Name :

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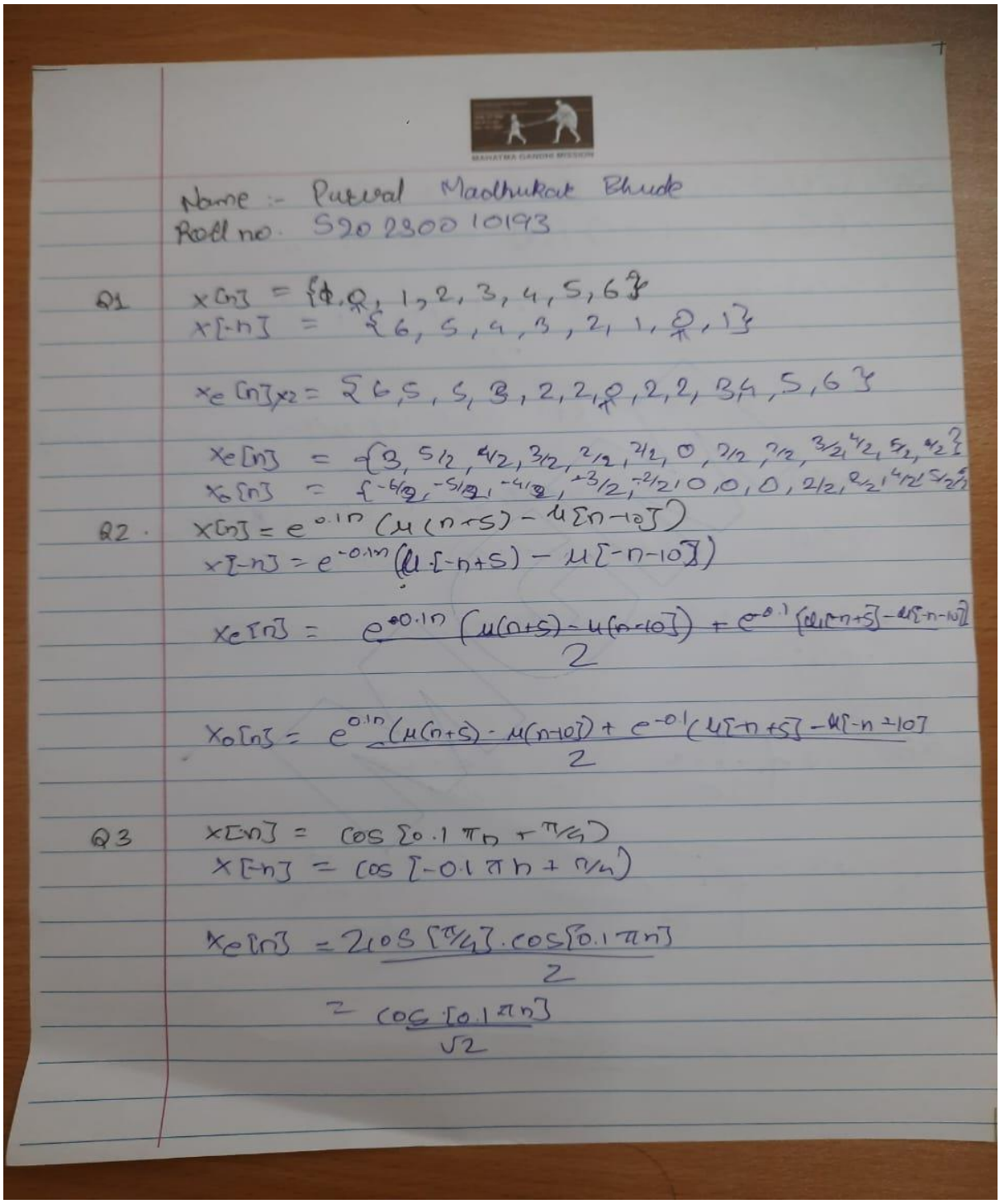
Subject: Signals and Systems

Assignment

Question 1



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Q1 $x[n] = \{4, 0, 1, 2, 3, 4, 5, 6\}$
$x[-n] = \{6, 5, 4, 3, 2, 1, 0, 1\}$

$x_e[n] = \{6, 5, 5, 3, 2, 2, 0, 2, 2, 3, 4, 5, 6\}$

$x_e[n] = \{3, 5/2, 4/2, 3/2, 2/2, 2/2, 0, 2/2, 2/2, 3/2, 4/2, 5/2, 6/2\}$
$x_o[n] = \{-6/2, -5/2, -4/2, -3/2, -2/2, 0, 0, 0, 2/2, 2/2, 4/2, 5/2, 6/2\}$

