

SARDAR PATEL UNIVERSITY

M.Sc. (Electronics and Communication) (Sem – I) (NC) Examination - 2015

24/04/2015, Friday

Time: 10:30 am To 1:30 pm

Subject: Signal & System

Subject Code: PS01CELC03

- Note: 1. State and assume the necessary data, wherever required.
2. Figures to the right indicate full marks.

Q.1 Choose the correct answer. [08]

- 1) Consider an analog signal $x(t) = \sin 480 \pi t + 3 \sin 720 \pi t$. what is the Nyquist sampling rate for this signal?
(a) 720 Hz (b) 480 Hz (c) 360 Hz (d) 240 Hz
- 2) _____ is process in which the analog signal is converted into a corresponding sequence of regularly spaced samples.
(a) Quantization (b) Sampling (c) Encoding (d) A-D Conversion
- 3) What is the fundamental period of the periodic signal $x(n) = \cos(0.002\pi n)$?
(a) 1000 (b) 100 (c) 0.001 (d) 0.01
- 4) _____ System have a finite memory.
(a) Static (b) Dynamic (c) Both (d) None of above
- 5) Z – transform of $\delta(n)$ is
(a) z^{-3} (b) z^3 (c) 1 (d) 0
- 6) The z – transform of $u(n)$ is _____.
(a) 1 (b) $\frac{1}{1-z^{-1}}$ (c) $\frac{z^{-1}}{1-z^{-1}}$ (d) $\frac{az^{-1}}{1-az^{-1}}$
- 7) What is the condition for signal $x(t)$ to be called time limited signal?
(a) $x(t) = 0 \mid t > \tau$ (b) $x(t) \neq 0 \mid t > \tau$ (c) $x(t) = 0 \mid t < \tau$ (d) $x(t) \neq 0 \mid t > \tau$
- 8) Twiddle factor for DFT $W_N =$ _____.
(a) $e^{j2\pi/N}$ (b) $e^{-j2\pi/N}$ (c) $e^{-j2\pi kn/N}$ (d) $e^{j2\pi kn/N}$

Q.2 Answer in short [ANY SEVEN] [14]

- 1) Explain periodic signal and a-periodic signal.
- 2) Define the following discrete time signal with diagram.
(i) Unit sample signal (ii) unit impulse signal

3) A Discrete time signal $x(n)$ is defined as

$$x(n) = \begin{cases} 1+n/3 & -3 \leq n \leq -1 \\ 1 & 0 \leq n \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

Determine its value and sketch the signal $x(n)$.

- 4) Determine the z – transform and ROC of $x(n) = (1+n)u(n)$.
- 5) Enlist the different properties of z – transform.
- 6) Write the synthesis and analysis equations for a continuous time periodic signal
- 7) Write the formulas for finding DFT and IDFT for N-point discrete time sequence.
- 8) Write the twiddle factor matrix for 4– point DFT.
- 9) Discuss linearity and symmetry properties of DFT.

Q3 A) Enlist the different discrete time system and explain each in detail. [06]

B) If the discrete time sampled signal is given by $x(n) = 3 \cos\left(\frac{\pi n}{2}\right)$ with $F_s = 300$ Hz, What is the continuous time signal obtain using ideal interpolation? [06]

OR

B) State the sampling theorem and explain the sampling of an analog signal. [06]

Q4 A) What is convolution? Determine the convolution of the discrete time signals $x(n) = \{1, 2, 0, 1, 2\}$ and $h(n) = \{1, -2, -3, 4\}$ using graphical method. [06]

B) A discrete time signal $x(n) = \{1, -1, 2, 5, 1\}$ sketch the following signal

(i) $x(n)$ (ii) $x(4-n)$ (iii) $x(n+1)$ (iv) $x(n-1)$ (v) $x(n+2)$

[06]

OR

B) Determine the z – transform and ROC of the following.

a. $x(n) = a^n u(n)$

[06]

b. $x(n) = a^n u(-n-1)$

c. $x(n) = \{3, 0, 0, 0, 0, 6, 1, -4\}$

Q5 A) Determine the z – transform and ROC of the following.

1) $x(n) = a^n (\cos \omega_0 n) u(n)$ 2) $x(n) = \left(\frac{1}{2}\right)^n u(n) + \left(\frac{1}{3}\right)^n u(n)$ [06]

B) Determine the inverse Z transform using power series expansion method / long division method [06]

$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$. when (a) ROC : $|z| > 1$ (b) ROC : $|z| < 0.5$

OR

B) Derive the power density spectrum for periodic discrete time signal. [06]

Q6 A) Compute the DFT of the 4 – point sequence [06]

$x(n) = \{1, 2, 3, 4\}$

Also plot magnitude and phase spectrum of the DFT.

B) Write the circular shift property of DFT and obtain the circular convolution of the

sequences $x_1(n) = \{2, 1, 2, 1\}$ and $x_2(n) = \{1, 2, 3, 4\}$ [06]

OR

B) Find all the values of twiddle factor matrix for 8 – point DFT. [06]
