Solution Information

1. LDR

Section 1: 3.6V at high light and 8V at low light; 5.5k and 66k
Section 2: 2.4V at high light and 7.5V at low light; 3k and 42k

2. Phase

Section 1: \( f = 400\text{Hz}, \) Phase = 180 or \( \pi (\pm) \), Ampl = 1.5, Phasor \( \tilde{U} = 1.5e^{j\pi} = -1.5 \)
Section 2: \( f = 250\text{Hz}, \) Phase = 90 or \( \pi/2 \), Ampl = 1, Phasor \( \tilde{U} = 1e^{j\pi/2} \)

3. Transistor as switch:

Section 1: \( R_1 = 5k, R_2 = 10k \)
ON is 0V, OFF is 4V = 6(10/15), ON more than half of the time, Red is output across R2, Blue is Base

Section 2: \( R_1 = 2k, R_2 = 10k \)
ON is 0V, OFF is 5V = 6(10/12), ON more than half of the time, Red is output across R2, Blue is Base
4. Filters

Section 1: High Pass, R and jωL, \( V_{\text{out}} = V_{\text{in}} \frac{(Z_2)}{(Z_1 + Z_2)} \), \( H(j\omega) = \frac{V_{\text{out}}}{V_{\text{in}}} = \frac{j\omega L}{R + j\omega L} \), \( \omega = 2\pi f = \omega = 2\pi \times 108.8k \), \( \omega L = (108.8)(15.9) = 1730 \),

\[ H(j\omega) = \frac{j1.73}{1 + j1.73} \frac{1 - j1.73}{1 - j1.73} = .75 + j.43 = .86\exp(j\frac{\pi}{6}) \), phase = 30 degrees,

\[ \tilde{V}_{\text{in}} = 2, \quad \tilde{V}_{\text{out}} = 1.72e^{j\omega/6}, \quad V_{\text{out}}(t) = 1.72\cos(34620\pi + \pi/6) \]

Section 2: Low Pass, R and jωL, \( V_{\text{out}} = V_{\text{in}} \frac{(Z_2)}{(Z_1 + Z_2)}, \) \( H(j\omega) = \frac{V_{\text{out}}}{V_{\text{in}}} = \frac{R}{R + j\omega L} \), \( \omega = 2\pi f = \omega = 2\pi \times 108.8k \), \( \omega L = (108.8)(15.9) = 1730 \),

\[ H(j\omega) = \frac{1}{1 + j1.73} \frac{1 - j1.73}{1 - j1.73} = .25 - j.43 = .5\exp(-j\frac{\pi}{3}) \), phase = -60 degrees,

\[ \tilde{V}_{\text{in}} = 2, \quad \tilde{V}_{\text{out}} = 1e^{-j\omega/3}, \quad V_{\text{out}}(t) = 1\cos(34620\pi - \pi/3) \]

5. Damped Harmonic Oscillator

Section 1: \( \alpha = 69.3, f = 300Hz, \omega = 1885, A = 4 \)
Section 2: \( \alpha = 45.8, f = 250Hz, \omega = 1885, A = 5 \)

6. Diode

Section 1: ON, .6 or .7, \((5-7)/300 = 14.3mA\), OFF, 5, 0mA
Section 2: ON, .6 or .7, \((6-7)/500 = 10.6mA\), OFF, 6, 0mA