

'Biomedical Digital Signal Processing'

QP Code : 31181

(3 Hours)

[Total Marks : 80

- N. B. : (1) Question No. 1 is compulsory.
 (2) Answer any three from remaining five questions.
 (3) Assume any data if need, justify it.



1. (a) Let $x(n) = (1, 2, 3, -1)$, $h[n] = (1, 1, -1)$ find $y[n] = x(n) * h[n]$ using
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 Z-transform properties only
- (b) Prove the time shifting property of DFT 5
- (c) Let $x[n] = (1, 2, 3)$ find, 3-point DFT of the sequence 5
- (d) Convert the analog filter with system function $H(s) = \frac{1}{s^2 + 5s + 6}$ into 5
 a digital filter using impulse invariant method, $T_s = 1$ sec.
2. (a) Determine $x(n)$ if $X(z) = \log(1 + az^{-1})$; $|z| > |a|$ 5
- (b) Find DT FT of the signal 5
 $x[n] = 1 \quad 0 \leq n \leq 4$
 $= 0 \quad \text{else where}$
- (c) Find $x(n)$ if $X(z) = \frac{1}{1 + \frac{1}{6}z^{-1} - \frac{1}{6}z^{-2}}$ if the signal is right sided. 5
- (d) If $x[n] = (1, 2, 3, 4)$, $h[n] = (1, 1, 1)$ find the circular convolution of $x[n]$ and $h[n]$ 5
3. (a) Find $x[n]$ if $X(k) = (10, -2+j2, -2, -2-j2)$ using IDFT radix -2, FFT algorithm. Draw the flow graph. 5
- (b) Prove the frequency shifting property of DFT 5
- (c) Find $X(k)$ using radix-2, DITFFT algorithm for finding DFT of the sequence $x(n) = (0, 1, 2, 3, 4, 5, 6, 7)$ draw the flow graph. 10
4. (a) Explain overlap add-method and overlap save method of linear filtering of long data sequence, with proper example. 10
- (b) Develop the radix -2, DITFFT algorithm for finding the 8-point DFT, draw the flow graph. 10

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5. (a) Design an FIR filter satisfying the following specification 10

$$H_d(e^{j\omega}) = e^{-j2\omega} \quad -\pi/4 \leq \omega \leq \pi/4$$

$$= 0 \quad \pi/4 < |\omega| \leq \pi$$

Determine the filter co-efficient if the window function is Hamming window; assume the length of the filter is 5- Find frequency response of the designed filter.

- (b) Design an IIR Butterworth filter satisfying the following specification 10
using bilinear transformation, assume $T_s = 1$ sec.

$$0.707 \leq |H(\omega)| \leq 1.0 \quad 0 \leq |\omega| \leq \pi/2$$

$$|H(\omega)| \leq 0.2 \quad \frac{3\pi}{4} \leq |\omega| \leq \pi$$

6. (a) Realise the filter using direct form - I, cascade and parallel form if 10

$$H(z) = \frac{1 + \frac{1}{2}z^{-1}}{(1 + \frac{1}{4}z^{-1})(1 + \frac{1}{3}z^{-1})}$$

- (b) Enumerate the application of DSP in Biomedical Engineering. Explain 10
any one in detail.