

Union College
ECE248
Spring 2015
Homework #5

Due June 2, 2015 by the end of the day

Unless otherwise noted, all problems from Malvino & Bates (7th ed)

A. Maximum undistorted output

12.3 Assume $\beta = 200$ and remember MPP (max peak-to-peak) = 2MP. You should get MPP = 10.6V_{pp}.

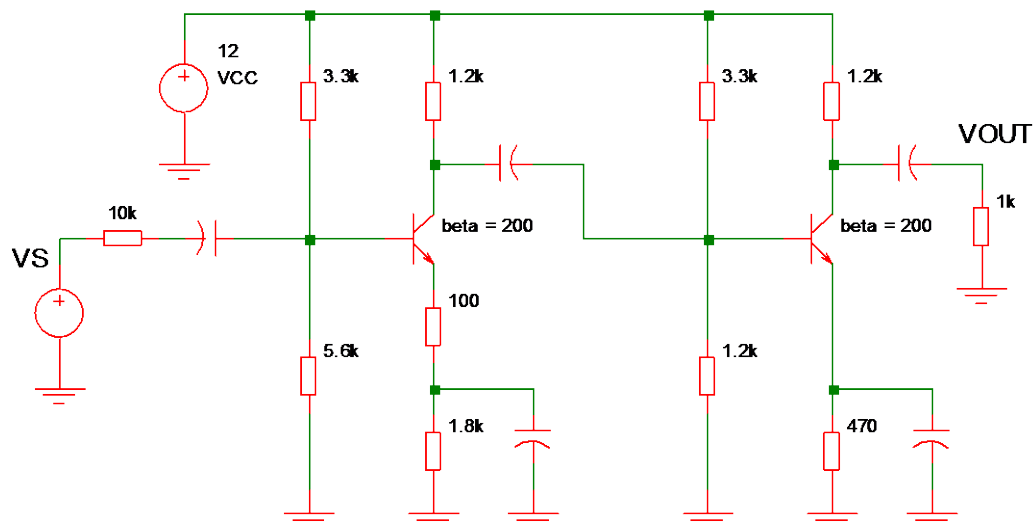
10.z Compute the maximum peak (MP) output of the swamped common emitter in Fig. 10-16 (page 342). Assume $\beta = 200$ (do not use 100). You should get an MP around 3 V.

11.x Compute the maximum peak (MP) output of the emitter follower in Fig. 11-21 (page 370). Assume $\beta = 150$. You should get an MP = 5.3V (approximately).

B. Carried over from assignment 4 on multi-stage amplifiers (if you haven't done them yet).

10.9 You should get $V_{OUT} = 3.44 V_{PP}$.

10.xx Compute the signal gain V_{OUT}/V_S for the circuit below. Assume $\beta = 200$. You should get $V_{OUT}/V_S = 54.5$.



C. BJT switches

7.48 Assume $\beta = 100$ for both transistors.

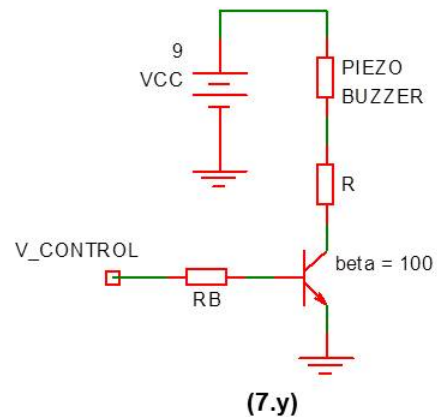
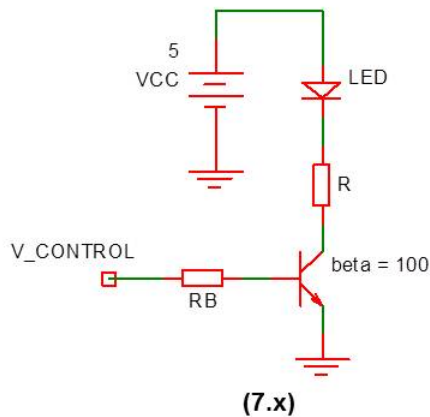
Hint: You should find that $I_{LED} = 15.7 \text{ mA}$ when $V_{BB} = 0$.

7.x Design a npn BJT driver for a white LED ($V_F = 3.5 \text{ V @ } 25 \text{ mA}$), as shown in the figure below. Assume $\beta = 100$, the control signal is 0 to +3.5V, and $V_{CC} = +5 \text{ V}$. Choose standard 5% resistor values (see course website for a table) for R and R_B . Choose R such that I_{LED} is NOT $< 25 \text{ mA}$.

Hint: You should get $R = 56 \text{ ohm}$ and $R_B = 1.1\text{kohm}$ (1.2kohm is OK).

7.y You want to use a microcontroller (0 to +5V output signal) with an “internally driven” piezo buzzer (6 VDC @ 120 mA). Design a npn BJT driver (assume $\beta = 100$) powered by a 9V battery, as shown in the figure below. Choose standard 5% resistor values. Make sure I_{PIEZO} is NOT $< 120 \text{ mA}$.

Hint: You should get $R = 24 \text{ ohm}$ and $R_B = 330 \text{ ohm}$ (360 ohm is OK).



D. Power FETs

14.27 You should get $P_{LAMP} = 30.5\text{W}$.

14.z You want to operate a 12 VDC motor (500 mA rating). You have a +12 V power supply. Consider an H-bridge made from two IRF9520 ($V_{GS,ON} = -10\text{V}$, $R_{DS,ON} = 0.6 \text{ ohm}$, $I_{D,ON} = 5\text{A}$) and two IRF520 ($V_{GS,ON} = +10\text{V}$, $R_{DS,ON} = 0.27 \text{ ohm}$, $I_{D,ON} = 5\text{A}$) transistors. When the control voltage is +12V, which transistors are on, and what is the voltage, current, and power of the motor?

Hint: You should get $I_M = 483 \text{ mA}$, $V_M = 11.6\text{V}$, and $P_M = 5.6\text{W}$.

