1. Draw the circuit diagram of a Wilson current mirror that uses PNP transistors. If the PNP transistors used have $\beta = 5.1$, compute the current transfer ratio.

2. Draw the circuit diagram of a one-stage PNP common emitter amplifier. Indicate all resistors and capacitors by symbols. There is no need to specify values.

3. Draw a circuit diagram showing how a 12 V battery, a 100 kΩ potentiometer, a 10 kΩ resistor, a `1N4148` silicon diode, and two digital voltmeters may be connected to determine the v-i characteristics of the given diode.

4. Draw a circuit diagram that indicates how an NPN transistor with $\beta = 8.6$ and a PNP transistor with $\beta = 21.4$ can be combined to make a Sziklai pair that behaves as a PNP transistor. Compute its overall β.

5. An amplifier is known to have a resistive input impedance R_i. The amplifier input, in series with a resistor R, is connected to a sinewave generator of negligible output impedance. When $R = 100.0$ kΩ, the output amplitude of the amplifier is 10 V. Changing R to 220.0 kΩ, changes the output amplitude to 6.8 V. Calculate R_i.

6. Draw the circuit diagram of a voltage doubler that uses two capacitors and two diodes.

7. A differential amplifier uses NPN transistors. The sum of its emitter currents is maintained at 2.5 mA. Calculate the differential input voltage needed to make the collector currents differ by 1.5 mA. Assume that the transistors have high beta values and that the operating temperature is such that $V_T = kT/q = 25$ mV.

8. In the circuit shown, $R_F = 68$ kΩ, $R_I = 22$ kΩ, $v_{\text{ref}} = 1.5$ V, and $v_{\text{in}} = 0.5$ V. Calculate v_{out}.
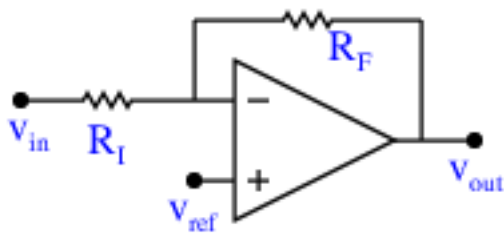
9. Design a Sallen-Key lowpass filter with $f_0 = 400$ Hz, $Q = 3$, and $H = 1$. Two precision 0.1 µF capacitors are available. Draw its circuit diagram indicating all component values.

10. Show how a dual power supply can be made using a transformer with a centre-tapped secondary, diodes, and capacitors.