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Course: B.Tech/IDD
Sub_Code: EOPC2003

3rd Semester Regular/Back Examination: 2025-26
SUBJECT: Signals and Systems
BRANCH(S): AEIE, ECE, EEVDT, ETC
Time: 3 Hours
Max Marks: 100
Q.Code: U571
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   (2 x 10)
   a)   Define an impulse signal with proper mathematical representation.
   b)   What do you mean by a discrete time system?
   c)   State the symmetricity property of auto correlation.
   d)   How the stability of an LTI system is determined?
   e)   Represent the given expression graphically: $3u(n - 2) + r(n)$.
   f)   Define DTFS with proper mathematical expression.
   g)   What is aliasing and how can it be avoided?
   h)   Write the time shifting property of CTFS.
   i)   Express the Fourier Transform of multiplication of two signals mathematically.
   j)   Differentiate between periodic and aperiodic signals.

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   (6 x 8)
   a)   What do you mean by a unit step, exponential, and ramp function? Express mathematically and graphically.
   b)   Express discrete time systems with a neat block diagram.
   c)   Discuss the techniques to analyze discrete LTI systems.
   d)   Find the cross correlation of the sequences $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{3, 5, 7\}$
   e)   How discrete time systems are described by difference equations?
   f)   Find the Fourier series coefficients for the given signal: $x(t) = 1 + \cos(2\pi t)$
   g)   Discuss the properties of DTFS. (at least six)
   h)   How is a signal reconstructed from its samples?
   i)   Explain Discrete-Time Processing of Continuous-Time Signals with proper block diagram.
   j)   Obtain the Fourier Transform of $x(t) = e^{-at}u(t), a > 0$
   k)   Discuss the Dirichlet's conditions for existence of Fourier Series.
   l)   Find the DTFT of $x(n) = (0.5)^n u(n) + 2^n u(-n - 1)$

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain the properties of cross-correlation in details with suitable example. **(8 + 8)**

b) Discuss the properties of Convolution in case of Causal LTI Systems with suitable example.

Q4 **a)** Explain the properties of Continuous time Fourier series (CTFS) in details with suitable example. **(8 + 8)**

b) Determine the Fourier Series representation of $x(n) = 4 \cos(\pi n/2)$.

Q5 Discuss any four operations on discrete signals with suitable illustrations. **(16)**

Q6 **a)** Compute the discrete-time Fourier Transform of the following signal. **(8 + 8)**
$x[n] = (a^n \sin \omega_0 n)\, u[n]$, $|a| < 1$

b) Discuss the properties of Discrete time Fourier transform (DTFT) in details with suitable example.