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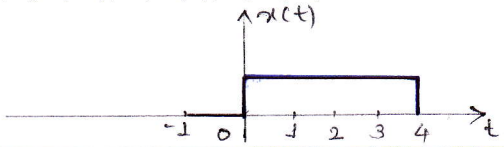
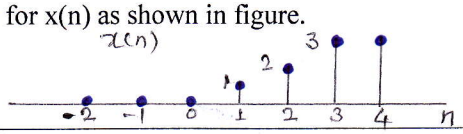
ECE Dept. | Exam. | Internal Assessment | Even Sem (2018-19)

FIRST INTERNAL ASSESSMENT

Sem: IV **Sub: Signals & Systems** **Sub. Code: 17EC42**
Date: 14/03/2019 **Time: 3 to 4 PM** **Max. Marks:30**

Note: Answer two full questions, draw sketches wherever necessary.

Q. No		Description of Question	Marks	CO	RBT LEVEL
1	a	Determine whether the following signals are periodic, if periodic determine the fundamental period. i. $x(t) = \cos 5\pi t + \sin 6\pi t$ ii. $x(t) = \cos(2\pi t) + \sin(3\pi t) + \cos(5\pi t - 3\pi/4)$	8	C210.1	L2
	b	Sketch the following signals for x(t) as shown in figure. i) x(2t), ii) x(t-2), iii) x(-t), iv) x(t/2) 	7	C210.1	L2
		OR			
2	a	Find even and odd parts of the given signal. i. $x(n) = u(n) - u(n-4)$ ii. $x(n) = \{2,3,4,5,6\}$	8	C210.1	L2
	b	Determine whether the DT system $y(n) = x^2(n)$ is linear, time-invariant, static, causal & stable.	7	C210.1	L2
3	a	Determine whether the following DT signal is energy signal, power signal or neither. i. x(n) = nu(n), ii. x(t)= 2 rect(t)	8	C210.1	L2
	b	Sketch the following signals for x(n) as shown in figure. i.x[n-2], ii. x[2n] iii. x[-n], iv. x[-n+2] 	7	C210.1	L2
		OR			
4	a	Determine whether the following signals are periodic, if periodic determine the fundamental period. i. $x(n) = 5\sin(7\pi/12)n + 8\cos(14\pi/8)n$ ii. $x(n) = 3e^{j3/5(n+1/2)}$	8	C210.1	L2
	b	Determine whether the CT system $y(t) = x^2(t)$ is linear, time-invariant, static, causal & stable.	7	C210.1	L2

Dr. Shilpa Shrigiri
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Sem : 4		Subject : Signals & Systems	Sub Code : 17EC42	Date : 14/03/2019		
Q. No.	Bit	Description		Marks	CO's	RBT LEVEL
1	(a)	(i) $x(t) = \cos 5\pi t + \sin 6\pi t$		8 (4+4)	CO1	L2
		$\omega_{01} = 5\pi$, $\omega_{02} = 6\pi$				
		$T_1 = 2\pi/\omega_{01} = 2\pi/5\pi = 2/5$				
		$T_2 = 2\pi/\omega_{02} = 2\pi/6\pi = 1/3$				
		$T_1/T_2 = 6/5 \Rightarrow$ rational number				
		$x(t)$ is periodic				
		$T_1/T_2 = 6/5 = 6/1 \times 5$, lcm of $(1,5) = 5$				
		fundamental Period $T = T_1 \times l$				
		$T = \frac{2}{5} \times 5 = 2$ Sec				
		(ii) $x(t) = \cos(2\pi t) + \sin(3\pi t) + \cos(5\pi t - 3\pi/4)$				
		$T_1 = 2\pi/2\pi = 1$, $T_2 = 2\pi/3\pi = 2/3$				
		$T_3 = 2\pi/5\pi = 2/5$				
		$T_1/T_2 = 3/2 \Rightarrow$ rational number				
		$T_1/T_3 = 5/2 \Rightarrow$ rational number				
		$x(t)$ is periodic				
		L.C.M $- 2 = l$				
		Period $= T = T_1 \times l = 1 \times 2 = 2$				
		$T = 2$ Sec				

