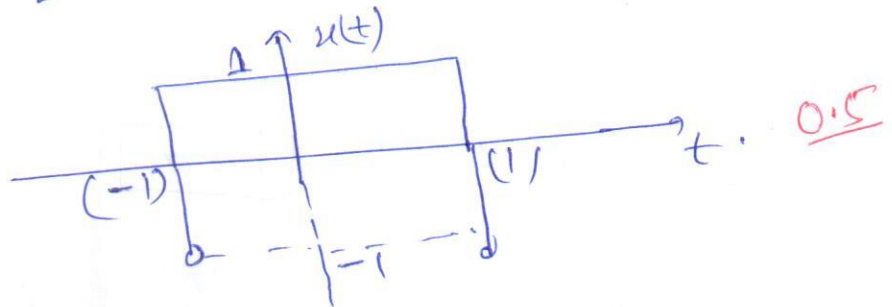


Mid Sem. Exam, 2017. (Solution)

Q.1.

(a)

$$x(t) = [u(t+1) - u(t-1)] - \delta(t+1) - \delta(t-1) \quad 0.5$$



(b)

$$x(t) = \begin{cases} Ae^{-\alpha t} & t > 0 \\ 0 & t < 0 \end{cases}$$

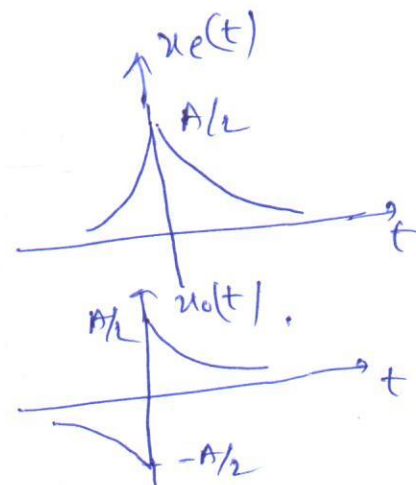
$$x(-t) = \begin{cases} Ae^{\alpha t} & t < 0 \\ 0 & t > 0 \end{cases}$$

$$x_e(t) = \begin{cases} \frac{1}{2} Ae^{-\alpha t} & t > 0 \\ \frac{1}{2} Ae^{\alpha t} & t < 0 \end{cases}$$

0.5

$$x_o(t) = \begin{cases} \frac{1}{2} Ae^{-\alpha t} & t > 0 \\ -\frac{1}{2} Ae^{\alpha t} & t < 0 \end{cases}$$

0.5



(c)

$$R_{xx}(\omega) = \frac{A^2}{2} G_s(\omega) \quad 1.$$

$$\text{at } \omega = 0 \quad P_x = R_{xx}(0) = \frac{A^2}{2} \quad 1.$$

(d)

$$P_x = D_0^2 + 2 \sum_{n=1}^{\infty} |D_n|^2 \quad 1$$

Q.2.

$$h_2(t) = \delta(t) + \frac{d}{dt}[\delta(t)] \quad 1$$



$$\begin{aligned} h(t) &= h_1(t) * h_2(t) \\ &= e^{-t} u(-t) * \delta(t) + e^{-t} u(-t) * \frac{d}{dt}[\delta(t)] \end{aligned} \quad 1$$

$$\begin{aligned}
 &= e^{-t} \cdot u(-t) \otimes \delta(t) + \delta(t) \otimes \frac{d}{dt} [e^{-t} \cdot u(t)] \quad \underline{1} \\
 &= e^{-t} \cdot u(-t) + \delta(t) [-e^{-t} u(-t) + e^{-t} \delta(-t)] \\
 &= e^{-t} u(-t) - e^{-t} u(-t) - e^{-t} \delta(-t) \\
 &= -e^{-t} \delta(-t) \\
 &= -\delta(t) \quad \underline{2}
 \end{aligned}$$

Q.3.

