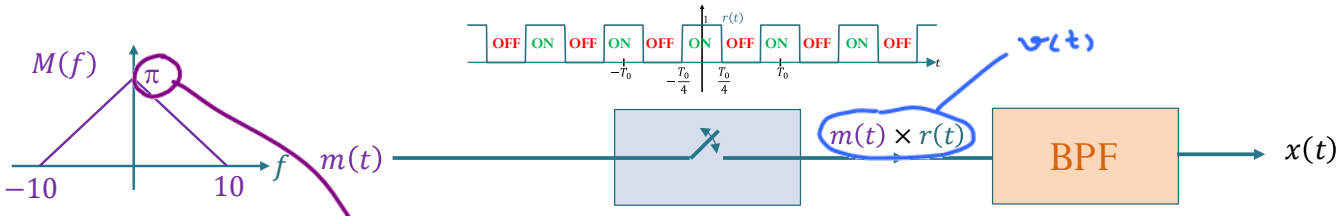
# ECS 332: In-Class Exercise # 11

## 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. **Explanation is not required for this exercise.**
3. **Do not panic.**

| Date: 19/ 10/ 2018 | | | |
|---|---|---|---|
| Name | ID (last 3 digits) | | |
| **Prapun** | **5** | **5** | **5** |
| | | | |
| | | | |

1. Consider a switching modulator in the figure below. $M(f)$ is also plotted on the left.

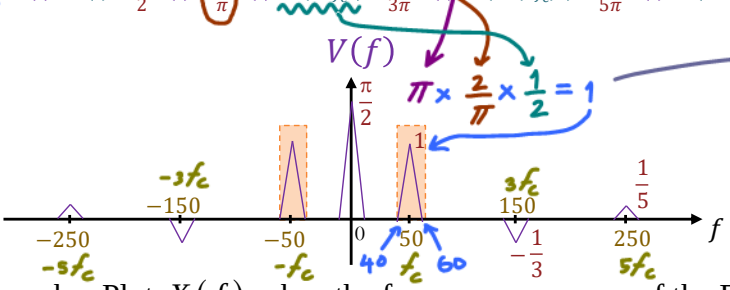


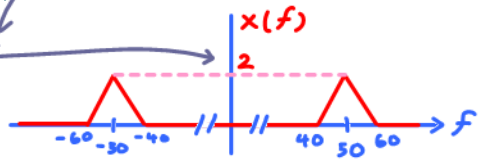

The switching box is operating at frequency 50 Hz with duty cycle 50%.

a. Plot $X(f)$ when the frequency response of the BPF is $H(f)=\begin{cases}2, & |f-50|\le 10,\\ 2, & |f+50|\le 10,\\ 0, & \text{otherwise.}\end{cases}$ $40\le f\le 60$, $-60\le f\le -40$

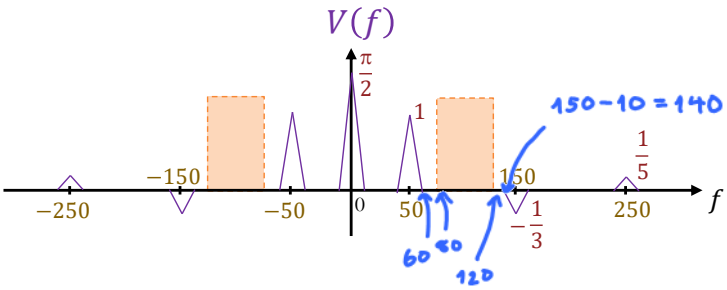
$$r(t)=\frac{1}{2}+\frac{2}{\pi}\cos(2\pi f_c t)-\frac{2}{3\pi}\cos(2\pi(3f_c)t)+\frac{2}{5\pi}\cos(2\pi(5f_c)t)+\cdots$$

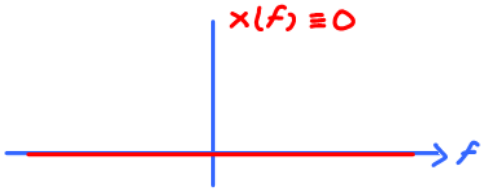
$$v(t)\equiv m(t)\times r(t)=\frac{1}{2}m(t)+\frac{2}{\pi}m(t)\cos(2\pi f_c t)-\frac{2}{3\pi}m(t)\cos(2\pi(3f_c)t)+\frac{2}{5\pi}m(t)\cos(2\pi(5f_c)t)+\cdots$$




b. Plot $X(f)$ when the frequency response of the BPF is $H(f)=\begin{cases}3, & |f-100|\le 20,\\ 3, & |f+100|\le 20,\\ 0, & \text{otherwise.}\end{cases}$ $80\le f\le 120$




c. Plot $X(f)$ when the frequency response of the BPF is $H(f)=\begin{cases}4, & |f-150|\le 5,\\ 4, & |f+150|\le 5,\\ 0, & \text{otherwise.}\end{cases}$ $145\le f\le 155$, $-155\le f\le -145$