Kirk Ambrose
EE 334

Electronics Test 2

1. $V_o = \left(1 + \frac{R_F}{R_i}\right) V_i = \left(1 + \frac{250 \times 10^3}{12 \times 10^3}\right)(150mV_{rms}) = (21.8333)(150 \times 10^{-3}) V_{rms}$

$V_o \approx 3.275 V_{rms}$

Hence, the output voltage of the op-amp amplifier, Vo is 3.275 Vrms

2. $V_{o1} = -\frac{R_f}{R_1}(V_1) = -\frac{330k\Omega}{33k\Omega}(12mV) = -(10)(12 \times 10^{-3})$

$V_{o1} = -120mV$

$V_o = -\left[\left(\frac{R_{f2}}{R_2}\right)V_{o1} + \left(\frac{R_{f2}}{R_3}\right)V_2\right] = -\left[\left(\frac{470k\Omega}{47k\Omega}\right)(-120mV) + \left(\frac{470k\Omega}{47k\Omega}\right)(18mV)\right]$

$= -\left[(10)(-120 \times 10^{-3}) + (10)(18 \times 10^{-3})\right] = -\left[-1.2 + 0.18\right]$

$V_o = 1.02V$

Hence, the output voltage of summing amplifer is 1.02V

3. $f_{oL} = \frac{1}{2\pi R_1 C_1} = \frac{1}{2\pi(10k\Omega)(0.05\mu F)} = \frac{1}{2\pi(10 \times 10^3)(0.05 \times 10^{-6})}$

$f_{oL} = 318.3Hz$

Hence, the lower cutoff frequency of the bandpass filter is 318.3Hz

$f_{oH} = \frac{1}{2\pi R_2 C_2} = \frac{1}{2\pi(20k\Omega)(0.02\mu F)} = \frac{1}{2\pi(20 \times 10^3)(0.02 \times 10^{-6})}$

$f_{oH} = 397.89Hz$

Hence, the upper cutoff frequency of the bandpass filter is 397.9Hz

4. (a) $I_{dc} = \frac{2}{\pi} I_p = \frac{2}{\pi}\left(\frac{20V}{4\Omega}\right) = \frac{40}{12.57} = 3.18$

$I_{dc} = 3.18A$

$P_i = (3.18A)(22V)$

$P_i = 70W$

$P_o = \frac{(20V)^2}{2(4\Omega)} = \frac{400}{8}$

$P_o = 50W$

$$\%n = \frac{50W}{70W} \times 100\%$$

$$\%n = 71.43\%$$

Therefore, the efficiency for the amplifier is 71.43%

(b) $I_{dc} = \frac{2}{\pi} I_P = \frac{2}{\pi}\left(\frac{4V}{4\Omega}\right) = \frac{8}{12.57} = 0.637$

$I_{dc} = 0.637A$

$P_i = (0.637A)(22V)$

$P_i = 4W$

$$P_o = \frac{(4V)^2}{2(4\Omega)} = \frac{4}{2}$$

$P_o = 2W$

$$\%n = \frac{P_o}{P_i} \times 100\% = \frac{2W}{14W} \times 100\%$$

$\%n = 14.3\%$

Therefore, the efficiency for the amplifier is 14.3%

5. (a) $I_{dc} = \frac{2}{\pi} I_{dc} = \frac{2}{\pi}\left(\frac{8V\sqrt{2}}{8\Omega}\right) = \frac{2.828}{3.14} = 0.900$

$I_{dc} = 0.9A$

$P_i = (0.9A)(30V)$

$P_i = 27W$

Hence, the input power dissipation of amplifier is 27W

(b) $P_o = \frac{V^2_L}{R_L} = \frac{(8V)^2}{(8\Omega)} = \frac{8}{1}$

$P_o = 8W$

Hence, the output power dissipation of amplifier is 8W

6a. $\text{Resolution} = \frac{V_{REF}}{2^n} = \frac{10V}{2^{14}} = \frac{10}{4096}$

Resolution = 2.44mV/count

Hence, the resolution of the ladder network is 2.41mV/count

7. $f_o = \frac{0.3}{R_1C_1} = \frac{0.3}{(4.7k\Omega)(0.001\mu F)} = \frac{0.3}{4.7 \times 10^{-6}}$

$f_o = 63.8KHZ$

$f_L = \pm \frac{8f_o}{V} = \pm \frac{8(63.8KHZ)}{6V}$

$f_L = 85.1KHZ$

Hence, the lock range of the PLL circuit is 85.1KHZ