Marking Scheme

Total No. of Questions – [   ]

Total No. of Printed Pages

U218-133 (T1)

G.R. No.	

OCTOBER 2018/ IN-SEM (T1)
S. Y. B. TECH. (E&TC) (SEMESTER - I)

COURSE NAME: Signals & Systems

COURSE CODE: ETUA21173

(PATTERN 2017)

Time: [**1 Hour**] [Max. Marks: **30**]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2 and Q.3 OR Q.4.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1)	a)	Correct Sketch of the sequences y[n] Correct Sketch of the sequences z[n] Correct Sketch of the sequences w[n] **2 Marks each**	6 Marks
	b)	correct ans with appropriate steps **2 Marks each** i) 2 ii) 2 iii) 1/2	6 marks
	c)	Finding T1 and T2 **1 Mark** Ration of T1 and T2 , finding periodicity **1 Mark** Finding Fundamental period **2 Marks**	4 marks
OR			
Q.2)	a)	Sketch the signal x(t-1) **1 & ½ Marks** Sketch the signal y(-t) **1 & ½ Marks** Final Ans **3 Marks**	6 marks
	b)	For Correct Even and odd components **1 & ½ Mark each**	6 marks
	c)	Correct mathematical expression **4 Marks**	4 marks
Q.3)	a)	Identification of system **2 Marks** sketch input x(t) **1 Mark** sketch corresponding output y(t) **3 Marks**	6 marks
	b)	Each classificiation with proper justification or solution **1 Mark Each**	4 marks
	c)	The meaning of causality **2 Marks** Classification with proper justification **2 Marks**	4 marks
OR			
Q.4)	a)	Stable and Causal classification **1 Mark Each** Linear and TV/TIV classification **2 Marks Each**	6 marks
	b)	Defincation of Static System **1 Mark** Each classificiation with proper justification or solution **1 Mark Each**	4 marks
	c)	State superposition principal **1 Mark** Classification with all proper steps **3 Marks**	4 marks

$x(t)$

(Solution)

October 2018 | In-sem (T1)

S.Y. B. Tech (E&TC) Sem-I

Course Name : Signals and Systems

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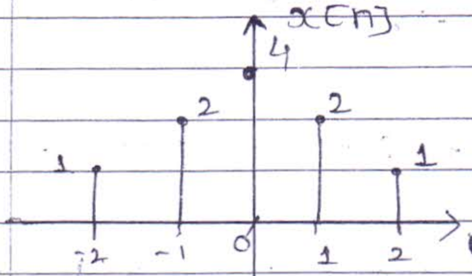
Pattern : 2017

Qu. 1 a] Sequence $x[n]$ has non-zero values shown in figure below; sketch the sequences $y[n]$, $z[n]$, $w[n]$

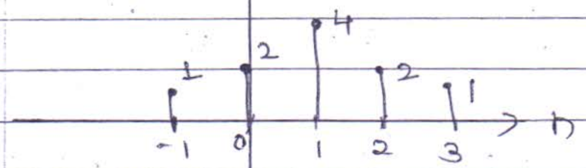
(i) $y[n] = \begin{cases} x\left[\frac{n}{2} - 1\right] & \text{for } n \text{ even} \\ 0 & n\text{-odd} \end{cases}$

