EEEN 322 PS 9 QUESTIONS

Q1

5.2-4 Estimate the bandwidth for $\varphi_{\text{PM}}(t)$ and $\varphi_{\text{FM}}(t)$ in Prob. 5.1-1. Assume the bandwidth of $m(t)$ in Fig. P5.1-1 to be the third-harmonic frequency of $m(t)$.

5.1-1 Sketch $\varphi_{\text{FM}}(t)$ and $\varphi_{\text{PM}}(t)$ for the modulating signal $m(t)$ shown in Fig. P5.1-1, given $\omega_c = 10^8$, $k_f = 10^5$, and $k_p = 25$.

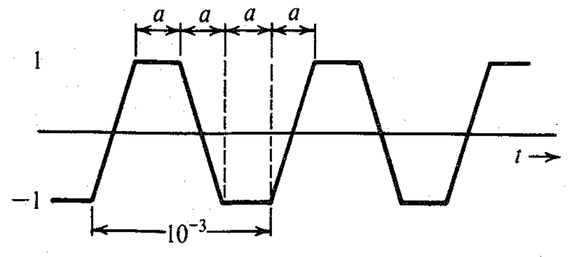

Figure P5.1-1

* *

Q2

5.3-1 Design (only the block diagram) an Armstrong indirect FM modulator to generate an FM carrier with a carrier frequency of 98.1 MHz and $\Delta f = 75$ kHz. A narrow-band FM generator is available at a carrier frequency of 100 kHz and a frequency deviation $\Delta f = 10$ Hz. The stock room also has an oscillator with an adjustable frequency in the range of 10 to 11 MHz. There are also plenty of frequency doublers, triplers, and quintuplers.

* *

Q3

5.3-2 Design (only the block diagram) an Armstrong indirect FM modulator to generate an FM carrier with a carrier frequency of 96 MHz and $\Delta f = 20$ kHz. A narrow-band FM generator with $f_c = 200$ kHz and adjustable Δf in the range of 9 to 10 Hz is available. The stock room also has an oscillator with adjustable frequency in the range of 9 to 10 MHz. There is a bandpass filter with any center frequency, and only frequency doublers are available.

* *

Q4

5.4-2 A periodic square wave $m(t)$ (Fig. P5.4-2a) frequency-modulates a carrier of frequency $f_c = 10$ kHz with $\Delta f = 1$ kHz. The carrier amplitude is A. The resulting FM signal is demodulated, as shown in Fig. P5.4-2b by the method discussed in Sec. 5.4 (Fig. 5.11). Sketch the waveforms at points b, c, d, and e.

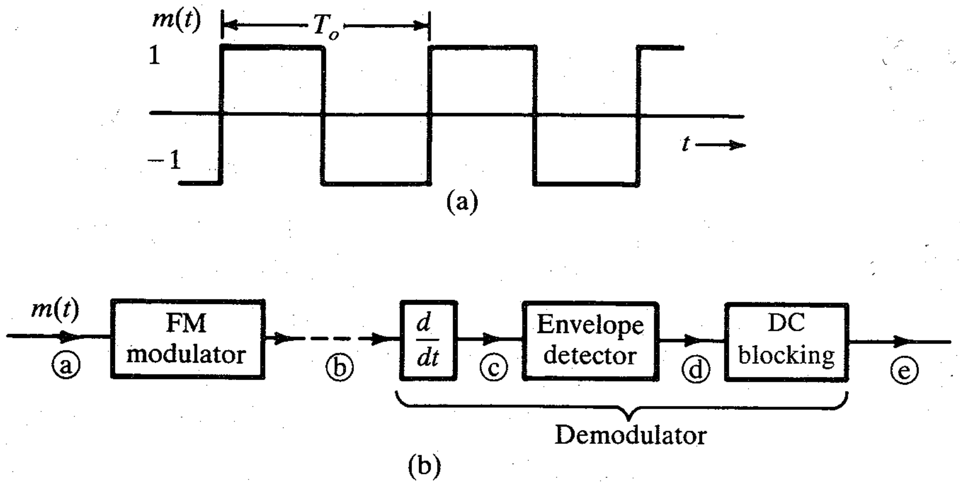

Figure P5.4-2

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EEEN 322 PS 9 SOLUTIONS

5.2-4 The baseband signal bandwidth $B = 3 \times 1000 = 3000$ Hz.

