

# Assignment

## EE23010: Probability and Random Processes

### Indian Institute of Technology, Hyderabad

Aman Kumar  
EE22BTECH11006

Question: For a real signal, which of the following is/are valid power spectral density/densities?

1)  $s_X(w) = \frac{2}{9+w^2}$

2)  $s_X(w) = e^{-w^2} \cos^2 w$

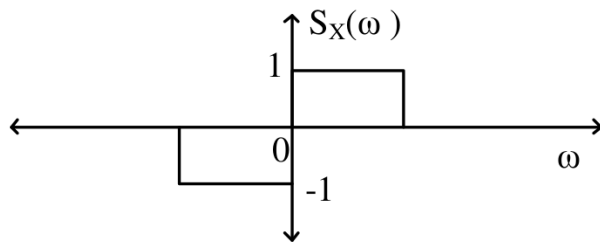


Fig. 3. Figure1

3)

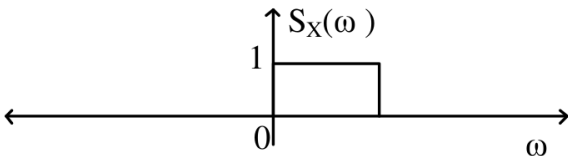


Fig. 4. Figure2

4)

#### Solution:

For a real signal, power spectral density(PSD)

should satisfy the following properties:

$$\text{Im}(s_X(w)) = 0 \quad (1)$$

$$s_X(-w) = s_X(w) \quad (2)$$

Now, checking for option (1)

$$\text{Im}\left(\frac{2}{9+w^2}\right) = 0 \quad (3)$$

$$(4)$$

Also,

$$\frac{2}{9+w^2} = \frac{2}{9+(-w)^2} \quad (5)$$

So, it is a valid PSD

Now, for option (2)

$$\text{Im}(e^{-w^2} \cos^2 w) = 0 \quad (6)$$

And,

$$e^{w^2} \cos^2 w = e^{(-w)^2} \cos^2(-w) \quad (7)$$

It is also a valid PSD.

Similarly, checking for (3) and option (4) doesn't satisfy the properties. So, it is not a valid PSD.

$\therefore$  Option (1) and (2) are correct.