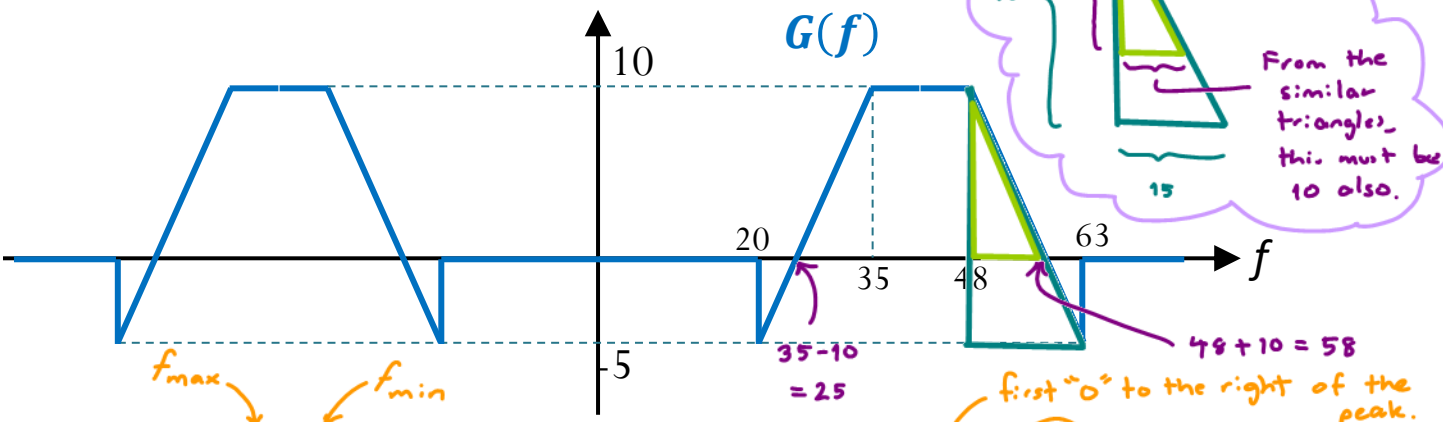
ECS 332: In-Class Exercise # 14

Instructions

1. Separate into groups of no more than three persons. **The group cannot be the same as any of your former groups after the midterm.**
2. Write down all the steps that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
3. **Do not panic.**

Date: **02** / **11** / 2018			
Name	ID (last 3 digits)		
Prapun	**5**	**5**	**5**

1. Find the BW values for the signal below. Note that the signal is real-valued and even in both domains.



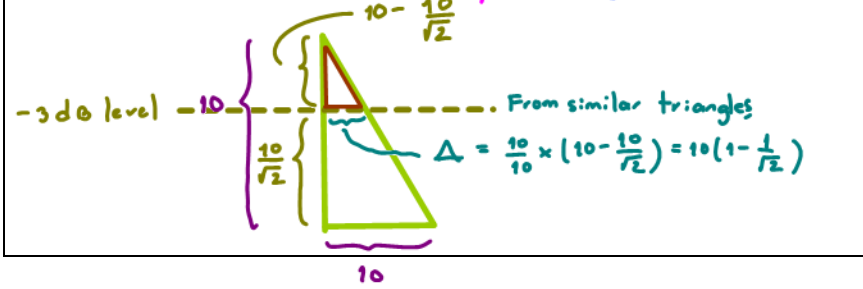
Absolute BW = $63-20$ = 43 Hz

Null-to-null BW = $58-25$ = 33 Hz. first "0" to the left of the peak.

3-dB BW (half-power BW) = $f_2 - f_1 = \Delta + (48-35) + \Delta = 2\Delta + 13 = 20\left(1-\frac{1}{\sqrt{2}}\right)+13$

$= 10(2-\sqrt{2}) + 13 \approx 18.86$

$\times 0.6 \approx 19$



2. [ENRPr] In QAM system, the transmitted signal is of the form

$$x_{\text{QAM}}(t) = m_1(t)\sqrt{2}\cos(2\pi f_c t) + m_2(t)\sqrt{2}\sin(2\pi f_c t).$$

Here, we want to express $x_{\text{QAM}}(t)$ in the form

$$x_{\text{QAM}}(t) = \sqrt{2}E(t)\cos(2\pi f_c t + \phi(t)),$$

where $E(t) \geq 0$ and $\phi(t) \in (-180^\circ, 180^\circ]$.

This problem assumes the messages are piecewise constant. Their values during two time intervals are listed below. Find the values of $E(t)$ and $\phi(t)$ during the corresponding time intervals.

Intervals	$m_1(t)$	$m_2(t)$	$E(t)$	$\phi(t)$
$0 \leq t < 1$	0	-3	3	90°
$1 \leq t < 2$	1	-1	$\sqrt{2}$	45°

The key idea is to use "$m_1 - jm_2$" during each time interval. Normally, a calculator is used to convert "$m_1 - jm_2$" into the polar form "$E \angle \phi$".