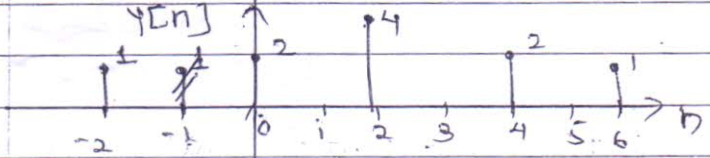
(ii) $z[n] = x[n] + y[n]$

(iii) $w[n] = x[n] \cdot y[n]$



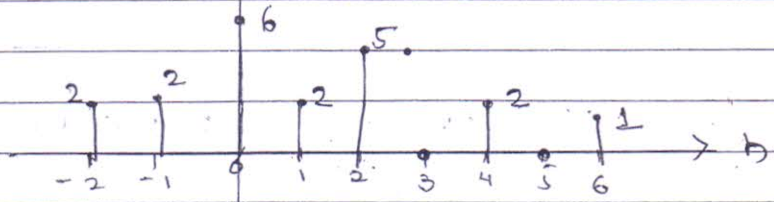
$x[n-1]$





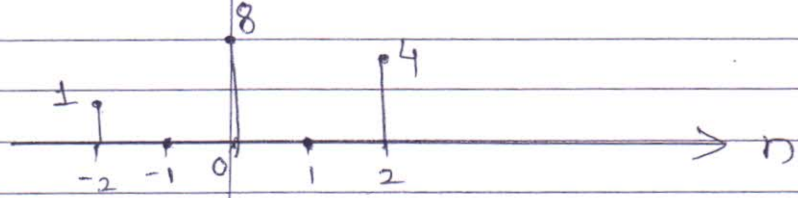
— (2)

$z[n] = x[n] + y[n]$

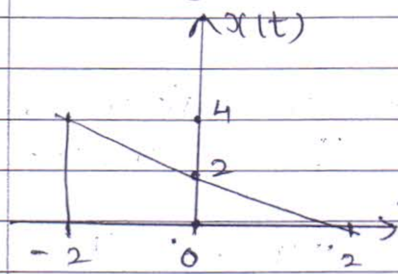


— (2)

$w[n] = x[n] \cdot y[n]$ — (2)



Q4. 1b] Evaluate the following properties of Impulse function for given signal $x(t)$ shown in figure below



(i) $\int_{-\infty}^{\infty} x(t)\,\delta(t)\,dt$

(ii) $\int_{-\infty}^{\infty} x(t-1)\,\delta(t-1)\,dt$

(iv) $\int_{-\infty}^{\infty} x(t)\,\delta(4t)\,dt$

Soln:

properties: ① $\int_{-\infty}^{\infty} x(t)\,\delta(t) = x(0)\,\delta(t)$

② $\int_{-\infty}^{\infty} x(t)\,\delta(t-t_0) = x(t_0)\,\delta(t-t_0)$

③ $\delta(at) = \frac{1}{|a|}\delta(t)$

i) $\int_{-\infty}^{\infty} x(t)\,\delta(t)\,dt = \int_{-\infty}^{\infty} x(0)\,\delta(t)\,dt = x(0)$

$= 2$ — 2

ii) $\int_{-\infty}^{\infty} x(t-1)\,\delta(t-1)\,dt = \int_{-\infty}^{\infty} x(0)\,\delta(t-1)\,dt$

$= 2$ — 2

iii) $\int_{-\infty}^{\infty} x(t)\,\delta(4t)\,dt = \int_{-\infty}^{\infty} \frac{1}{4}\,x(t)\,\delta(t)$

$= \frac{1}{4}(2) = \frac{1}{2}$ — 2

2

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(c) Inspect wether the following ~~sigig~~ signals are periodic, if they are periodic calculate fundamental period

$$x(t) = 5\cos(5t+30) + 18\sin(6t+20)$$

Let $x_1(t) = 5\cos(5t+30)$ with F.P. T_1

and $x_2(t) = 18\sin(6t+20)$ with F.P. T_2

$$T = \frac{2\pi}{\omega_0}$$

Comparing $x_1(t)$ and $x_2(t)$ with std. signal we get ω_0 : $x(t) = A\sin(\omega_0 t+\phi)$

$$T_1 = \frac{2\pi}{5} \qquad T_2 = \frac{2\pi}{6} \quad \text{— 1}$$

$$\frac{T_1}{T_2} = \frac{2\cancel{\pi}}{5} \times \frac{6}{2\pi} = \frac{6}{5}$$

$\because$ ratio of T_1 and T_2 is rational

$\therefore$ given signal $x(t)$ is periodic in nature — 1.

