Paper / Subject Code: 32204 / Discrete Time Signal Processing

Seat NO

TE | SEM-V | EXTC / CBCS

(3 Hours)

Total Marks: 80

25 NOV 2019

Note the following instructions.

1. Question **No.1** is **compulsory**
2. Attempt **any three** questions from remaining **five** questions
3. Solve in **total four** questions
4. Assume suitable data wherever necessary, justify the same
5. **Figures** to the **right** indicate **full marks**.

1 a. Compare IIR and FIR digital filters [4]

b. State and prove time shifting property of DFT [4]

c. Compare general purpose and special purpose DSP processors [4]

d. Explain limit cycles in IIR digital filters [4]

e. A digital filter has the following impulse response identify the type of filter from pole zero plot. $h(n) = 0.8\,\partial(n) + 0.36(-0.8)^{n-1}u(n-1)$ [4]

2 a. Using BLT method of IIR filter design. Design a digital Butterworth HPF, monotonic in passband with 3dB frequency of 1000 Hz and down at 10 dB at 350 Hz. The sampling frequency is 5000 Hz [10]

b. Transform analog filter transfer function H(s) given below in to digital filter transfer function H(z) using Impulse Invariance Transformation method with T= 1 sec. $H(s) = \frac{0.5(s+4)}{(s+1)(s+2)}$ [5]

c. Explain the effect of coefficient quantization (truncation and rounding) on IIR filter. [5]

3 a. Design an FIR bandpass filter to meet following specification using frequency sampling method. [8]

i. Cutoff Frequencies = 1000 Hz and 3000 Hz,
ii. Sampling Frequency = 8000 Hz,
iii. Length of filter N=7

b. The unit sample response of a system is h(n) = {1, 2} use overlap-save method of linear filtering to determine output sequence for the repeating input sequences x(n) = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} [7]

c. One of the zero of an antisymmetric linear phase FIR filter lies at z = 0.5, find the location of the other zeros and hence find the transfer function and impulse response of the filter. [5]

4 a. For the sequences, x[n] ={ 1, 2, 4, 5}, p[n]={6, 3, 6, 9} & q(n) ={ 1, -2, 4,-5} [8]

i. Find X[k] using DFT.
ii. Find P[k] using X[k] only.
iii. Find Q[k] using X[k] only.

where x[n], p[n], q[n] and X[k], P[k], Q[k] are DFT pairs respectively

b. Design a digital FIR low pass filter using Hamming window for following specification, Cutoff frequency= 500 Hz, Sampling frequency = 2000 Hz, Order of filter = 10 [7]

c. Compare the truncation and rounding errors using Fixed point and Floating point representation [5]

5 a. If x(n) = {1, 1, 2, 2, 3, 3, 4, 4 }, Find X(K) using DIF-FFT algorithm. Compare computational complexity of above algorithm with DFT. [8]

b. Find DFT of the sample data sequence x(n) = { 1, 1, 2, 2, 3, 3} and compute the corresponding amplitude and phase spectrum [7]

c. Explain DTMF detection using Goertzel algorithm [5]

6. Write short notes on **any Two** [20]

a. Effect of finite word length in digital filters

b. Architecture of TMS320C67XX digital signal processor

c. Application of DSP for Radar signal processing

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