CONTOH SOAL FM

① Hitung index modulasi dan BW FM jika deviasi frekuensi = 75 kHz dan sinyal pemodulasi ber-frekuensi 15 kHz.

Jawab :

$\Delta f = 75\ kHz$

$f_m = 15\ kHz$

$\beta = \frac{\Delta f}{f_m} = \frac{75}{15} = 5$

$BW = 2 f_m (\beta + 1) = 2 \times 15\ (5+1)\ kHz = 180\ kHz$.

② Suatu modulator FM mempunyai sinyal pembawa $S_c(t) = 20 \cos(2\pi 10^8 t)$ volt. Sinyal FM yang terjadi akan mengalami "null carrier pertama" jika diberi informasi $S_m(t) = 2 \cos(\pi \cdot 10^4 t)$ volt.

a. Hitung deviasi frekuensi (Δf), BW Carlson dan daya sinyal FM.

b. Gambar spektrum frekuensi sinyal FM di atas.

c. Hitung Δf, β dan BW jika sinyal informasi diubah menjadi:

$S_m'(t) = 4 \cos(2\pi \cdot 10^3 t)$

Jawab :

Null carrier pertama $\beta = 2.4$.

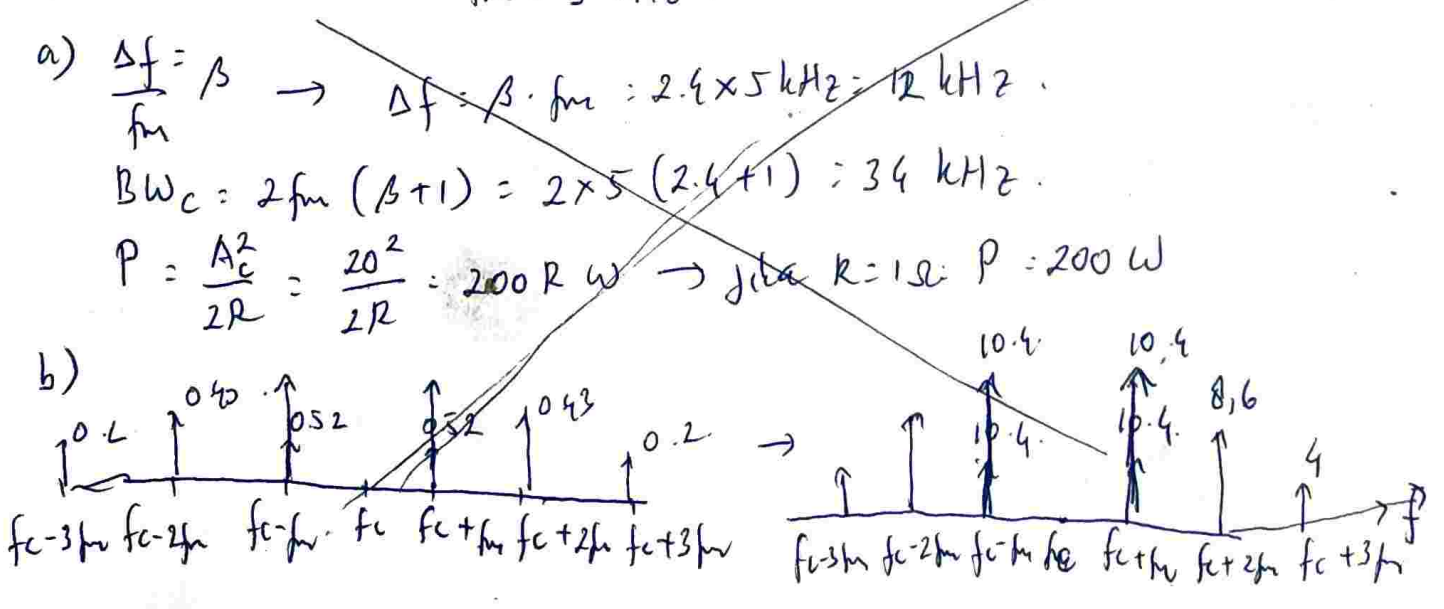
$f_m = 5\ kHz$.

a) $\frac{\Delta f}{f_m} = \beta \rightarrow \Delta f = \beta \cdot f_m = 2.4 \times 5\ kHz = 12\ kHz$.

