Paper / Subject Code: 89304 / Signals and Systems

May 27, 2024   02:30 pm - 05:30 pm   1T00836 - T.E.(Electrical Engineering)(SEM-VI)(Choice Base Credit Grading System) (R- 19) (C Scheme) / 89304 - Signals and Systems   QP CODE: 10056446

Time (3 Hours)   **Marks: 80**

Note: (1) Question no. 1 compulsory
   (2) Attempt any 3 question out of remaining five questions.
   (3) Draw neat diagram wherever necessary.

Q 1.   Attempt any Four out of Six questions (5 marks each)   (20)

   a. Check whether the given system $y(n) = | x(n) |$ is linear/non-linear, time variant/time invariant, static/dynamic, stable/unstable, causal/non causal systems.
   b. Explain Sampling theorem in detail.
   c. Discuss Rectangular, Hamming windows used to design FIR filters.
   d. Find the 4-point DFT of the sequence $x(n)= \{1 , -2 , 3 , 2\}$.
   e. Explain ROC and its properties.
   f. Explain minimum phase, maximum phase and mixed phase systems with examples.

Q 2. a. Obtain the Z-transform of   **(10)**
   (1) $x(n) = n(n+1) u(n)$
   (2) $x(n) = u(-n)$.

   b. Determine the periodicity of the following   **(10)**
   (1) $x(t) = 2 \cos 3t + 3 \sin 7t$
   (2) $x(t) = 5 \cos 4\pi t + 3 \sin 8\pi t$

Q3. a. A LTI is described by the equation $2y(n) + 3y(n-1) + y(n-2) = u(n) + u(n-1) - u(n-2)$. Find response of the system when the initial conditions are given by $y(-1) = 2$ and $y(-2) = -1$ and when unit step is applied as the input.   **(10)**

   b. Design a digital low pass FIR filter for a following specification   **(10)**

$$H_d (\omega) = \begin{cases} e^{-j\omega\tau} & \text{for } \omega \le \omega_C \\ 0 & \text{otherwise} \end{cases}$$

   Using rectangular window of length $=7$ & $Wc=1$rad/sample.

Q4. a. Determine inverse Z-transform of $X(z) = \dfrac{1}{1-1.5 z^{-1}+0.5 z^{-2}}$ **(10)**
   for ROC (1) $| z | > 1$ (2) $| z | < 0.5$ (3) $0.5 < | z | < 1$

   b. Discuss the method of Bilinear transformation for design of IIR filter.   **(10)**

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Q5. a. Explain any five properties of DFT (**10**)

b. Compute DFT for the sequence x(n) = {0.5,0.5,0.5,0.5,0,0,0,0) using radix -2 DIT-FFT algorithm. (**10**)

Q6. a) An LTI system is described by the equation: (**10**)
Y(n) = x(n) + 0.8 x(n-1) +0.8 x(n-2) -0.49 y(n-2)
Determine the transfer function of the system, sketch poles and zeroes on the z-plane.

b) Find y(n) by using convolution if x(n) = [1,3,5,3] and h(n) = [2,3,1,1]. (**10**)

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