

ENEE3304 Power Amplifiers Homework Problems

5.1-2 The circuit shown in Fig. P5.1-2 is a class A power amplifier which must supply a maximum undistorted power of 2 W to the 10- Ω load. The *minimum* necessary transistor ratings are to be specified. Find I_{CQ} , P_{CC} , and η . Also specify $P_{C,max}$, $v_{CE,max}$, and $i_{C,max}$ for the transistor. Neglect R_e and bias-circuit losses.

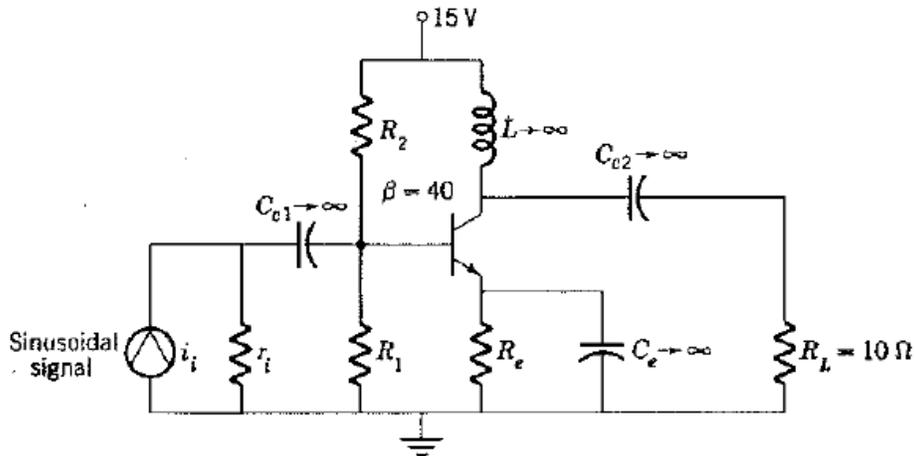


FIGURE P5.1-2

5.2-1 The transistor ratings are to be specified for class A operation in Fig. P5.2-1. The maximum required load power is 2 W. Neglect R_e and bias-circuit losses.

- Find P_{CC} , assuming that the amplifier is designed for maximum efficiency.
- Find I_{CQ} .
- Specify the $i_{C,max}$, $v_{CE,max}$, and $P_{C,max}$ ratings for the transistor.
- If $R_L = 6.25 \Omega$, find the turns ratio N .

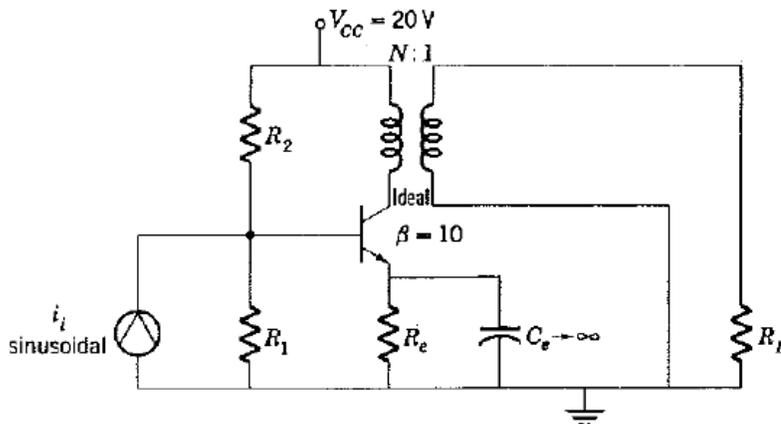
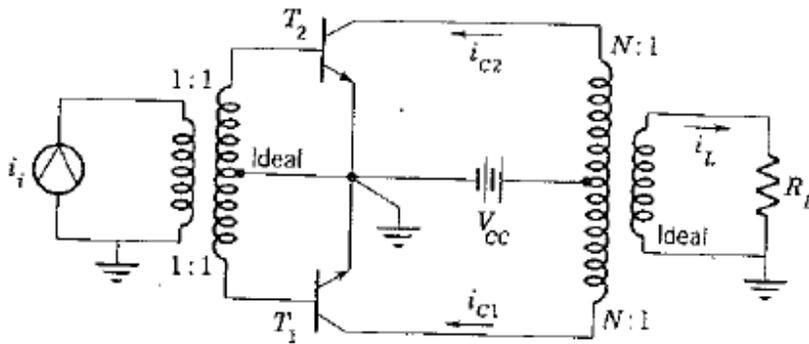


FIGURE P5.2-1

5.3-2 Design a class B push-pull amplifier to deliver 10 W to a 10-Ω load, using transistors which have $BV_{CEO} = 40$ V. Specify $P_{C,max}$ for each transistor, V_{CC} , and the required N .