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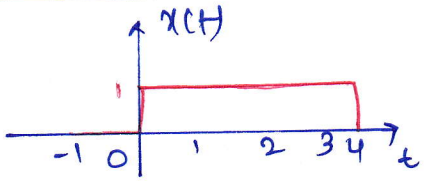
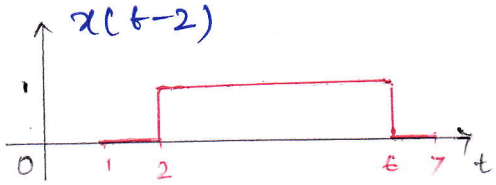
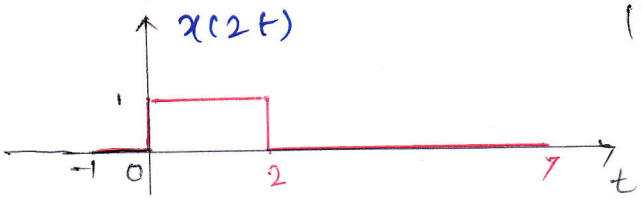
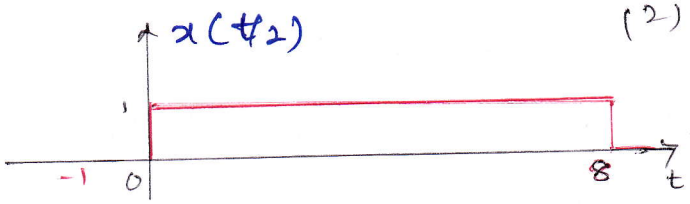
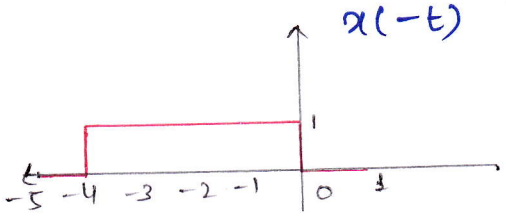
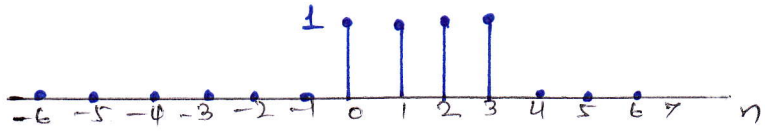
IA - 1 SCHEME OF EVALUATION

Sem : 4		Subject : Signals & Systems	Sub Code : 17EC42	Date : 14/03/2019		
Q. No.	**Bit**	**Description**		**Marks**	**CO's**	**RBT LEVEL**
1	(b)	$x(t)$  $x(t-2)$  $x(2t)$ (2)  $x(t+2)$ (2)  $x(-t)$ (2)  (1)		7	C 210.1	L2
2	(a)	Even and odd parts of the signal (i) $x(n) = u(n) - u(n-4)$ 		8 (4+4)	C 210.1	L2

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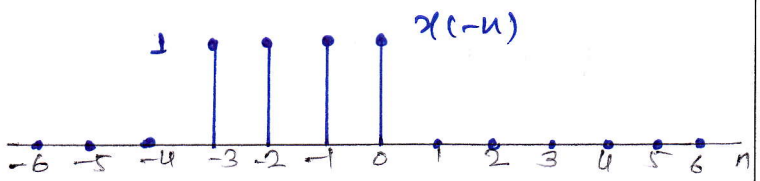
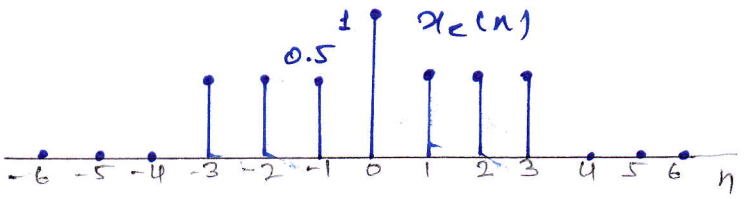
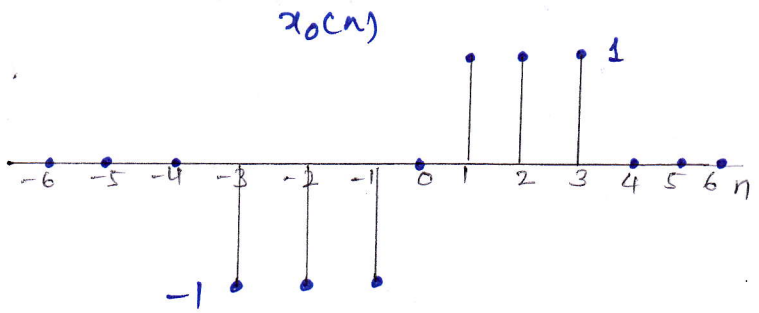
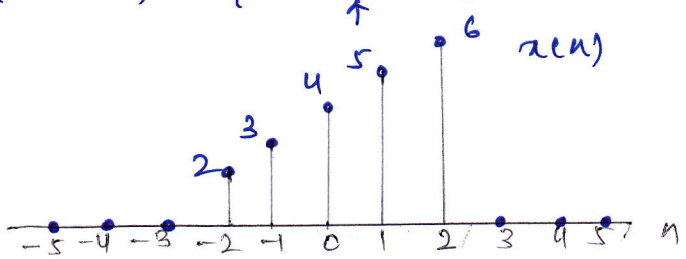
Q. No.	Bit	Description		Marks	CO's	RBT LEVEL

