Tute-1

1. For silicon at T=300K, Intrinsic carrier concentration $(n_i) = 1.45 \times 10^{10}\ cm^{-3}$. This silicon is doped at room temperature (300K) with Arsenic atoms (pentavalent), and the donor concentration is (N_D) =6× 10^{16} cm^{-3}.

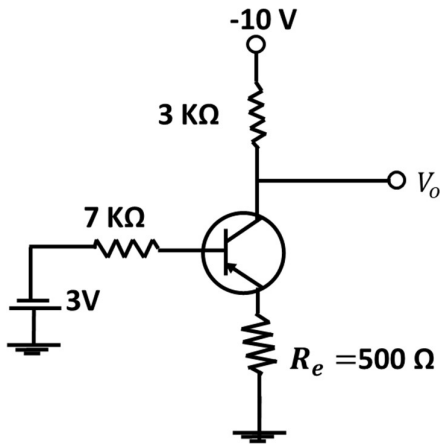
Find the equilibrium concentration of electrons, holes and shift of the chemical potential (Fermi level) with respect to intrinsic chemical potential.

2. For the circuit shown, assume $\beta = h_{FE} = 100$

a) Find if the silicon transistor is in cutoff, saturation or in the active region.

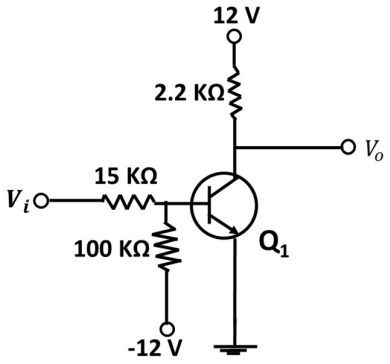
b) Find V_O

c) Find the minimum value for the emitter resistance R_e for which the transistor operates in the active region.

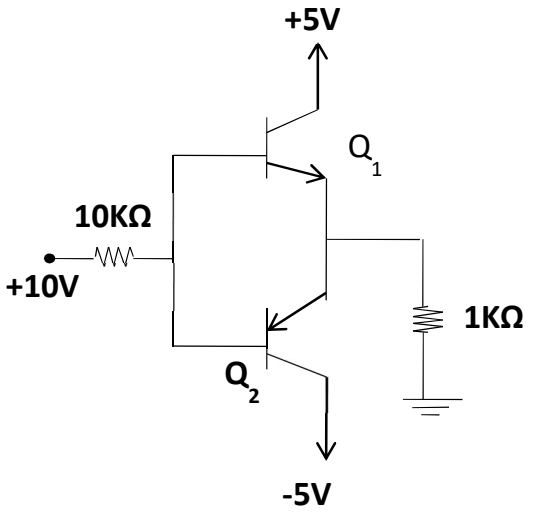


3.A transistor circuit is given below (silicon transistor). The transistor has a minimum value of β=30

i) Find Vo for $V_i = 12V$
ii) Find Vo for $V_i = 1V$

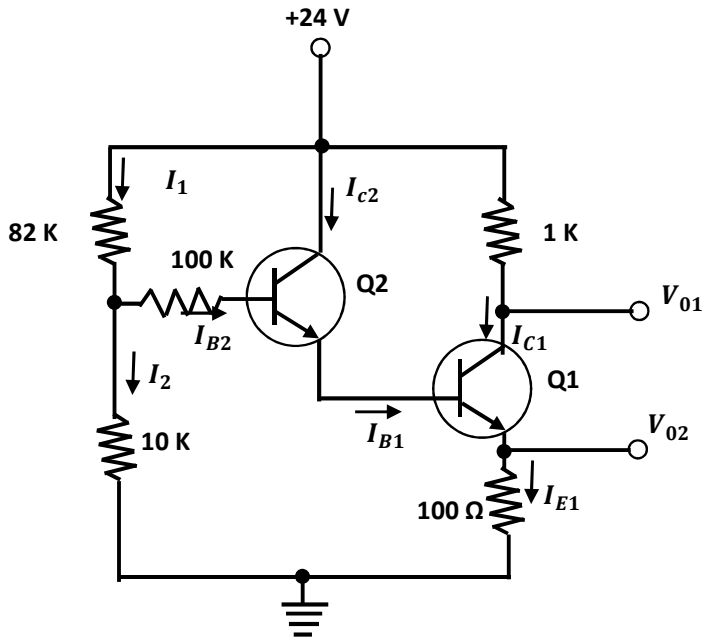


Q4. Assume β_{min}=30. Find V_B, V_E, I_{C1}, I_{C2} for the following circuit.



Q5. For the circuit shown, transistors Q1 and Q2 operate in the active region with $V_{BE1} = V_{BE2} = 0.7\ V$, $\beta_1 = 100$, and $\beta_2 = 50$. The reverse saturation current may be neglected.

(a) Find the currents I_{B2} , I_1, I_2, I_{C2}, I_{B1}, I_{C1}, and I_{E1}
(b) Find the voltage V_{O1} and V_{O2}



Q6. In the circuit given below, find the minimum value of R, for which one out of the two transistors remains in active region. Both the transistors are similar and made of silicon with $\beta = 100$, Neglect reverse saturation current