$BW_C = 2 f_m (\beta + 1) = 2 \times 5\ (2.4+1) = 34\ kHz$.

$P = \frac{A_c^2}{2R} = \frac{20^2}{2R} = 200R\ W \rightarrow$ jika $R = 1\Omega$: $P = 200\ W$

b)



c)

Jawab no. 2

Null carrier pertama → $\beta = 2,4$.

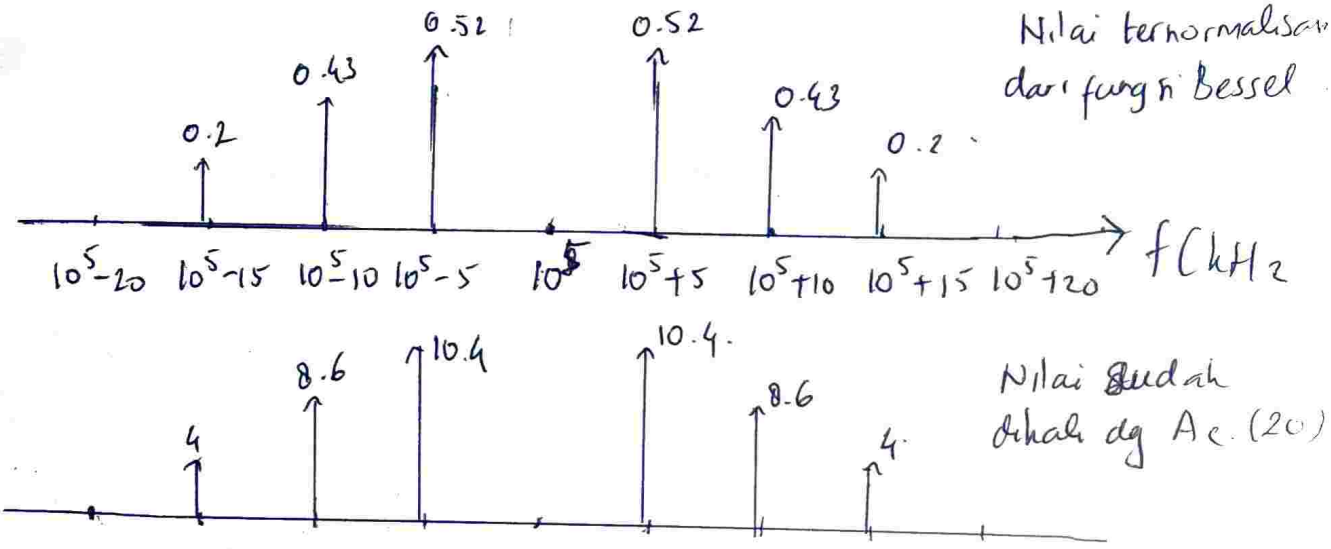
$f_m = 5\,kHz$. (dari persamaan sinyal pemodulasi)

a) $\beta = \frac{\Delta f}{f_m} \rightarrow \Delta f = \beta \cdot f_m = 2.4 \times 5\,kHz = 12\,kHz$.

$BW_C = 2 f_m (\beta + 1) = 2 \times 5 (2,4+1) = 34\,kHz$.

$P = \frac{A_c^2}{2R} = \frac{20^2}{2R} = \frac{200}{R}$ Watt → jika $R = 1 \rightarrow P = 200\,W$.

b)



Nilai ternormalisasi dari fungsi Bessel

Nilai sudah dikali dg A_c (20)

c) Pada null carrier yg pertama (kasus a) dicari nilai k_f (nilai k_f konstan)

$\beta = \frac{k_f A_m}{f_m} \rightarrow k_f = \frac{\beta f_m}{A_m} = \frac{2.4 \times 5}{2} \approx 6\,kHz/V$

Jika diganti dg $s_m'(t) = 4\cos(24\pi \cdot 10^3 t) \rightarrow f_m = 12 \times 10^3\,Hz$ $= 12\,kHz$.

$\Delta f = k_f A_m = 6 \times 4 = 24\,kHz$.

$\beta = \frac{\Delta f}{f_m} = \frac{24}{12} = 2$.

$BW_C = 2 f_m (\beta + 1) = 2 \times 12 (2+1) = 72\,kHz$