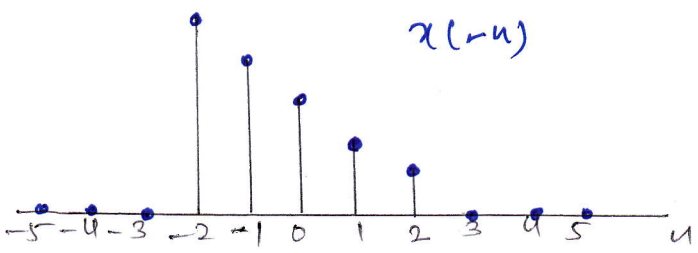






(i) $x(n) = \{2, 3, 4, 5, 6\}$





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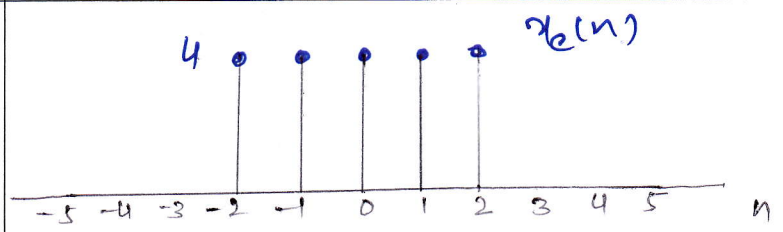
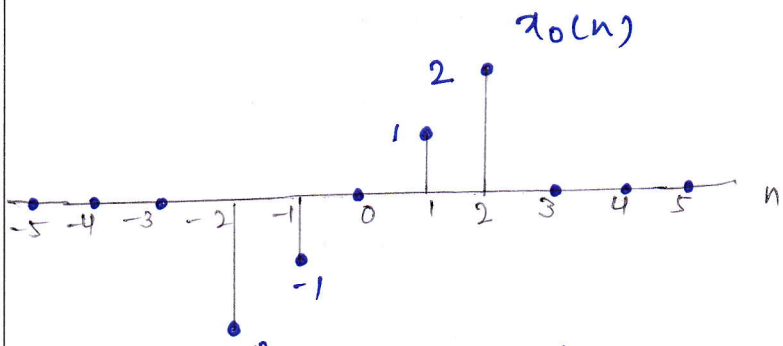
Q. No.	**Bit**	**Description**		**Marks**	**CO's**	**RBT LEVEL**





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

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

2 (b) $y(n) = x^2(n)$ — T — C 210.1 — L_2

$y(n) = T\{x(n)\} = x^2(n)$

$T\{a x_1(n) + b x_2(n)\} = [a x_1(n) + b x_2(n)]^2$

$\neq a T\{x_1(n)\} + b T\{x_2(n)\}$

System is non linear — (2)

$T\{x(n-n_0)\} = x^2(n-n_0)$

$y(n-n_0) = x^2(n-n_0)$

$y(n-n_0) = T\{x(n-n_0)\}$

System is time invariant (2)

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Q. No.	Bit	Description		Marks	CO's	RBT LEVEL

The output depends only on the present value of the input.
System is memoryless/static -①
The output depends on the future values of the input.
System is causal. -①

If $|x(n)| \le B_x < \infty$
then $|y(n)| = |x^2(n)| \le B_y < \infty$
System is stable -①

3 (a) (i) $x(n) = nu(n)$ — 8 (4+4) — C 210.1 — L_2

$$E = \lim_{N\to\infty} \sum_{n=-N}^{N} |x(n)|^2$$

$$= \lim_{N\to\infty} \sum_{n=0}^{\infty} n^2 = \infty$$

$E = \infty$

$$P = \lim_{N\to\infty} \frac{1}{2N+1} \sum_{n=-N}^{N} |x(n)|^2$$

$$= \lim_{N\to\infty} \frac{1}{2N+1} \sum_{n=0}^{N} n^2 = \infty$$

Thus $x(n) = nu(n)$ is neither an energy nor a power signal.