- 5.4-2 For the complementary-symmetry amplifier shown in Fig. P5.4-2 (a) calculate R_x to eliminate crossover distortion at 0.65 V.
- Sketch the maximum undistorted sinusoidal waveform for v_{CE2} , i_{C2} , and i_L .
 - Determine P_{out} , P_{CC} , and η for maximum output current.
 - Determine the maximum collector dissipation and the maximum collector-current amplitude yielding this dissipation.

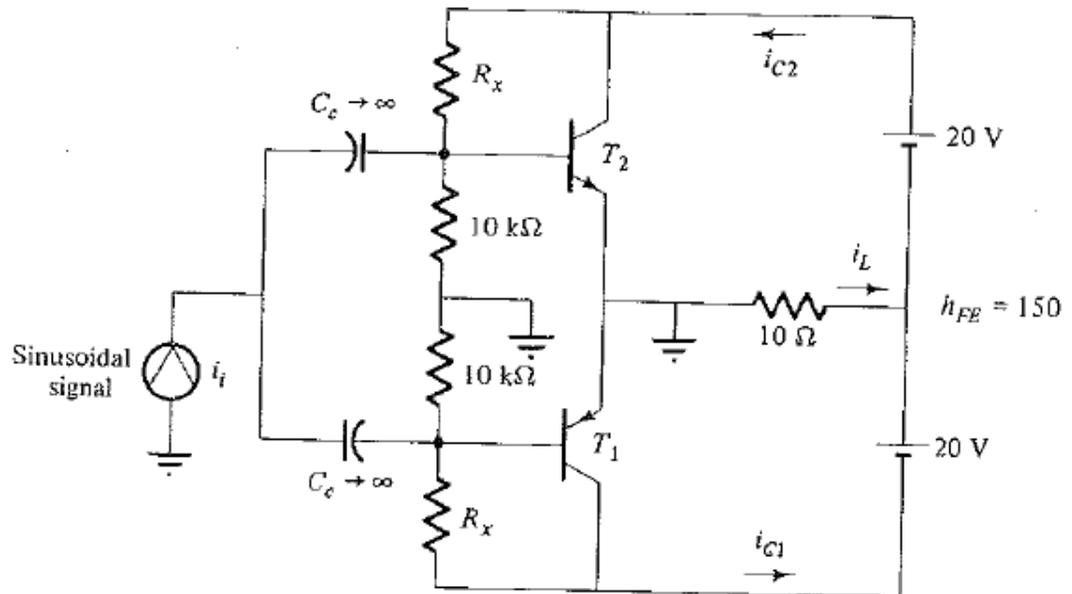


FIGURE P5.4-2

14.1 A class A emitter follower, biased using the circuit shown in Fig. 14.2, uses $V_{CC} = 5\text{ V}$, $R = R_L = 1\text{ k}\Omega$, with all transistors (including Q_3) identical. Assume $V_{BE} = 0.7\text{ V}$, $V_{CEsat} = 0.3\text{ V}$, and β to be very large. For linear operation, what are the upper and lower limits of output voltage, and the corresponding inputs? How do these values change if the emitter–base junction area of Q_3 is made twice as big as that of Q_2 ? Half as big?

