USN

10EE52

Fifth Semester B.E. Degree Examination, June/July 2019
Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following :
i) Deterministic and random signals
ii) Energy and power signals. **(10 Marks)**

b. Prove that if x(a) is an odd signal, then
$$\sum_{n=\infty}^{\infty} x(a) = 0$$ **(05 Marks)**

c. Verify whether the system
$y(t) = e^{x(t)}$ is time invariant, linear, memory, stable and causal. **(05 Marks)**

2 a. The impulse response h(n) of a discrete time LTI system is given by
$h(n) = \{1, \underset{\uparrow}{3}, 2, -1, 1\}$ and the input
$x(a) = u(n) - u(n-3)$. Determine the system output y(n). Sketch y(n) Vs n. Also, verify results of convolution. **(05 Marks)**

b. For a discrete LTI system, the input. $x(n) = \alpha^n$, u(n) and h(n) = u(n). Calculate and plot the output signal y(a). **(10 Marks)**

c. Show that convolution satisfies distributive property. **(05 Marks)**

3 a. Consider a LTI system with unit impulse response $h(t) = e^{-t}$, u(t) and the input $x(t) = e^{-3t}\{u(t) - u(t-2)\}$. Determine the output y(t) and draw y(t) vs t. **(10 Marks)**

b. Determine the complete response of system described by the difference equation. :
$$y(n) - \frac{1}{9} y(n-2) = x(n-1)$$
if $y(-1) = 1$, $y(-2) = 0$ and $x(n) = u(n)$.
Use the conventional method. **(10 Marks)**

4 a. With respect to DTFS, state and prove the following properties :
i) Convolution ii) Modulation. **(10 Marks)**

b. Determine the Fourier series representation for the signal x(t) = Cos 4t + Sin 8t. **(05 Marks)**

c. The periodic signal x(t) is given by e^{-t} and period T = 2 seconds. Determine the Fourier coefficients for $-1 \le t \le 1$. **(05 Marks)**

PART – B

5 a. State and prove Parseval's theorem as applied to Fourier Transform. **(05 Marks)**

b. Calculate the Fourier transform of $x(t) = e^{-a|t|}$, were a > 0. Draw its spectrum. **(05 Marks)**

c. Determine the signal x(n) if
$$x(jw) = \frac{5jw + 12}{(jw)^2 + 5jw + 6}.$$ **(05 Marks)**

d. Calculate the Fourier transform if

$x(t) = \sum_{k=0}^{\infty} \alpha^k \; \delta(t - KT)$ where $|\alpha| < |$ **(05 Marks)**

6 a. Determine the DTFT of following :
i) $x(n) = 2^n \cdot u(-n)$
ii) $x(n) = \left(\frac{1}{4}\right)^n \cdot u(n+4)$ **(10 Marks)**

b. The impulse response of a continuous time LTI system is given by
$h(t) = \frac{1}{RC} \cdot e^{-t/RC} \cdot u(t)$.
Determine the frequency response and draw its magnitude and phase response. **(10 Marks)**

7 a. Determine the z – transform of
i) $x(n) = -u(-n-1) + \left(\frac{1}{2}\right)^n \cdot u(n)$
ii) $x(n) = \alpha^{|n|}$
Specify its ROC. **(10 Marks)**

b. Using appropriate properties, determine z-transform of
$x(n) = n^2 \left(\frac{1}{2}\right)^n u(n-3)$. What is its ROC? **(10 Marks)**

8 a. Determine the inverse z-transform for

$$x(z) = \frac{z^3 + z^2 + \frac{3}{2z} + \frac{1}{2}}{z^3 + \frac{3}{2}z^2 + \frac{1}{2z}}$$

If ROC : $|z| < \frac{1}{2}$, use partial fraction expansion method. **(10 Marks)**

b. Determine the impulse response h(n) for a causal LTI system if the input $x(n) = \left(\frac{1}{2}\right)^n u(n) - \frac{1}{4}\left(\frac{1}{2}\right)^{n-1} \cdot u(n-1)$ and its output $y(n) = \left(\frac{1}{3}\right)^n u(n)$. Use z- transform approach. **(05 Marks)**

c. Determine the unilateral z-transform for $y(n) = x(n-2)$, if $x(n) = \alpha^n$. **(05 Marks)**

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