PG – 504

III Semester M.Sc. Degree Examination, December 2013/January 2014
(N.S.)
ELECTRONIC SCIENCE
EL 302 : Digital Signal Processing

Time : 3 Hours Max. Marks : 80

Instructions : *1) Section – **A** : Answer **all** questions. Each carries **4** marks.*
*2) Section – **B** : Answer **any four** full questions.*

SECTION – A

1. Explain a common coding process for mapping of quantization levels to binary numbers.
2. Determine the DTFT of $x(n)=(0.8)^n u(n)$. Using properties determine DTFT of $x_1(n) = 2n(0.8)^n u(n)$.
3. Show that the DFT corresponds to the z-transform evaluated at N equally spaced points on the unit-circle in the z-plane.
4. Discuss briefly the quantization and rounding problems that occur while designing digital filters.
5. Give the block diagram of a central arithmetic logic unit in a DSP processor.

SECTION – B

6. a) Use the bilinear transformation to convert the analog filter with the system function $H(s) = \frac{s}{s^2 + 3s + 2}$ into a digital filter for T = 2. Specifically, find the system function H(z) of the digital filter.

   b) Discuss properties of Z-transform. **(9+6)**

7. a) Use overlap save method to convolve two sequences h(n) = {1, 0, 1} and x(n) = {1, 3, 2, –3, 0, 2, –1, 0, –2, 3, –2, 1}

   b) Explain why in the Overlap-Add method for real-time processing, one must add the last M-1 points of the previous block with the first 'M –1' points of the current block in order to obtain the correct results.

   c) Write error sources in an approximation of the DTFT to derive DFT. **(6+5+4)**

P.T.O.

8. a) Sketch the 8-point Balckman window function

$$w(n) = 0.42 - 0.5\cos\left(\frac{2\pi n}{N-1}\right) + 0.8\cos\left(\frac{4\pi n}{N-1}\right).$$

b) Evaluate and plot the magnitude spectrum of 8-point DFT for the signal x(t) = sin (2 π 1000 t) V using Blackman window function. **(5+10)**

9. a) Given the transfer function of a comb filter is $G(z) = 1 - z^{-5}$,

i) draw the pole/zero diagram of the filter,

ii) verify that the pole/zero representation corresponds to the given transfer function, and

iii) plot the filter's magnitude/frequency characteristic.

b) A digital filter designed by the lowpass butterworth filter with a cut-off frequency of 1 radian/second and a sampling frequency of 30.2 radians/second, has the transfer function $G(z) = z/(26.8z^2 - 45.6z + 20)$. Calculate the minimum word length to maintain stability, assuming that filter coefficients are

i) rounded, and ii) truncated.

c) Explain briefly the limit cycle oscillations and deadband effect. **(6+7+2)**

10. a) Write a note on classification of signals with examples. **8**

b) Determine the increase z transform of $x(z) = \dfrac{z}{3z^2 - 4z + 1}$

State the initial and final value theorem. Determine the initial and final value of the above signal. **7**

11. Write notes on **any three** : **(3×5=15)**

i) Recovery of analog signals

ii) DSP chip architecture

iii) Sampling theorem

iv) FFT algorithms

v) DFT properties.

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