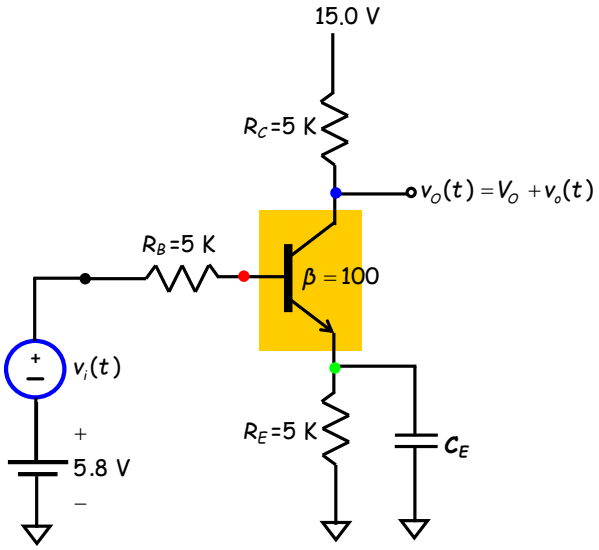
EL213 Analog Circuits
Second in-semester exam

Time: 1:30 Hour Maximum marks: 40

(a) Make proper assumptions where necessary. (b) Use of calculator is allowed. (c) Each question carries 10 marks. (d) Answer any four questions.

Q1. Consider the following BJT amplifier

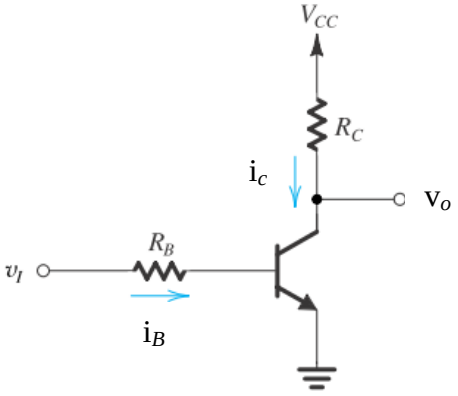


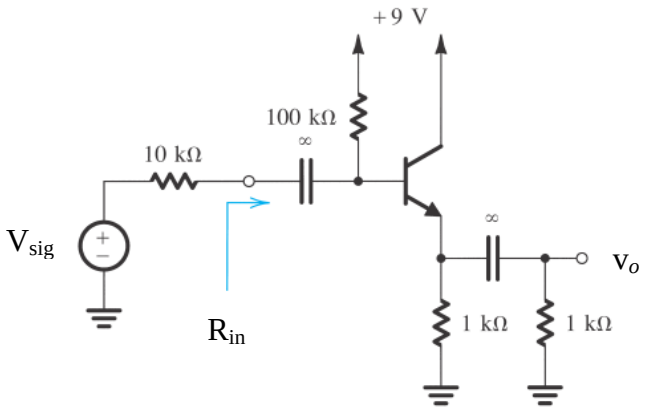
Determine its small-signal, open-circuit voltage gain: $A_{vo} = \dfrac{v_o(t)}{v_i(t)}$

Q2. For the emitter-follower circuit shown, the BJT used is specified to have β values in the range of 40 to 200 (a distressing situation for the circuit designer). For the two extreme values of β (β = 40 and β = 200), find:

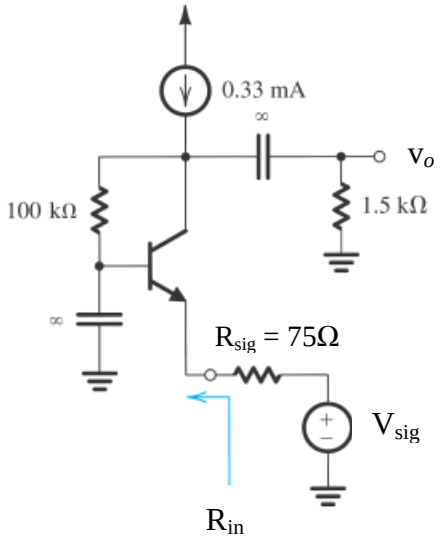
(a) I_E , V_E , and V_B . (b) the input resistance R_{in} . (c) the voltage gain v_o / v_{sig}.

Q3. Draw the voltage transfer characteristics for the logic inverter shown below. Compute the breakpoints of the transfer characteristics for a representative case Vcc = 5 V, R_C = 3 kΩ, R_B = 15 kΩ, ß = 45. Calculate noise margin and the gain in the transition region.





Q4. For the circuit below, find the input resistance R_{in} and the voltage gain v_o / v_{sig}. Assume that the source provides a small signal v_{sig} and that $\beta = 100$.



Q5. For a version of the CE amplifier circuit below, R_{sig} = 10 k Ω , R_1 = 68 k Ω, R_2 = 27 kΩ, R_E = 2.2 k Ω, R_C = 4.7 k Ω, and R_L = 10 k Ω . The collector current is 0.8 mA, β = 200, f_T = 1 GHz, and Cμ = 0.8 pF. Neglecting the effect of r_x and r_o , find the midband voltage gain and the upper 3-dB frequency f_H .