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Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S4 (S,FE) / S2 (PT) (S,FE) Examination May 2024 (2015 Scheme)

Course Code: EC202
Course Name: SIGNALS & SYSTEMS

Max. Marks: 100   Duration: 3 Hours

PART A
Answer any two full questions, each carries 15 marks.

Marks

1 a) Determine whether the following system is time-invariant, linear, dynamic and causal.   (8)

$$y(n) = x(n) + \frac{1}{x(n-1)}$$

  b) Compute the power and energy of the following signals and check whether they are power signals or energy signals   (7)

  (i) $x(n) = (\frac{1}{3})^n u(n)$

  (ii) $x(t) = (1 + e^{-5t})u(t)$

2 a) An LTI system is characterized by the impulse response h(n) = {1,2,-1}. Find the response of the system for the input x(n) = {1,-2,-1,1}   (8)

  b) Find the convolution of the given signals x(t) and h(t)   (7)

  $x(t) = e^{-at}u(t)$, $h(t) = e^{-bt}u(t)$

3 a) Derive the condition for stability of a discrete time LTI system in terms of its impulse response.   (5)

  b) *Given x(t) = u(t+1) + u(t-1) – u(t-2) – u(t-4).*   (10)
  Plot (i) x(t) (ii) x(t-3) (iii) x(2t) (iv) x(2t-3) (v) x(-t)

PART B
Answer any two full questions, each carries 15 marks.

4 a) State and prove the time-shifting property of Fourier Transform.   (5)

  b) Determine the Laplace transform of the signal given below and find the ROC   (10)

  $x(t) = e^{-3t}u(t) + e^{-4t}u(t)$

  What are the pole and-zero locations?

5 a) What is ROC of Laplace Transform? State any 5 properties of ROC   (7)

  b) Determine the Fourier transform of the following signals   (8)

  1) $x(t) = sin\ (\Omega_0 t)$

  2) $x(t) = sgn(t)$

6 a) State and prove the sampling theorem for low-pass signals.   (4)

   b) Find the inverse Laplace transform of $X(s) = \dfrac{1}{s(s+2)}$ (5)

   c) Find the Nyquist rate and Nyquist interval for the signals   (6)

       (a) sinc $(100\pi t)$ · and   b) sinc $(100\pi t)$ + sinc$(50\pi t)$.

PART C
Answer any two full questions, each carries 20 marks.

7 a) State and prove the time-shifting property of z-transform   (4)

   b) Determine the discrete Fourier series representation for the sequence   (8)
       $x(n) = \cos\dfrac{\pi}{4}n$ and plot the magnitude and phase response.

   c) Determine the inverse DTFT of the following signals   (8)

       1) $X(e^{jw}) = e^{-jw}$ $for -\pi \le w \le \pi$

       2) $X(e^{jw}) = e^{-jw}[0.5 + 0.5\,\cos(w)]$

8 a) State and prove the convolution property of DTFT.   (4)

   b) Find the frequency response of the following causal systems using DTFT   (8)

       1. $y(n) = \dfrac{1}{2}x(n) + x(n-1) + \dfrac{1}{2}x(n-2)$

       2. $y(n) - \dfrac{1}{4}y(n-1) - \dfrac{3}{8}y(n-2) = x(n) + x(n-1)$

   c) Find the DTFT of the following signals   (8)

       1) $x(n) = u(n-k)$

       2) $x(n) = \delta(n+2) - \delta(n-2)$

9 a) Establish the relationship between s-plane and z-plane   (4)

   b) Compute the z-transform and ROC of the following sequences.   (8)
       i) $x(n) = a^n u(n)$

       ii) $x(n) = -b^n u(-n-1)$

   c) A discrete-time LTI system is characterised by the impulse response   (8)
       $x(n) = \left(\dfrac{1}{3}\right)^n u(n)$. Use z transform to determine the frequency response of the
       system to the input $x(n) = \left(\dfrac{1}{5}\right)^n u(n)$.

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