CS Test Unit 3

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4C2

1) $Q = \frac{\text{Resonance freq}}{\text{Bandwidth}}$

$= \frac{100\,MHz}{100\,KHz} = \frac{100 \times 1000}{100} \frac{KHz}{KHz}$

$\boxed{Q = 1000}$

2) Super hetrodyne receiver loaded Q of antenna couple circuit = 125

Image freq = 465 KHz

(ii) IF & rejection ratio for tanning 1 MHz

$f_{si} = f_s + 2f_i = 1 + 2 \times 0.465$

$f_{si} = 1.93\,MHz$

$f = \frac{f_{si}}{f_s} - \frac{f_s}{f_{si}} = \frac{1.93}{1} - \frac{1}{1.93}$

$= 1.412$

$\alpha = \sqrt{1 + 125^2 (1.412)^2}$

$\boxed{\alpha = 3.21 \times 10^{-5}}$

2) If a rejection ratio for tuning 30 MHz

$f_{si} = f_s + 2f_i = 30 + 2 \times 0.465$

$f_{si} = 30.93$ MHz

$f = \frac{f_{si}}{f_s} - \frac{f_s}{f_{si}} = \frac{30.93}{30} - \frac{30}{30.93}$

$= 0.061$

$\alpha = \sqrt{1 + Q^2 f^2} = \sqrt{1 + 125^2 (0.061)^2}$

$\boxed{\alpha = 7.69}$

(ii) If required to make rejection ratio as good as 1 MHz will be

for $\alpha = 7.69$, ~~f should be 0.061~~

$\cancel{f = \frac{f_{si}}{f_s} - \frac{f_s}{f_{si}} = \frac{f_{si}}{1} - \frac{1}{f_{si}}}$

$\cancel{0.061 = \frac{f_{si}^2 - 1}{f_{si}}}$

$\cancel{f_{si}^2 - 0.061 f_{si} - 1 = 0}$

$\cancel{f_{si} = \frac{0.061 \pm \sqrt{(0.061)^2 + 4}}{2}}$

$\boxed{\cancel{f_{si} = 1.031 \text{ MHz}}}$

$176.377 = \sqrt{1 + 125^2 j^2}$

$\frac{31107 - 1}{125^2} = 1.99$

$f^2 = 1.99 \approx 1.410$

$1.410 = \frac{f_{si}}{30} - \frac{30}{f_{si}}$

$42.32 f_{si} - f_{si}^2 + 900 = 0$

$\boxed{f_{si} = 13.935 \text{ MHz}}$

Answer 3

$C_s = 2\Delta f$

$\Delta f = \frac{C_s}{2} = 62.5\,kHz$

$m_f = \frac{\Delta actual}{\Delta max} \times 100$

$= \frac{62.5}{75} \times 100$

$\boxed{m_f = 83.3\%}$

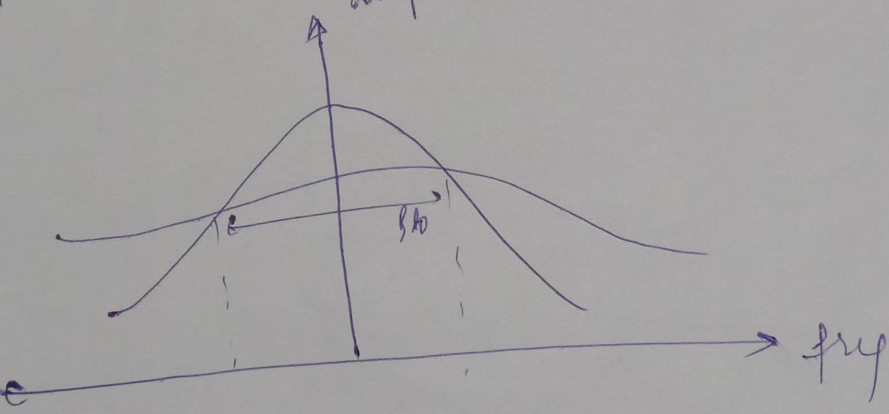
Answer 4

Characteristics of Receivers

a) Selectivity
ability of Rx to select desired signal and reject unwanted signal.

b) Sensitivity
ability of Rx to pick weak signal and amplify it.

c) Fidelity
ability of Rx to reproduce all the freq components of message signal



Answer 5

We know,

$S_{fm} = A_c \cos(2\pi f_c + \beta \sin 2\pi f_m t)$

given: $V(t) = 12 \cos(6\times10^8 t + 5 \sin 1250 t)$

$\beta = 5$

$f_c = \frac{6\times10^8}{2\pi} = 95.54$ MHz

$2\pi f_m = 1250$ $\quad f_m = 199$ Hz

$\beta = \frac{\Delta f}{m}$ $\quad \Delta f = 995$ Hz

$P = \frac{(V_{rms})^2}{R} = \frac{\left(\frac{V_{max}}{\sqrt{2}}\right)^2}{R} = \frac{\left(\frac{12}{\sqrt{2}}\right)^2}{10}$

$P = \frac{72}{10} = 7.2W$

Answer 6

$k_f = \frac{\Delta f}{A_m} = \frac{1\times10^3}{1} = 1$ KHz/V

now, the second case

$A_m = 5V$ & $f_m = 2$ KHz

$\Delta f = k_f \times A_m = 1\times5 = 5$ KHz

β, Mod index $= \frac{\Delta f}{f_m} = \frac{5 \text{ KHz}}{2 \text{ KHz}} = 2.5$

Fm signal,

$s(t) = 3\cos(2\pi\times10^6 + 2.5 \sin(4\pi\times10^3 t)$