No. of pulses $\therefore \boxed{L = \infty} \quad \underline{2}$

for (1)	for (0)
1	1
1	2
1	3
1	4
...	...
N	N
(AP)	(AP)

$$P = \lim_{N \rightarrow \infty} \left(\frac{2N}{N^2 + 3N} \right)$$

$$\boxed{P = 0} \quad \underline{3}$$

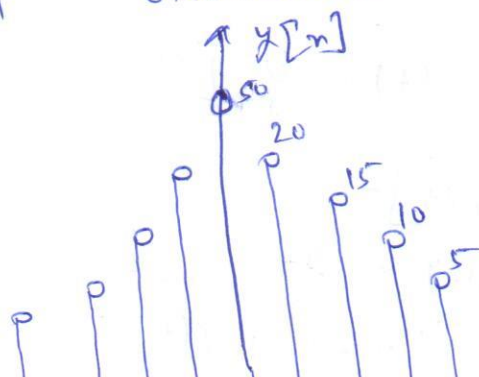
Q.4.

$$y[n] = \sum_{k=-\infty}^{\infty} x[k] g[n-k]$$

$$y[n] = 0 \quad 5 \leq |n| \leq 19 \quad \& \quad |n| \geq 15$$

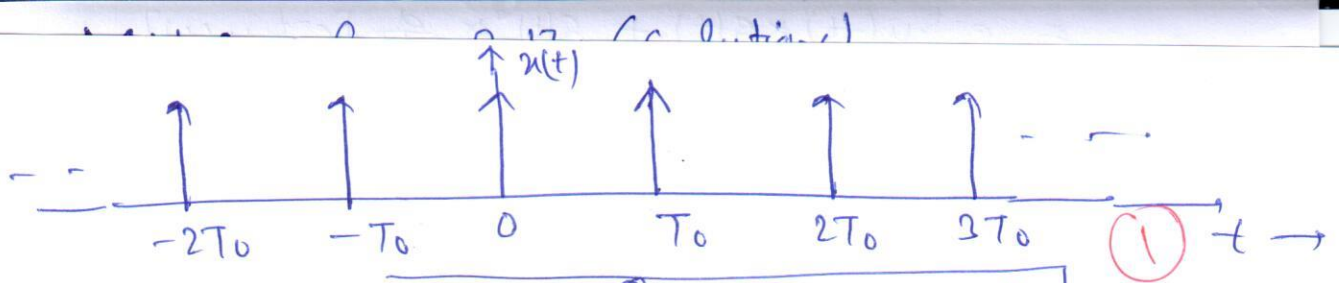
n	y[n]
0	5x5 + 5x5 = 50
±1	5x4 + 0 = 20
±2	5x3 + 0 = 15
±3	5x2 + 0 = 10
±4	5x1 + 0 = 5
±5	0
...	...
±10	0x0 + 5x1 = 5
±11	0x0 + 5x1 = 20

n	y[n]
±12	0x0 + 5x3 = 15
±13	0x0 + 5x2 = 10
±14	0x0 + 5x1 = 5
±15	0
...	...
±18	0



2.

Q.5



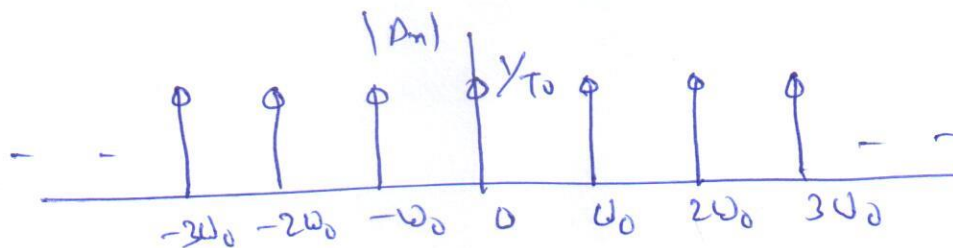
$$x(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_0)$$

$$x(t) = \sum_{n=-\infty}^{\infty} D_n e^{jn\omega_0 t}, \quad \omega_0 = \frac{2\pi}{T_0}$$

$$\Rightarrow D_n = \frac{1}{T_0} \int_{-T_0/2}^{T_0/2} x(t) e^{-jn\omega_0 t} dt$$

$$D_n = \frac{1}{T_0}$$

$$x(t) = \frac{1}{T_0} \sum_{n=-\infty}^{\infty} e^{jn\omega_0 t}$$



2