*N/ni^2);
% ***** Plot Vbi in linear format *****
plot(N,Vbi,'r-')
xlabel('\it N_a = N_d (cm^{-3})','fontsize',14,'fontname','times'),
ylabel('\it V_{bi} (V)','fontsize',14,'fontname','times'),
% ***** Plot Vbi in semilog format *****
figure; semilogx(N,Vbi,'r-');
xlabel('\it N_a = N_d (cm^{-3})','fontsize',14,'fontname','times'),
ylabel('\it V_{bi} (V)','fontsize',14,'fontname','times'),
set(findobj('type','axes'),'fontsize',12,'fontname','times')
set(findobj('type','line'),'linewidth',1.5)
set(findobj('type','axes'),'linewidth',2)
```