Fundamental period :

$$T_1 = \frac{\cancel{2}\cancel{\pi}}{\cancel{5}_1} \times \frac{\cancel{30}\,6}{\cancel{\pi}} \qquad T_2 = \frac{\cancel{2}\cancel{\pi}}{\cancel{6}_1} \times \frac{\cancel{30}\,5}{\cancel{\pi}}$$

$$T_1 = 12 \qquad T_2 = 10$$

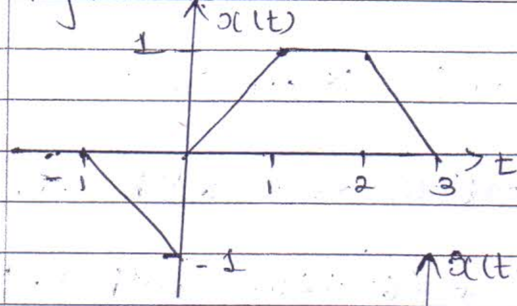
$$\text{LCM of } (T_1, T_2) = 60$$

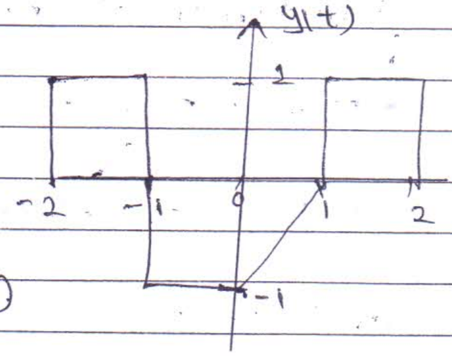
$$T = \frac{\text{LCM}}{\text{common factor}} = \frac{60}{30/\pi}$$

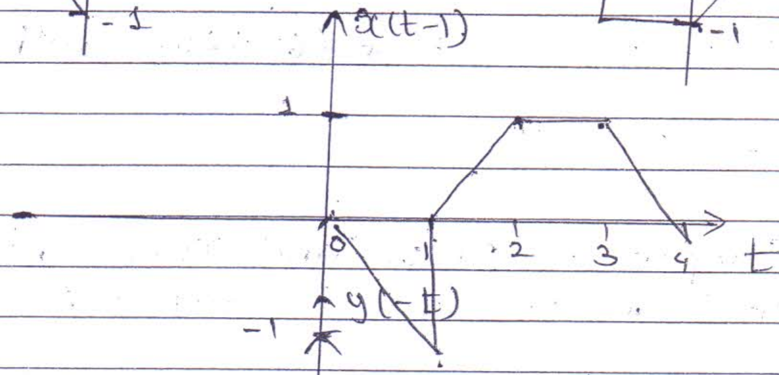
$$\boxed{T = 2\pi \text{ sec}} \quad / \ \underline{2\pi}$$

2

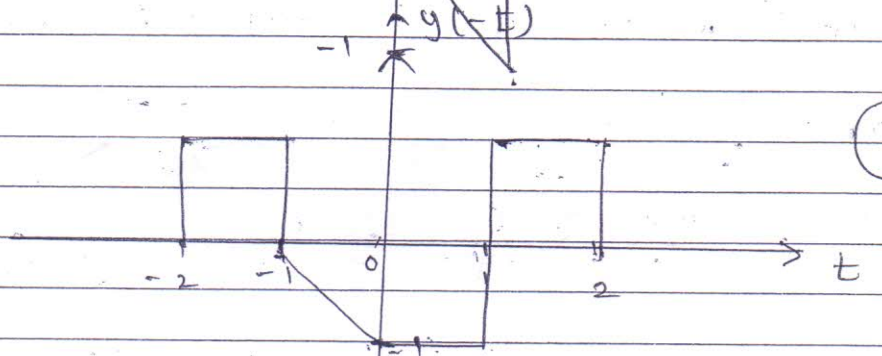
Qu. 2a) Sketch the signal $z(t) = x(t-1)\, y(-t)$ where $x(t)$ and $y(t)$ are shown in figure below.





