

Digital Electronics and Logic Design (EC 207)

2021-22

Problem Sheet: 1

Q1: Calculate the forward bias current of a Si diode when forward bias voltage of 0.4 V is applied, the reverse saturation current is 1.17 nA and the thermal voltage is 25.2 mV. Consider ideality factor as 1. (Ans: 9.156 mA)

Q2: Calculate the reverse saturation current of a diode if the current at 0.2V forward bias is 0.1mA at a temperature of 25°C, and the ideality factor of 1.5. (Ans: 0.5 nA)

Q3: Find the diffusion current in a sample of Ge having concentration gradient for electrons of 1.5×10^{22} electrons/m⁴. Consider diffusion constant of electrons 0.00120m²/sec.

Q4: A metal with the work function of 4.6 eV deposited on the Si having work function: 5.02eV, electron affinity 4 eV. Draw:

a) the band diagram before forming the junction and under equilibrium conditions (mark the fermi energy level, the band edges, the vacuum energy level, and built-in potential.)

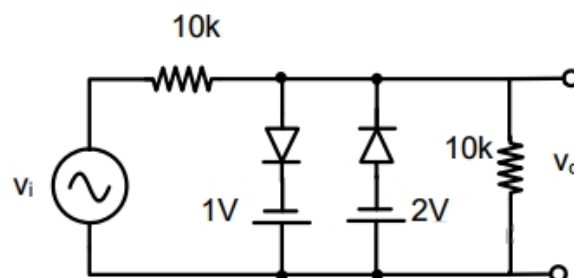
b) Is this a Schottky or ohmic contact, and why?

c) By how much should the metal work function be altered to change the type of contact? Explain with reference to the band diagram.

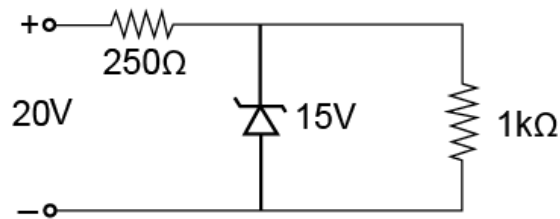
d) Draw the band diagram with the 0.2 V forward biased.

e) Draw the band diagram under 1 V reverse biased.

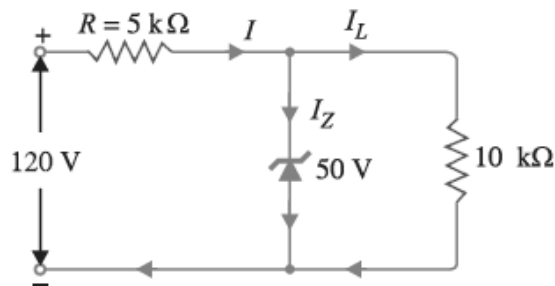
Q5: Assuming the diodes to be ideal in the figure, plot the output voltage waveform for the input voltage of 5V.



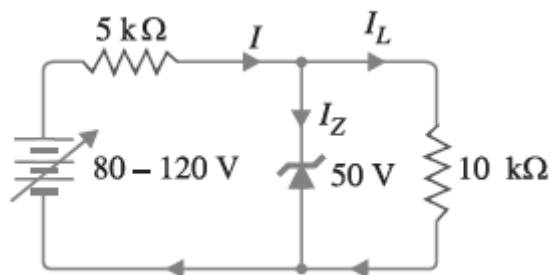
Q6: A Zener diode, having breakdown voltage equal to 15V, is used in a voltage regulator circuit shown in figure. The current through the diode is:



Q7: For the circuit shown in Figure below, find: (i) the output voltage (ii) the voltage drop across series resistance (iii) the current through Zener diode.



Q8: For the circuit shown in Figure below, find the maximum and minimum values of Zener diode current.



Q9: In the circuit shown in Figure below, the voltage across the load is to be maintained at 12 V as load current varies from 0 to 200 mA. Design the regulator. Also find the maximum wattage rating of Zener diode.

