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B TECH
(SEM-VI) THEORY EXAMINATION 2017-18
DIGITAL SIGNAL PROCESSING

Time: 3 Hours *Max. Marks: 100*

Note: Attempt all the sections. Assume missing data suitably, if any.

SECTION-A

1. Attempt all of the following questions: **(2×10=20)**

(a) If x (n) = {6, 5, 4, 3} what will be x $((2\text{-}n))_4$.

(b) What is the DFT of δ (n)?

(c) What is the equation for order of Butterworth filter?

(d) What is difference between IIR and FIR filter?

(e) Write Gibbs phenomena.

(f) Define Time Reversal of a sequence in DFT.

(g) What is twiddle factor in DFT?

(h) Write the frequency transformation rule for the conversion of LP to HP filter.

(i) What is the difference between circular convolution and linear convolution?

(j) Write the expression for hamming window.

SECTION-B

2. Attempt any three of the following questions: **(3×10=30)**

(a) Use the 4 point DFT and IDFT to determine circular convolution of the following sequence:

x (n) = {1, 2, 3, 1}

h (n) = {4, 3. 2, 2}

(b) Determine the 8-point DFT of the following sequence using DIF FFT algorithm: x (n) = {1, 2. 3. 4}

(c) Write a short notes on the following:

(i) Butterfly Computation (ii) Inplace Computation (iii) Bit reversal

(d) Use bilinear transformation to convert low pass filter, H(s) = $1/\, s^2 + \sqrt{2s} + 1$ into a high pass filter with pass band edge at 100 Hz and F_s = 1 kHz.

(e) Design a digital Butterworth filter that satisfied the following constraints, using Impulse invariant Transformation.

$$0.9 \le H(e^{j\omega}) \le 1 \qquad 0 \le \omega \le \frac{\pi}{2}$$

$$H(e^{j\omega}) \le 0.2 \qquad \frac{3\pi}{4} \le \omega \le \pi$$

SECTION – C

3. Attempt any one of following questions: **(1×10=10)**

(a) (i) A system function is given as under:

$$H(z) = \frac{(1 + 8z^{-1} + 6z^{-2})}{(1 + 8z^{-1} + 12z^{-2})}$$

realize the system function using ladder structure.

(ii) State and prove the circular convolution theorem.

(b) Design a linear phase FIR (high pass) filter of order seven with cutoff frequency $\frac{\pi}{4}$ radian/ sec using Hanning window.

4. Attempt any one of following questions: **(1×10=10)**

(a) Determine the circular convolution of the following sequences and compare the results with linear convolution:

x (n) = (1,2,3,4)
h (n) = (1,2,1)

(b) The first five point of the 8-point DFT of a real valued sequence are:

{0.25, 0.125 - j0.3018, 0, 0.125 - j0.0518, 0}. Determine the remaining three points.

5. Attempt any one of following questions: **(1×10=10)**

(a) The system function of the analog filter is given as :

$$H(s) = \frac{s+0.1}{(s+0.1)^2 + 16}$$

Obtain the system function of digital filter using bilinear transformation which is resonant at $\omega_r = \frac{\pi}{2}$

(b) Design an FIR filter to meet the following specifications:

Pass band edge = 2 kHz
Stop band edge = 5 kHz
Stop band attenuation = 42 dB
Sampling frequency = 20 kHz
Use Hanning window.

6. Attempt any one of following questions: **(1×10=10)**

(a) Obtain the direct form I, direct form II, cascade and parallel form realization for the following system:

y (n) = - 0.1 y(n-1) + 0.2 y(n-2) +3 x(n) + 3.6 x(n-1) + 0.6x(n-2)

(b) Find the inverse DFT of the sequence :

X (k) = {6, -2+j2, -2, -2-j2}, using DIT-FFT algorithm.

7. Attempt any one of following questions: **(1×10=10)**

(a) What is the different window functions used for windowing? Explain the effect of using different window functions for designing FIR filter on the filter response.

(b) Derive and draw the flow graph for DIF FFT algorithm for N=8.