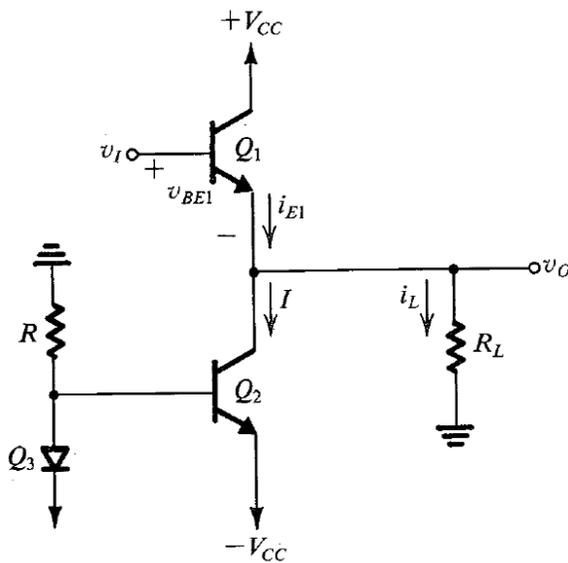
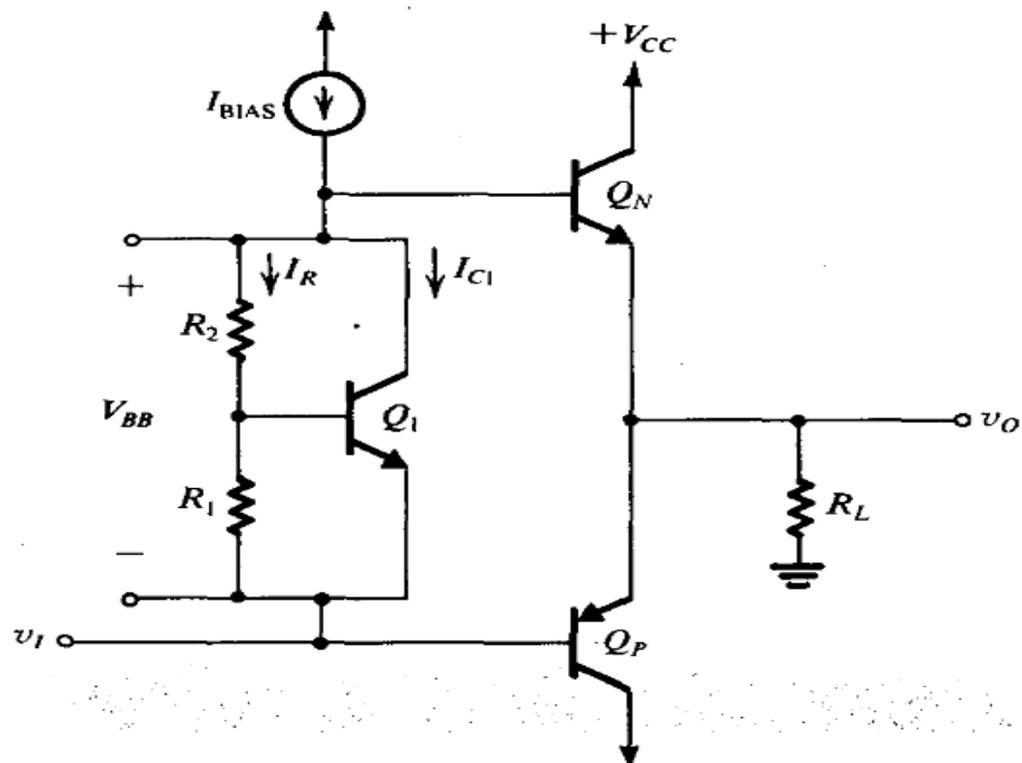


FIGURE 14.2 An emitter follower (Q_1) biased with a constant current I supplied by transistor Q_2 .

****14.24** A V_{BE} multiplier is designed with equal resistances for nominal operation at a terminal current of 1 mA, with half the current flowing in the bias network. The initial design is based on $\beta = \infty$ and $V_{BE} = 0.7$ V at 1 mA.

Find the required resistor values and the terminal voltage.



14.30 A power transistor for which $T_{J_{\max}} = 180^{\circ}\text{C}$ can dissipate 50 W at a case temperature of 50°C . If it is connected to a heat sink using an insulating washer for which the thermal resistance is $0.6^{\circ}\text{C}/\text{W}$, what heat-sink temperature is necessary to ensure safe operation at 30 W? For an ambient temperature of 39°C , what heat-sink thermal resistance is required? If, for a particular extruded-aluminum-finned heat sink, the thermal resistance in still air is $4.5^{\circ}\text{C}/\text{W}$ per centimeter of length, how long a heat sink is needed?