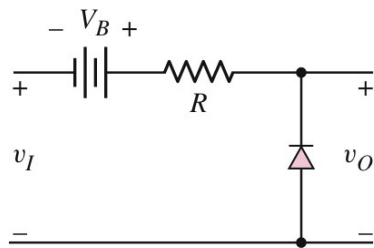
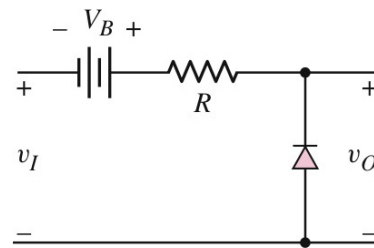


1. (20%) Let the diode cut-in voltage be  $V_\gamma$ . If the input voltage  $v_I$  is a sine function, plot the steady-state output waveforms  $v_O$  in the following circuits.

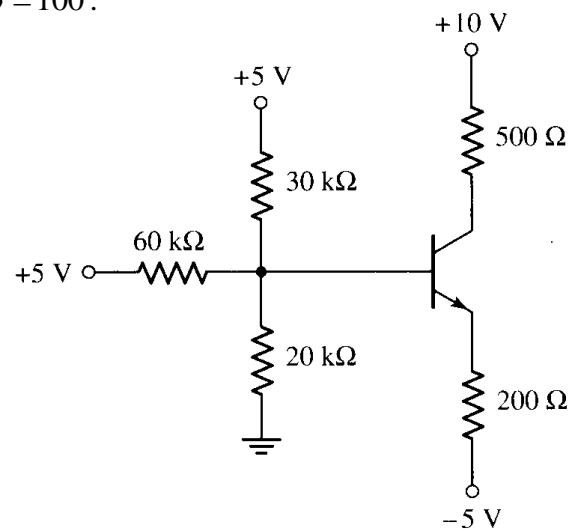


(a)



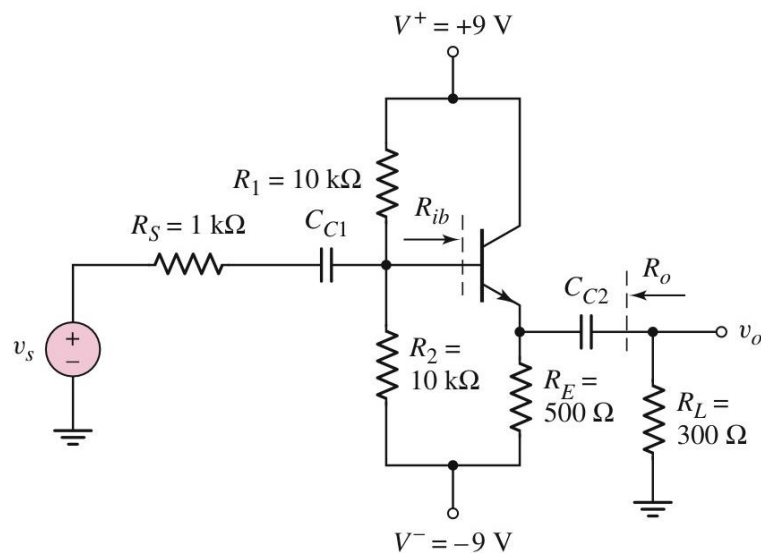
(b)

2. (25%) Find  $I_{CQ}$  and  $V_{CEQ}$  of the transistor, assuming  $\beta = 100$ .



3. (30%) The transistor parameters are  $\beta = 180$  and  $V_A = \infty$ .

- Find  $I_{CQ}$  and  $V_{CEQ}$ . (10 points)
- Find the small-signal voltage gain  $A_v = v_o / v_s$ . (10 points)
- Determine the input and output resistances  $R_{ib}$  and  $R_o$ . (10 points)



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4. (25%) Assume that all transistors are matched. Let  $I_{REF} = 0.2\text{mA}$ ,  $K_n = 0.2\text{mA/V}^2$ ,  $V_{TN} = 1\text{V}$ , and  $\lambda = 0.02\text{V}^{-1}$ . Determine the output resistance looking into the drain of  $M_6$ .

