Serial #

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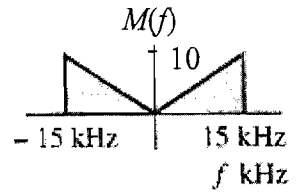writing your serial #

Name: KEY   Sec. 1

1. Given two signals $m(t)$ with the spectrum shown in the figure and $g(t)$ which is band limited to 10 *kHz*. Determine the minimum sampling (Nyquist) rate for the following signals.

$M(f)$

10

− 15 kHz | 15 kHz

$2g(t)m(t)$, $g(t)+m(t)$, $dm(t)$ /dt . *Justify your answer*

f kHz

① $2\,g(t)m(t)$: the bandwidth of the product equal to the sum of the indivisual BW's "convolution!"
= 0 + 15 K + 10 K = 25 K ⟹ Nyquist rate = 50 K Hz

② $g(t) + m(t)$: the spectrum will not increase by addition
BW = max (10k + 15k) = 15 K Hz ⟹ Nyquist rate = 30 KHz

③ $\dfrac{d\,m(t)}{dt}$: dirivative of the signal has same BW as the original signal - BW = 15 K Hz ⟹ Nyquist rate = 30 KHz

2. If the previous signal $m(t)$ is sampled at a rate of 15 kHz. Sketch the spectrum of the sampled signal. Show all details and show the final results. <u>Can the signal be reconstructed?</u>

$\overline{G(\omega)} = \dfrac{1}{T_s} \sum\limits_{n=-\infty}^{\infty} G(\omega - n\omega_s)$

$10/T_s$

−15   15k 30k f
✳ 2π = ω

150 K

✳ 2π = ω
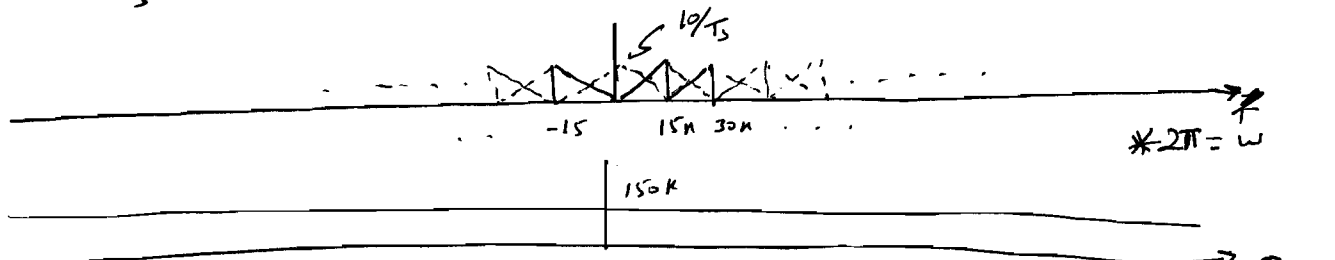
The signal cannot be reconstructed because it's sampled at less than Nyquist rate (aliasing).

Good Luck, **Dr. Ali Muqaibel**