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Q. No.	**Bit**	**Description**		**Marks**	**CO's**	**RBT LEVEL**

3 (b)

i) $x(t) = 2\,rect(t)$

$rect(t) = 1 \quad ; |t| \le 1/2$

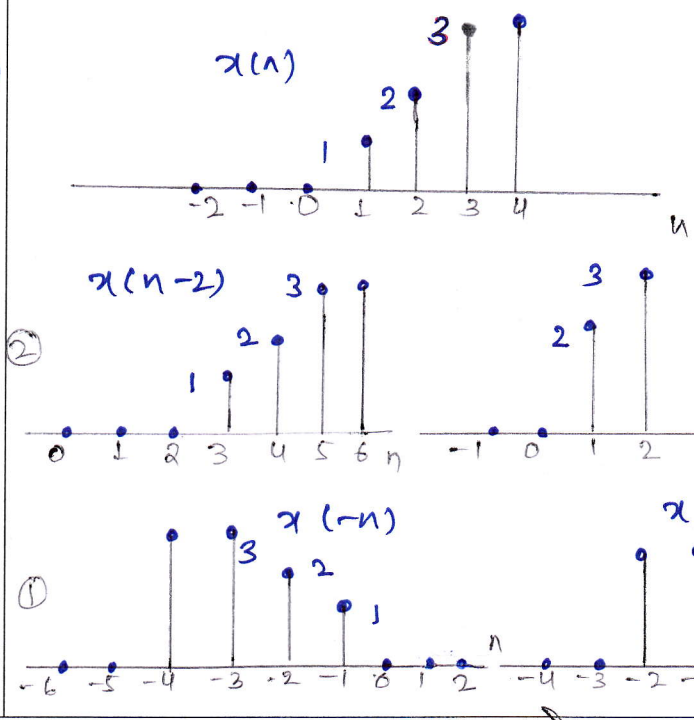
$= 0 \quad ; |t| > 1/2$

$$E = \int_{-\infty}^{\infty} |x(t)|^2 dt$$

$$= \int_{-\infty}^{\infty} |2\,rect(t)|^2 dt$$

$$= 4 \int_{-1/2}^{1/2} dt = 4$$

Hence $x(t)$ is energy signal



Marks	CO's	RBT LEVEL
7	C 210.1	L2

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IA - 1 SCHEME OF EVALUATION

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4 (a) (i) $x(n) = 5\sin(7\pi/12)n + 8\cos(14\pi/8)n$ — 8 (4+4) — C 210.1 — L_2

$\Omega_{o1} = 7\pi/12 = \frac{7}{24} \times 2\pi = \frac{m}{N_1} = \frac{7}{24}$ is rational number

$N_1 = 24$

$\Omega_{o2} = \frac{14\pi}{8} = \frac{7}{8} \cdot 2\pi$

$\frac{m}{N_2} = \frac{7}{8} \Rightarrow$ rational number

LCM of $(24, 8) = l = 24$

$N_2 = 8$ $\quad N = l = 24$

(ii) $x(n) = 3e^{j3/5(n+1/2)}$

$= 3e^{j(3/10)} e^{j(\frac{3}{5})n}$

$\Omega_o = 3/5 \neq \frac{m}{N} \cdot 2\pi$

$\therefore x(n)$ is non-periodic

4 (b) $y(t) = x(t^2)$ — 7 — C 210.1 — L_2

$y(t) = T\{x(t)\} = x(t^2)$

$T\{a x_1(t) + b x_2(t)\} = a x_1(t^2) + b x_2(t^2)$

$= a\,T\{x_1(t)\} + b\,T\{x_2(t)\}$

$\therefore$ System is linear.

$T\{x(t-t_0)\} = x(t^2 - t_0)$

$y(t-t_0) = x\{(t-t_0)^2\}$

$y(t-t_0) \neq T\{x(t-t_0)\}$

$\therefore$ System is time variant

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Q. No.	Bit	Description		Marks	CO's	RBT LEVEL

The output depends only on the future value of the input.

∴ The system is not static.

$y(-2) = x(0)$

The output depends on the future value of the input.

$y(3) = x(9)$

∴ The system is non-causal.

Let $|x(t)| \leq B_x < \infty$

then $|y(t)| = |x(t+2)| \leq B_y < \infty$

If the input is bounded, then the output is also bounded.

∴ System is stable.

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