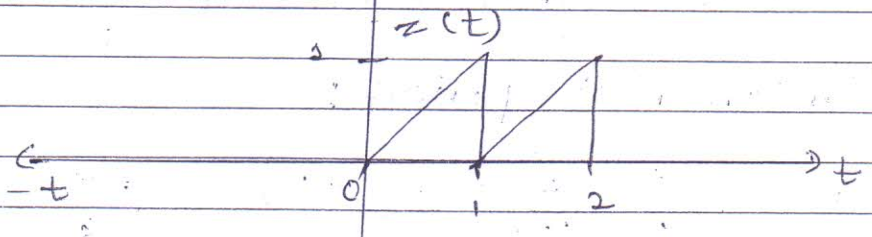


$1\frac{1}{2}$



$1\frac{1}{2}$

$z(t) = x(t-1) \cdot y(-1)$



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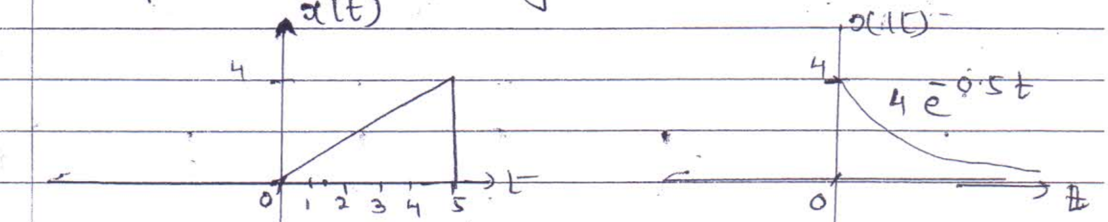
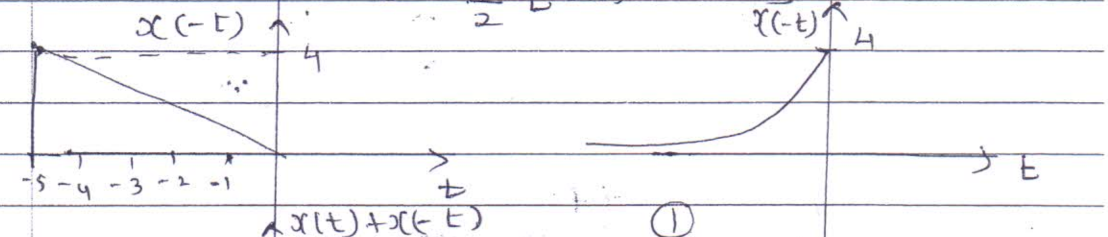
2 b) Sketch and label the even and odd component of signal shown in fig.