Q2. $x[n] = e^{0.1n}(u(n+5) - u[n-10])$
$x[-n] = e^{-0.1n}(u[-n+5) - u[-n-10])$

$x_e[n] = \frac{e^{0.1n}(u(n+5) - u(n-10)) + e^{-0.1}(u[-n+5] - u[-n-10])}{2}$

$x_o[n] = \frac{e^{0.1n}(u(n+5) - u(n-10)) + e^{-0.1}(u[-n+5] - u[-n-10])}{2}$

Q3 $x[n] = \cos[0.1\pi n + \pi/4)$
$x[-n] = \cos[-0.1\pi n + \pi/4)$

$x_e[n] = \frac{2\cos[\pi/4] \cdot \cos[0.1\pi n]}{2}$

$= \frac{\cos[0.1\pi n]}{\sqrt{2}}$

$x_o[n] = -2\sin \pi/4 \sin 0.1\pi n]/2$

$= \frac{-\sin 0.1\pi n]}{\sqrt{2}}$

Q4 $x(t) = \cos(2\pi t)\,[u(t) - u(t-1)]$

$x(-t) = -\cos(2\pi t)\, u(t) - \cos(2\pi t)\, u(-t-1)$

$x_e(t) = \frac{\cos(2\pi t)\,(u(t+1) - u(t-1))}{2}$

$x_o(t) = \frac{2\cos(2\pi t)\,u(t) - \cos(2\pi t)\,u(t-1) - \cos(2\pi t)\,u(t+1)}{2}$

Q5 $x(t) = 1 + 1.5\cos(\pi t/5) - 0.6\cos(\pi t/6)$

$y(-t) = 1 + 1.5\cos(-\pi t/5) - 0.6\cos(-\pi t/6)$

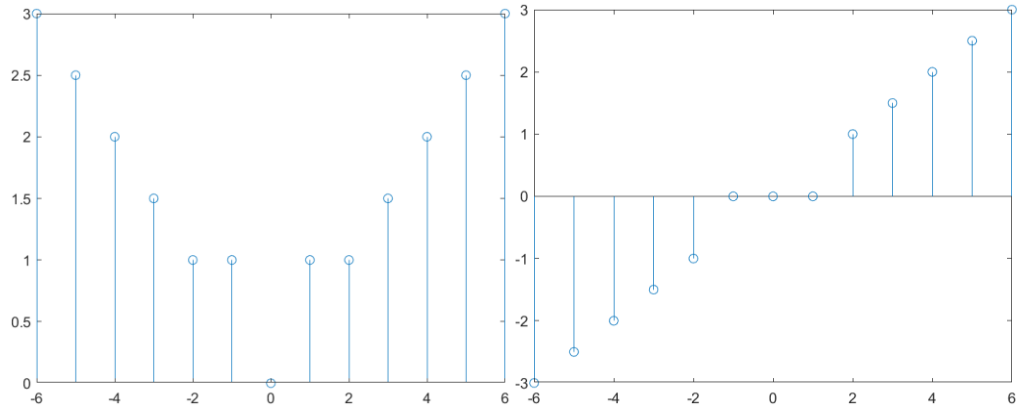
$y_e(t) = 1 + 1.5\cos(\pi t/5) - 0.4\cos(2\pi t/5)$

$y_o(t) = 0$

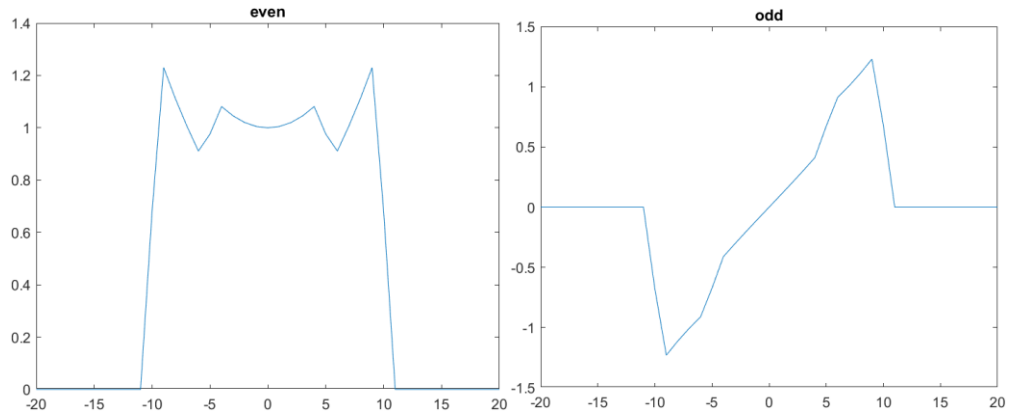
Q5 $y \begin{cases} t & ; 0 \le t \le 1 \\ -t+2 & ; 1 < t < 2 \\ 0 & ; \text{else} \end{cases}$

