Problem 3.23

(a) For f_c = 1.25 kHz, the spectra of the message signal $m(t)$, the product modulator output $s(t)$, and the coherent detector output $v(t)$ are as shown in Fig. 1, respectively:

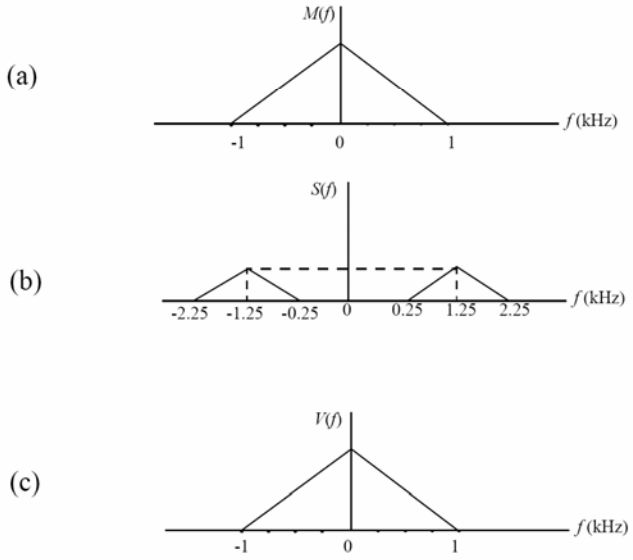

Figure 1

(b) For the case when f_c = 0.75, the respective spectra are as shown in Fig. 2:

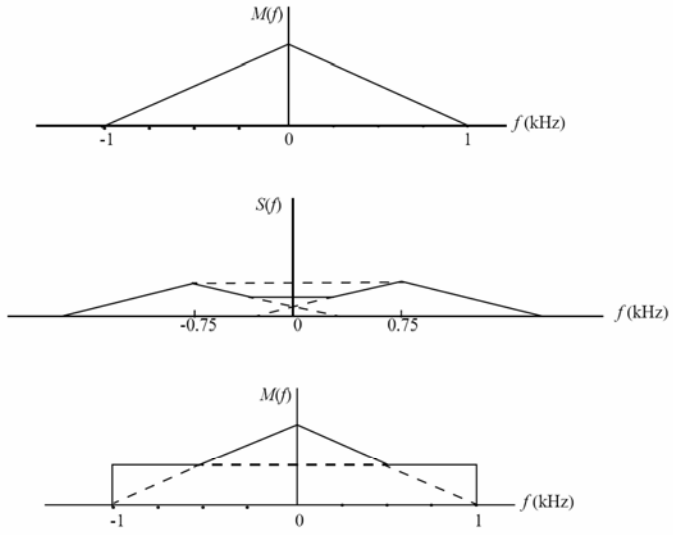

Figure 2

To avoid sideband-overlap, the carrier frequency f_c must be equal to or greater than 1 kHz. The lowest carrier frequency is therefore 1 kHz for each sideband of the modulated wave $s(t)$ to be uniquely determined by $m(t)$.