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Code No: 157BG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, February/March - 2022

DIGITAL SIGNAL PROCESSING
(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks

- 1.a) Check whether following systems are linear, causal, time invariant, stable, static
 $y(n) = x(n) \cos(x(n))$
- b) Explain in detail about conversion of analog signal to digital signal with suitable block diagram and also explain about reconstructing the signal from its samples. [7+8]
- 2.a) Consider causal and stable LTI system whose I/Ps and O/Ps are related through second order difference equation $y(n) - (1/6)y(n-1) - (1/6)y(n-2) = x(n)$, determine system impulse response $h(n)$ for the system.
- b) Describe the decimation process with a factor of 'M'. Obtain necessary expression and sketch frequency response. Also discuss aliasing effect. [7+8]
- 3.a) Prove the following properties of DFT when $H(K)$ is the DFT of an N-point sequence $h(n)$
i) $H(K)$ is real and even when $h(n)$ is real and even.
ii) $H(K)$ is imaginary and odd when $h(n)$ is real and odd.
- b) Two finite duration sequence are given by $x(n) = \sin(n\pi/2)$ for $n = 0, 1, 2, 3$ and $h(n) = 2n$ for $n = 0, 1, 2, 3$. Determine circular convolution using DFT & IDFT method. [8+7]
- 4.a) State and prove the properties of Discrete Fourier Transform.
- b) Compute IDFT of the sequence
 $x(n) = \{ 7, -0.707-j0.707, -j, 0.707-j0.707, 1, 0.707+j0.707, j, -0.707+j0.707 \}$ using FFT algorithm. [7+8]
- 5.a) Determine system function $H(z)$ for a Butterworth filter using Bilinear transformation for the constraints
 $0.8 \leq |H(e^{j\omega})| \leq 1, 0 \leq \omega \leq 0.2\pi$
 $|H(e^{j\omega})| \leq 0.2, 0.6\pi \leq \omega \leq \pi$ with $T=1$ sec.
- b) Discuss the location of poles for Chebyshev filter. [8+7]
- 6.a) Discuss in detail about Butterworth filter. What is the effect of varying order of N on magnitude and phase response?
- b) The specifications of desired low pass filter is
 $0.8 \leq |H(\omega)| \leq 1.0; 0 \leq \omega \leq 0.2\pi$
 $|H(\omega)| \leq 0.2; 0.6\pi \leq \omega \leq \pi$
Design a Chebyshev digital filter using impulse invariant Transformation. [8+7]

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- 7.a) Determine the filter coefficients of $h(n)$ of length $M=15$ obtained by sampling method with its frequency response as

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$$H(2\pi K/15) = 1 \quad ; K=0,1,2,3,4$$
$$= 0.4 \quad ; K=5$$
$$= 0 \quad ; K=6,7$$

- b) Design a HPF of length 8 with cut off frequency of 4 rad/sec using Hamming window. Plot the magnitude and phase response. [7+8]

- 8.a) What is the need for signal scaling? How the overflow error scaling is performed?

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b) Realize system with following difference equation $y(n) = (3/4)y(n-1) - (1/8)y(n-2) + x(n) + (1/3)x(n-1)$ using Direct form-I and Direct form-II. [7+8]

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