EE 302 PS 09 - SOLUTIONS

Additional Problems: 1-5

Additional Problem 1

A diode allows current to flow in only one direction. In this circuit, it allows current to flow through R2 in such a way that the voltage across R2 is always non-negative. Thus, negative voltages are removed from the received AM waveform.

Additional Problem 2

2.a.

$$f_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi(9.25\text{ nH})(5\ \mu\text{H})} = 740.06\text{ kHz}$$

2.b.

$$Q = \frac{2\pi f_r L}{R} = \frac{2\pi(740.06\text{ kHz})(9.25\text{ nH})}{581.2\times10^{-6}\ \Omega} = 74$$

2.c.

$$BW = \frac{f_r}{Q} = \frac{740.06\text{ kHz}}{74} = 10\text{ kHz}$$

2.d. L_1/C_1 provide a bandpass filter to isolate an individual radio station.

2.e. Yes.

Additional Problem 3

If Q is fixed at 74 and the radio is tuned such that $f_r = 1480$ kHz, bandwidth is

$$BW = \frac{f_r}{Q} = \frac{1480\text{ kHz}}{74} = 20\text{ kHz}$$

The filter is now under-selective because its passband is too wide.

Additional Problem 4

See Figure 1 for the rectified wave.

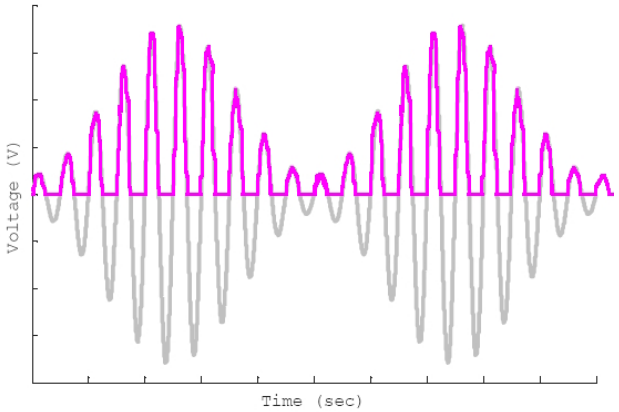

FIGURE 1. Rectified wave for Problem 4.

Additional Problem 5

See Figure 2 for the envelope of the rectified wave (channel 1) for part a and the output of the DC-blocking capacitor (channel 2) for part b. For part b, the DC offset is removed (blocked) so that the demodulator's output has an average value of zero.

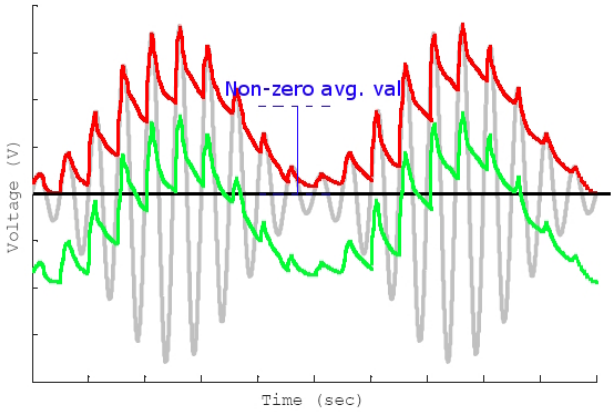

FIGURE 2. The envelope of the rectified wave for Problem 5.a is shown in red. The output of the DC-blocking capacitor for Problem 5.b is shown in green.