TFA Assignment 3

1.Use 0.5 (at least) minutes of your own voice signal for the following questions.

a.Plot the spectrogram (STFT) with a frame size of 100msec and frameshift of 10ms

b.Plot the spectrogram (STFT) with a frame size of 50msec and frameshift of 10ms

c.Plot the spectrogram (STFT) with a frame size of 20msec and frameshift of 10ms

d.Plot the spectrogram (STFT) with a frame size of 10msec and a frameshift of 5msWrite your observation for varying frame sizes.

2.Use 0.5 (at least) minutes of your own voice signal for the following questions. Plot the spectrogram (STFT) with a frame size of 20msec and frameshift of 10ms using window functions (a). Hamming (b) Hanning (c) Rectangular and (d) Triangular windows. Write your observation for varying window types?

3) Calculate Time Bandwidth product of following signals

a) $e^{-|t|}e^{j\omega_0 t}$
b) $\frac{1}{1+t^2}$
c) $(1-|t|)\left[u(t+1) - u(t-1)\right]$

$u(t)$ is Heaviside step function.

4) When can we achieve minimum time bandwidth product among following scenarios.

i) If signal is limited to some region in time domain.

ii) If signal is limited to some region if frequency domain

iii) It does not depend on above two points.

Justify your answer, mention one example

5) Calculate Analytical signal for

a) $x(t) = \sin(\omega t + \theta)$

b) $x(t) = \cos(\omega t + \theta)$

c) $x(t) = 2e^{-j\omega t}$