GATE Assignment 1

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Download all python codes from

https://github.com/Adarsh541/EE3900/blob/main/Gate1/codes/Gate1.py

Download latex-tikz codes from

https://github.com/Adarsh541/EE3900/blob/main/Gate1/Gate1.tex

1 Problem(GATE 2021 EC Q4)

Consider a real-valued base-band signal $x(t)$, band limited to 10 kHz. The Nyquist rate for the signal $y(t) = x(t)\,x\left(1+\frac{t}{2}\right)$ is

1) 15 kHz
2) 30 kHz
3) 60 kHz
4) 20 kHz

2 Solution

Since $x(t)$ is a base-band signal bandwidth is equal to maximum frequency in the signal.

$$\text{bandwidth of } x(t) = 10kHz \tag{2.0.1}$$

$$\text{bandwidth of } x\left(1+\frac{t}{2}\right) = \frac{10}{2}kHz \tag{2.0.2}$$

$$= 5kHz \tag{2.0.3}$$

$$\text{bandwidth of } y(t) = (10+5)kHz \tag{2.0.4}$$

$$= 15kHz \tag{2.0.5}$$

$$\text{Nyquist rate} = 2 \times \text{maximum frequency} \tag{2.0.6}$$

$$= 30kHz \tag{2.0.7}$$

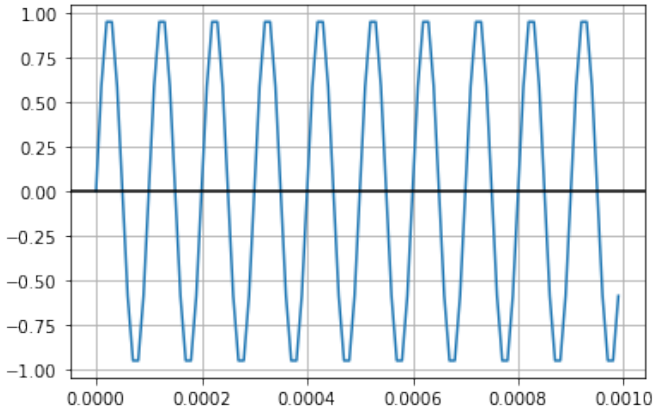

Fig. 4: $x(t)$:Sinusoidal signal with freq=10kHz

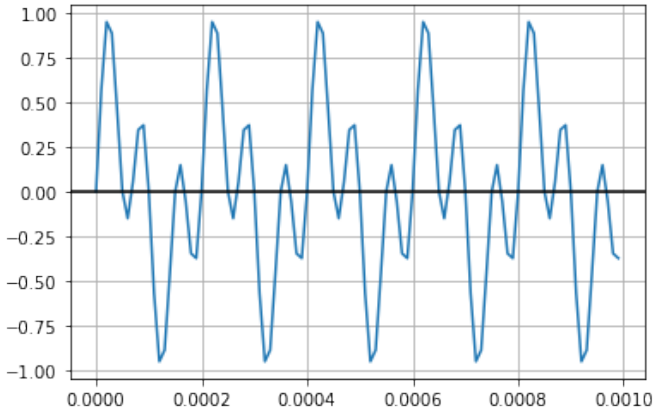

Fig. 4: $y(t)$

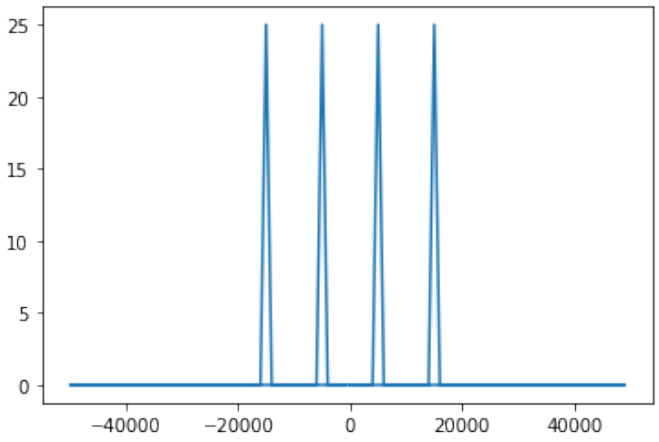

Fig. 4: DFT of $y(t)$