Faculty of Engineering
End Semester Examination May 2025
EC3CO23 Signals & Systems

Programme	:	B.Tech.	Branch/Specialisation	:	EC
Duration	:	3 hours	Maximum Marks	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

				Marks	**CO**	**BL**

Section 1 (Answer all question(s))

Q1. Signal can be defined as: — Marks 1, CO 1, BL 1
- ◉ Information
- ○ Data
- ○ Both (A) and (B)
- ○ None of these

Q2. The signal $x(t) = A \cos(\omega t + \varphi) u(t)$ is- — Marks 1, CO 2, BL 2
- ○ An energy signal
- ◉ A power signal
- ○ An energy as well as a power signal
- ○ Neither an energy nor a power signal

Q3. If a function f(t).u(t) is shifted to left side by t_0, then the function can be expressed as: — Marks 1, CO 1, BL 2
- ○ $f(t-t_0) u(t)$
- ○ $f(t) u(t-t_0)$
- ◉ $f(t-t_0) u(t-t_0)$
- ○ $f(t+t_0) u(t+t_0)$

Q4. What are the two types of fourier series? — Marks 1, CO 2, BL 1
- ◉ Trigonometric and exponential
- ○ Trigonometric and logarithmic
- ○ Exponential and logarithmic
- ○ Trigonometric only

Q5. A system which is linear is said to obey the rules of- — Marks 1, CO 3, BL 1
- ○ Scaling
- ○ Additivity
- ◉ Both scaling and additivity
- ○ Homogeneity

Q6. Convolution of any signal with impulse function results- — Marks 1, CO 3, BL 2
- ◉ Signal itself
- ○ Unity
- ○ Impulse
- ○ Zero

Q7. Response generated by any system to impulse signal is known as- — Marks 1, CO 2, BL 2
- ◉ Impulse response
- ○ Step response
- ○ Ramp response
- ○ None of these

Q8. Convolutive integral is- — Marks 1, CO 2, BL 2
- ○ Commutative
- ○ Associative
- ○ Distributive
- ◉ All of these

Q9. What is the ROC of the signal $x(n)=\delta(n-k)$, k>0? — Marks 1, CO 4, BL 2
- ○ Z=0
- ○ Z=∞
- ◉ Entire z-plane, except at z=0
- ○ Entire z-plane, except at z=∞

Q10. What is the ROC of the z-transform of the signal $x(n)= a^n u(n)+b^n u(-n-1)$? — Marks 1, CO 5, BL 3
- ◉ $|a|<|z|<|b|$
- ○ $|a|>|z|>|b|$
- ○ $|a|>|z|<|b|$
- ○ $|a|<|z|>|b|$

Section 2 (Answer all question(s)) Marks CO BL

Q11. Distinguish between (i) Energy signal & Power Signal (ii) Even & Odd signal   3   2   1

Rubric	Marks
(a) Energy signal & Power Signal	1.5
(b) Even & Odd signal	1.5

Q12. (a) Explain orthogonality of signals. What is the importance of orthogonal signals in approximation theory?   7   3   3

Rubric	Marks
Explain orthogonality of signals.	3.5
What is the importance of orthogonal signals in approximation theory?	3.5

(OR)

(b) What is a different between mean square convergence and point wise convergence?

Rubric	Marks
What is a different between mean square convergence and point wise convergence. .	7

Section 3 (Answer all question(s)) Marks CO BL

Q13. Write down the Dirichlet's conditions for Fourier Series.   3   2   1

Rubric	Marks
Write down the Dirichlet's conditions for Fourier Series.	3

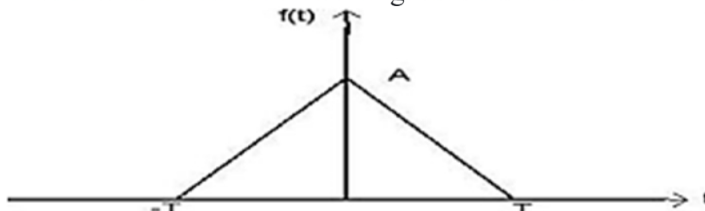**Q14. (a)** Find the exponential Fourier series for-   7   3   4

$$f(t) = \begin{cases} \frac{4}{\pi}t & 0 \leq t < \frac{\pi}{2}, \\ \frac{-4}{\pi}t & \frac{-\pi}{2} \leq t \leq 0 \end{cases}$$

Rubric	Marks
expression wise marking, complete solution full marks	7

(OR)

(b) Find the Fourier Transform of the given waveform-

Rubric	Marks
expression wise marking, complete solution full marks	7

Section 4 (Answer all question(s)) Marks CO BL

Q15. Explain the following properties of continuous time linear time invariant systems   2   2   1
- Stability
- Time invariance

Rubric	Marks
Explain the following properties of continuous time linear time invariant systems a. Stability	1
Explain the following properties of continuous time linear time invariant systems b. Time invariance	1

Q16. (a) Determine the output of a continuous time LTI system defined by the following linear constant   **8**   **4**   **3**
coefficient differential equation.
$(d^2y)/(dt^2) + 5dy/dt + 6y = u(t)$
System is initially relaxed.

Rubric	Marks
expression wise marking, complete solution full marks	8

(OR)

(b) Determine the response of a continuous time linear time invariant system with
impulse response: $h(t) = u(t)$
input applied: $x(t) = \exp(-t)u(t)$

Rubric	Marks
Determine the response of a continuous time linear time invariant system with impulse response: h(t)=u(t) input applied: x(t)=exp(−t)u(t)	8

Section 5 (Answer all question(s))   Marks CO BL

Q17. Explain the following properties of discrete time linear time invariant systems-   3   3   2
- Causality
- Linearity

Rubric	Marks
a. Causality	1.5
b. Linearity	1.5

Q18. (a) Determine the response of a discrete time linear time invariant system with impulse response: $h(n) = u(n)$
input applied: $x(n) = [1, 0, -1]$
(input signal starts at n=0)

7 4 2

Rubric	Marks
expression wise marking, complete solution full marks	7

(OR)

(b) Determine the output of a discrete time LTI system defined by the following linear constant coefficient difference equation.
$y(n) + y(n - 2) + 6y(n - 2) = 2^n u(n)$
Initial conditions: y(-1)=1; y(-2)=-1

Rubric	Marks
CF	3
PI	4

Section 6 (Answer all question(s))

Marks CO BL

Q19. Find the Z transform of following functions

4 2 2

- $n\, u\, (n)$
- $\frac{1}{n} u\, (n)$
- $u\, (n - 4)$
- $u\, (n) - u\, (n - 10)$

Rubric	Marks
one number for each	4

Q20. (a) Explain the linearity and differential properties of Z transform.

6 5 3

Rubric	Marks
Linearity	3
differential properties	3

(OR)

(b) Determine the step response of a linear systems with following impulse function.
$H\, (z) = \frac{Z}{Z^2 + 2Z + 4}$

Rubric	Marks
Y(z) = X(Z) * H(Z)	4
invers of Y(Z)	2

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