

BE DEGREE EXAMINATIONS APRIL/MAY 2014

(Regulation 2009)

Fifth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

ECE261: Digital Signal Processing

Time: 3 Hours

Maximum Marks: 100

Answer ALL Questions

PART A (10 x 1=10 Marks)

- The discrete-time signal $x(n) = (-1)^n$ is periodic with fundamental period
A. 6 B. 4 C. 2 D. 0
- The discrete time system described by $y(n)=x(n^2)$ is
A. causal, linear and time varying B. causal, non-linear and time varying
C. non causal, non-linear and time-invariant D. non causal, linear and time-invariant.
- Two sequences $x_1(n)$ and $x_2(n)$ are related by $x_2(n) = x_1(-n)$. In the z - domain, their ROC's are
A. the same. B. reciprocal of each other.
C. negative of each other. D. complements of each other
- The z -transform of the function $\sum_{k=-\infty}^0 \delta(n-k)$ has the following region of convergence
A. $z > 1$ B. $z = 1$ C. $z < 1$ D. $0 < z < 1$
- The DFT of a signal $x(n)$ of length N is $X(k)$. When $X(k)$ is given and $x(n)$ is computed from it, the length of $x(n)$
A. is increased to infinity B. remains N
C. becomes $2N - 1$ D. becomes N^2
- Calculate DFT of $x(n) = \{1, 0, 1, 0\}$.
A. $x(k) = \{2, 0, 2, 0\}$ B. $x(k) = \{1, 0, 1, 0\}$
C. $x(k) = \{2, 0, 1, 0\}$ D. $x(k) = \{0, 2, 0, 2\}$
- Find the response of an FIR filter with impulse response $h(n) = \{1, 2, 4\}$ to the input sequence $x(n) = \{1, 2\}$.

- A. $y(n) = \{1, 4, 8, 8\}$ B. $y(n) = \{1, 4, 6, 6\}$
C. $y(n) = \{1, 2, 8, 8\}$ D. $y(n) = \{1, 4, 4, 6\}$

- Drawbacks of IIR filters are:
A. phase distortion and ringing. B. prevent phase distortion
C. more computation D. all of above
- The basic process that's going on inside a DSP chip is
A. Quantization B. MAC
C. logarithmic transformation D. vector calculations
- Using the default naming convention in MATLAB, an $m \times 1$ array has:
A. 1 row and m wcolumns B. mv columns and 1 row
C. vm rows and 1 column D. 1 row and 1 column

PART B (10x2=20 Marks)

- Give the classification of signals.
- Is a discrete time signal described by the input output relation $y[n] = nx[n]$ time invariant?
- State the time shifting and time scaling properties of z -transform.
- Obtain the inverse z transform of $X(z) = 1/z - a$, $|z| > |a|$
- Determine the DFT of the sequence $x(n) = \{1, -1, 1, -1\}$
- Draw the radix-2 DIT-FFT butterfly structure.
- Distinguish IIR and FIR filters.
- What is warping effect?
- List the different addressing modes in TMS320C54XX processor.
- Write down the matlab code for computing $x = a/bc$. Given that $a=2$, $b=3$ and $c=4$.

PART C (5x14=70 Marks)

- a) (i) How discrete time signals are classified? Explain each with one example. (10)
(ii) State sampling theorem. How the aliasing can be avoided? (4)

(OR)

b) (i) Define linearity and time invariance property of a system. Give one example for each (5)

(ii). For each impulse response listed below. (9)

- a) $h(n) = 2n u(-n)$
- b) $h(n) = \sin(n\pi/2)$
- c) $h(n) = e^{2n} u(n-1)$

Determine whether the corresponding system is Causal and Stable

22. a) (i) If $Y(Z) = 0.5(1 - 0.5z^{-1}) / (1 - 0.25z^{-1})(1 - 0.75z^{-1})(1 - z^{-1})$ find the steady state value of $y(n)$ if it exists. Also find $x(\infty)$ if $X(z)$ is given by $X(Z) = 3z / (z-1)(z+1)$ (7)

(ii) Determine the signal having the Z-transform of $X(Z) = (z^3 + z^2) / (z-3)(z-1)$ (7)

(OR)

b) (i) Determine poles of the system and check the stability of the system. (7)

$$y(n) - 0.25y(n-1) + 0.25y(n-2) - (1/16)y(n-3) - 2x(n) - 3x(n-1) = 0$$

(ii) Find the output sequence from the given output spectrum. (7)

$$Y(e^{j\omega}) = \frac{e^{j\omega} + 1 + e^{-j\omega}}{3(1 - ae^{-j\omega})}$$

23. a) (i) Derive the DFT of the sample data sequence $x(n) = \{1, 1, 2, 2, 3, 3\}$ and compute the corresponding amplitude and phase spectrum. (7)

(ii) Find the inverse DFT of $X(k) = \{1, 2, 3, 4\}$ (7)

(OR)

b) (i) Given $x(n) = \{0, 1, 2, 3, 4, 5, 6, 7\}$ find $X(k)$ using DIT FFT algorithm. (7)

(ii) Given $X(k) = \{28, -4 + j9.656, -4 + j4, -4 + j1.656, -4, -4 - j1.656, -4 - j4, -4 - j9.656\}$, find $x(n)$ using inverse DIT FFT algorithm. (7)

24. a) (i) Design a Chebyshev filter with a maximum pass band attenuation of 2.5 dB at 20

rad/sec and the stop band attenuation of 30db at 50 rad/sec. (7)

(ii) Using impulse invariance method obtain $H(Z)$ if $T = 1$ sec and $H(s)$ is

$$s^2 / (s^2 + \sqrt{2}s + 1) \quad (7)$$

(OR)

b) Design an ideal low pass filter with a frequency response.

$$H_d(e^{j\omega}) = 1 \quad \text{for } -\pi/2 \leq \omega \leq \pi/2$$

$$0 \quad \text{for } \pi/2 \leq |\omega| \leq \pi$$

Find values of $h(n)$ for $N=11$ and find $H(z)$ and frequency Response.

25. a) List the on-chip peripherals in TMS320C54XX digital signal processor. Draw the Architecture of it and explain.

(OR)

b) (i) Program to find the linear convolution of two sequences. (7)

(ii) DFT and IDFT using matlab functions. (7)
