Q1 (a) An abrupt Si p-n junction node has

$N_A = 10^{23}/m^3$ on p-side

$N_d = 10^{21}/m^3$ on n-side

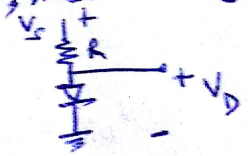
(i) Calculate the majority & minority concn for both side

(ii) Calculate the contact potn & the width of the depletion region under zero bias condn. at 300 K

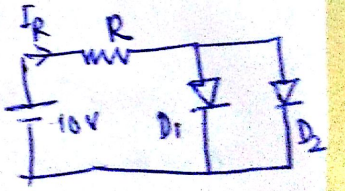
Assume the intrinsic carrier concn of Si is $1.5 \times 10^{16}/m^3$ & $\epsilon_r = 11.8$

Q2. The bandgap of GaAs and AlAs are 1.43 eV and 2.16 eV resp. Assuming the bandgap of $Al_x Ga_{(1-x)} As$ to vary linearly with x b/w the two extreme values (0, 1), find the value of x that would result in the emission of 600 nm from $Al_x Ga_{1-x} As$

Q2 (a) Consider the circuit shown in Fig 1, $R = 10k\Omega$, V_s^+ consists of a dc value of 10V which is superimposed with a ac voltage of 1-V peak amplitude & 60 Hz frequency. Calculate both the dc & ac voltage across the diode, Assume the diode is of Si - type



(b) In the circuit of Fig-2, $V_{\gamma_1} = 0.6V$ and $V_{\gamma_2} = 0.3V$ Calculate the I_R, $R = 330\Omega$



(3)

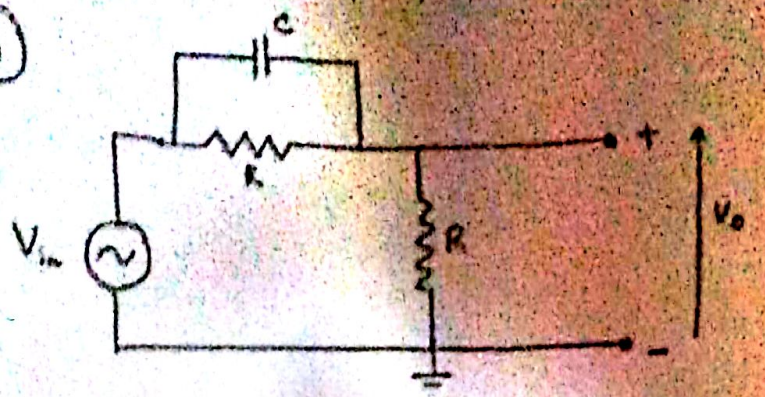
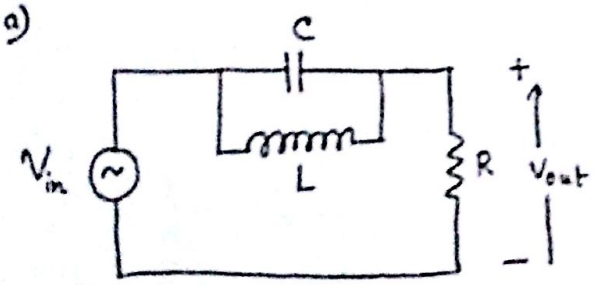


Fig. 3

For the circuit shown in Fig. 3. Obtain the complex transfer function and express them in magnitude and phase form. for $R = 1k\Omega$, $C = 1\mu F$, Calculate the 3-dB cut-off frequency and the frequency at which the phase difference between input and output voltage is 45°.

(4) Identify each of these filter types and explain how you were able to identify their characteristics.

a)



b)