1. (20%) Please <u>draw the I-V curves in the same figure</u> for a p-n diode under the following conditions:
(a) without any light illumination; (b) under light illumination (which generates excess electrons and holes).

2. (15%) Please explain why the carrier drift velocity saturates at high field in silicon.

3. (15%) Consider a silicon p-i-n diode. The n-region and the p-region are highly doped, and the undoped intrinsic region is 1-μm-thick. The built-in voltage is 1 V. The drift transport characteristics of carriers (electrons and holes) are shown below. When the diode is reversely biased at 2 V, what is the drift velocity of the slower carriers in the intrinsic region?
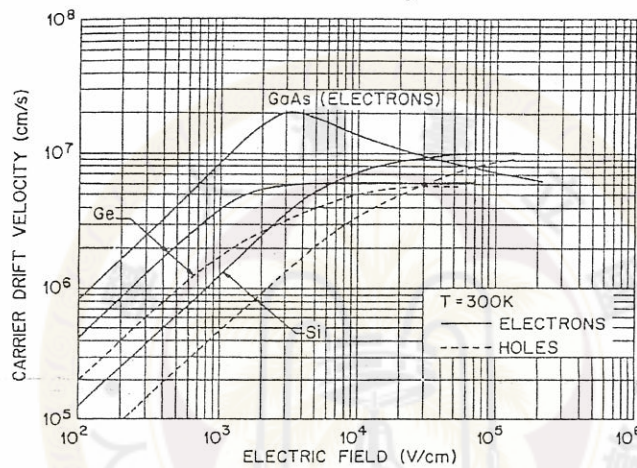
4. Current sources are often used in IC design. Please use the bipolar transistor technology to design a current source with the characteristic that the current is proportional to absolute temperature and resistant to process variation. It can be assumed that the transistors are well matched.
(a) Draw the circuit schematic diagram. (15%)
(b) Explain clearly how the design works. (10%)

5. A multi-pole amplifier having the first pole at 2MHz, second pole at 10MHz and a dc open-loop gain of 60 dB is to be frequency-compensated for closed-loop gain as low as unity.
(a) If the amplifier is compensated by introducing a new dominant pole, what is the highest frequency that the new pole should be introduced? (15%)
(b) The amplifier can also be stabilized by using Miller compensation. Please explain how Miller compensation works to stabilize the amplifier assuming that the 10MHz pole won't be changed by the compensation. (10%)

試題隨卷繳回