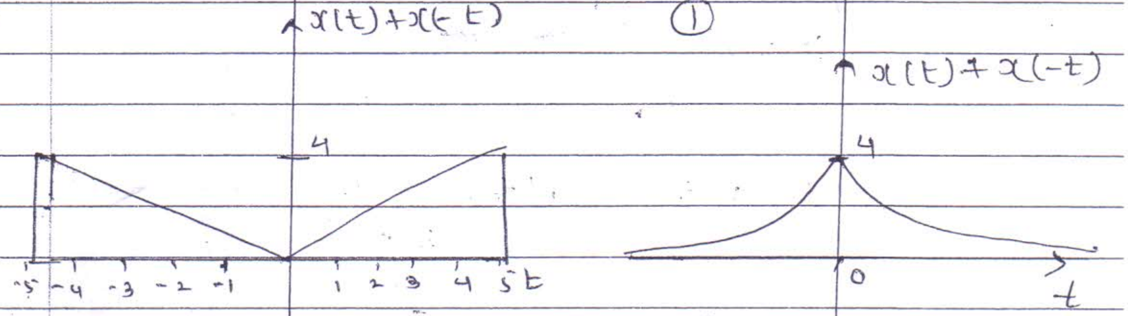


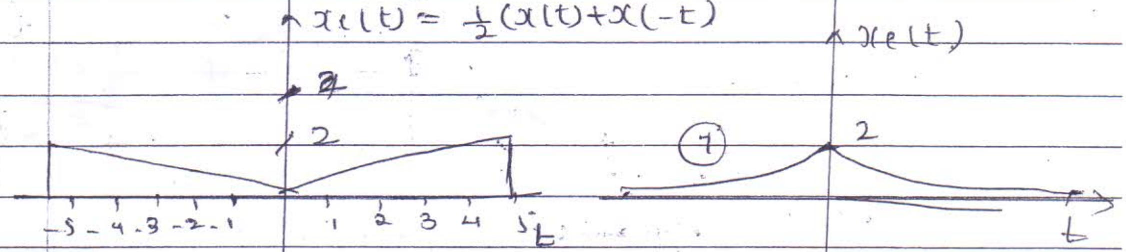
$$x_e(t) = \frac{1}{2}[x(t) + x(-t)]$$

$$x_o(t) = \frac{1}{2}[x(t) - x(-t)]$$

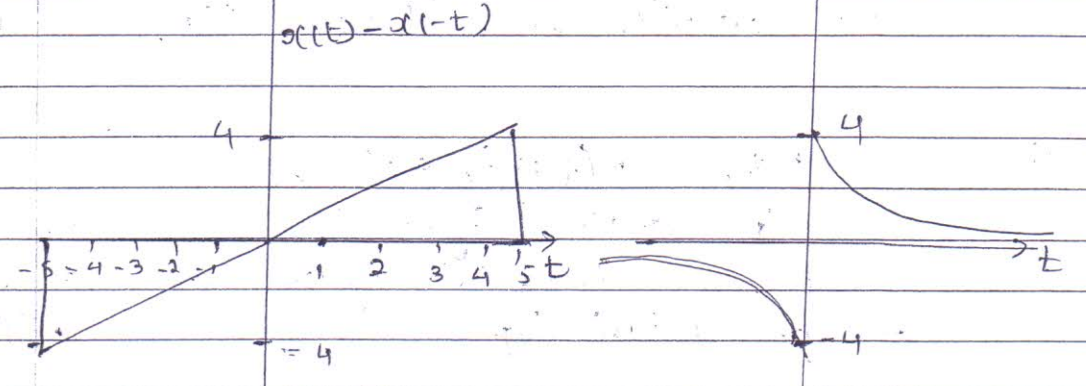


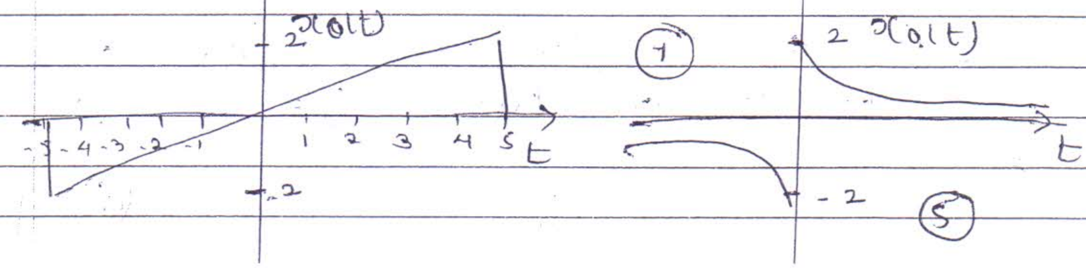
(1) (1)





(1) (1)