$y(-t) = \begin{cases} -t & ; 0 \ge t \ge -1 \\ t+2 & ; -1 > t \ge -2 \\ 0 & ; \text{else} \end{cases}$

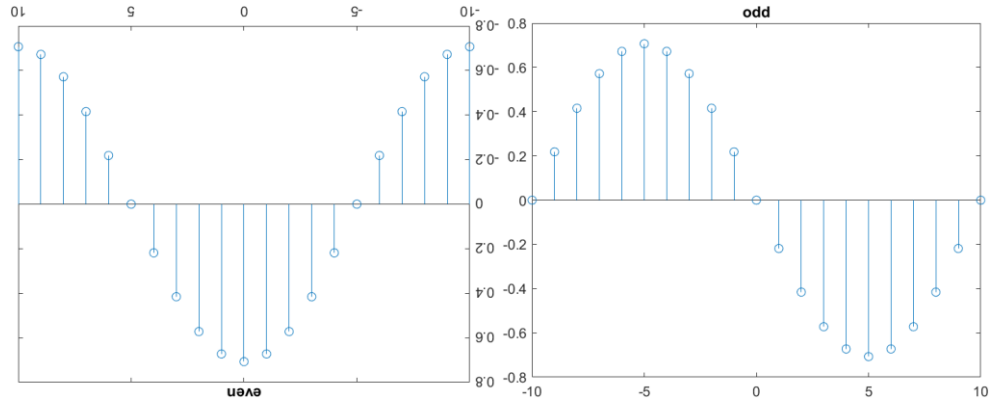
a)



b)



c)



Question 2

b) $y(t) = (1+j)e^{j\pi t/2}$, $0 \le t \le 10$.

$$E = \int_0^{10} |1+j|^2 \, |e^{j\pi t/2}|^2 \, dt$$

$$= \int_0^{10} 2\,dt = 20$$

∴ energy signal.

c) $y(t) = 1$, $0 \le t \le 100$

$$E = \int_0^{100} |y(t)|^2 \, dt$$

$$= \int_0^{100} 1\,dt$$

$$= [t]_0^{100}$$

$$\boxed{E = 100}$$

$$P = \lim_{T\to\infty} \frac{1}{2T} \int_0^{T/2} 1\,dt$$

$$\boxed{P = 0}$$

d) $x(t) = \begin{cases} 2\cos(4t - \pi/4), & t \ge 0 \\ 0, & \text{else} \end{cases}$

$$E = \int_0^{\infty} 4\cos^2(4t - \pi/8)\,dt$$

$$= \int_0^{\infty} 1 + \sin(8t - \pi/2)\,dt$$

$$E = \infty$$

$$P = \lim_{T\to\infty} \frac{1}{2T} \int_0^{T/2} 2\,dt$$

$$= \infty$$

$$y_e(t) = \begin{cases} t/2 & -2 \le t < -1 \\ -t/2 & -1 \le t < 0 \\ t/2 & 0 \le t \le 1 \\ t/2 & 1 \le t \le 2 \\ 0 & \text{else} \end{cases}$$

$$y_o(t) = \begin{cases} -(t+2)/2 & -2 \le t < -1 \\ t/2 & -1 \le t \le 0 \\ t/2 & 0 < t < 1 \\ -t/2 & 1 \le t \le 2 \\ 0 & \text{else.} \end{cases}$$

Q2a) $x(t) = \cos\left(\frac{\pi t}{2} + \pi/4\right)$

$$E = \int_{-\infty}^{\infty} \left(\cos^2\left(\frac{\pi t}{2} + \frac{\pi}{4}\right)\right) dt$$

$$= \int_{-\infty}^{\infty} \frac{1 + \sin(\pi t)}{2}\, dt$$

$$\approx \infty$$

$$P = \lim_{T \to \infty} \frac{1}{2T} \int_{-T}^{T} \frac{1 + \sin(\pi t)}{2}\, dt$$

$$= \lim_{T \to \infty} \frac{1}{4T} \left(\left[t \right]_{-T}^{T} + \left(\frac{\cos(\pi t)}{\pi} \right)_{-T}^{T} \right)$$

$$\Rightarrow P = 1/2$$

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question a)
Energy: 9223372036854775807
Power: 0

question b)
Energy: 0
Power: 0

question c)
Energy: 100
Power: 1

question d)
Energy: 9223372036854775807
Power: 2
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