For FM : $\Delta f = \frac{k_f m_p}{2\pi} = \frac{10^5 \times 1}{2\pi} = 15.951$ kHz and $B_{FM} = 2(\Delta f + B) = 37.831$ kHz.

For PM : $\Delta f = \frac{k_p m'_p}{2\pi} = \frac{25 \times 8000}{2\pi} = 31.831$ kHz and $B_{PM} = 2(\Delta f + B) = 66.662$ kHz.

* *

Q2

5.3-1 The block diagram of the design is shown in Fig. S5.3-1.

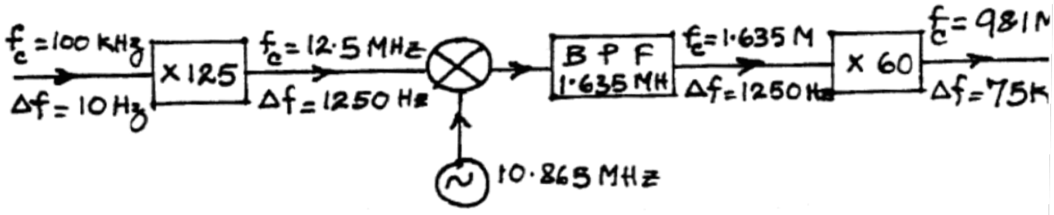

Fig. S5.3-1

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Q3

5.3-2 The block diagram of the design is shown in Fig. S5.3-2.

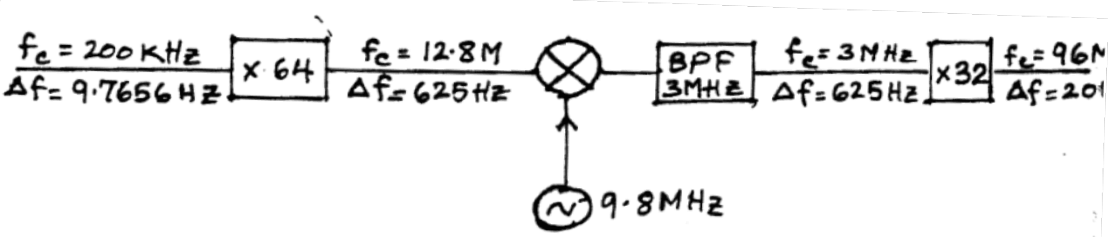

Fig. S5.3-2

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Q4

5.4-2 Figure S5.4-2 shows the waveforms at points b, c, d, and e. The figure is self explanatory.

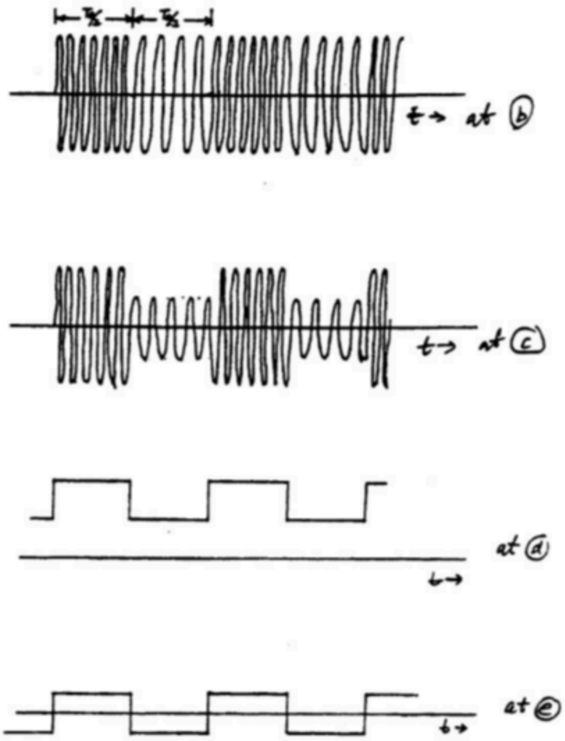

Fig. S5.4-2