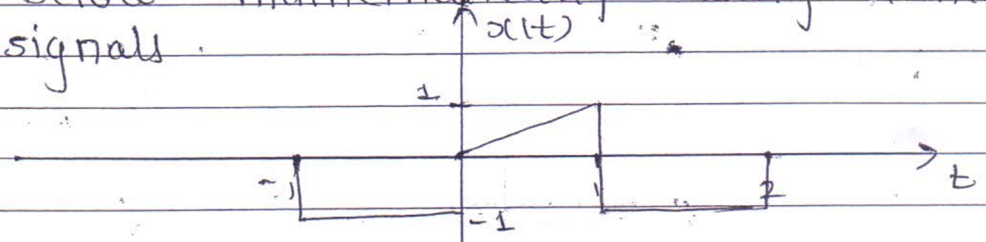




(1) (1)

(5)

2C Express the waveform shown in fig below mathematically using elementary signals.



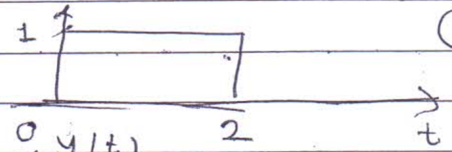
$x(t) = \underbrace{-u(t+1) + u(t)}_{1} + r(t) - r(t-1) - 2u(t-1) + u(t-2)$

(3)

(4)

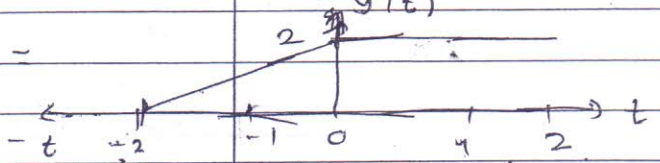
Q 3 a) $y(t) = \int_{0}^{\cancel{t}\, t2} x(\tau)\, d\tau$

i/p $x(t) = u(t) - u(t-2)$



(1)

$y(t) =$



(3)

It is ~~dyamic~~ dynamic system as o/p depends on future i/p. (2)

b) $y(t) = x(t+10) + x^2(t)$

i) static / Dynamic

It is dynamic system as o/p depends on ~~pre~~ future i/p — (1)

ii) It is Non-causal system as o/p depends on future i/p — (1)

(6)

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iii) It is non-linear system (1)

IF proved by appropriate steps

iv) TIV — (1) — " —

c) causality :- IF o/p depends ~~only~~ on past or/and present i/p but does not depends upon Future i/p it is known as causal system.

i.e. only practically possible i/p — (2)

$$y(t) = \int_{-\infty}^{2t} x(\tau)\, d\tau$$ it is non-causal system

as limits depends upon 2t — (2)

$$y(4) = \int_{-\infty}^{8} x(\tau)\, d\tau$$

Q4 a) $y[n] = \frac{1}{3}\{x[n] + x[n-1] + x[n-2]\}$

i) stable system. — (1)

As the system is moving average o/p will be Finite for finite ~~o/p~~ i/p

ii) causal system — (1)

o/p of the system depends upon present and past i/p only

iii) linear system : — (2)

IF solved by appropriate steps

iv) TIV system — (2)

IF solved by appropriate steps.

(7)

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Q4 b) static system :-

IF o/p of the system depends only on present i/p or If the system does not have memory it is known as static system — (1)

i) $y(t) = x(t-2)$ - - Dynamic system

as o/p depends on past i/p or system is a delay block — (1)

ii) $y[n] = x[2n]$ - - Dynamic system — (1)

e.g $y[5] = x[10]$

$y[-3] = x[-6]$

o/p of the system depends on past as well as future i/p. — (1)

iii) $y(t) = x^2(t)$ - - static system — (1)

as no operation on independent variable o/p dependes only on present i/p.

Q4 c) statement of superposition Thm — (2)

$$\frac{dy}{dt} + 3t\,y(t) = t^2 x(t)$$

It is linear system.

IF solved by all appropriate steps — (2)

(8)